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December 12, 2019

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Subject: Smoky Canyon Mine Remedial Investigation/Feasibility Study (RI/FS)
FINAL Feasibility Study Technical Memorandum #1:
Identification and Screening of Remedial Technologies

Dear Art,

Please find enclosed a report cover and spine, title page, and CD of the *FINAL Feasibility Study Technical Memorandum #1: Identification and Screening of Remedial Technologies* (FSTM#1) for the Smoky Canyon Mine RI/FS, as requested in the December 4, 2019 approval letter from the Forest Service. Simplot is providing the enclosed submittal in accordance with the August 2009 Settlement Agreement and Order on Consent/Consent Order (ASAOC).

This document also can be downloaded at the website:

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Please contact me if there are questions regarding this submittal.

Sincerely,

Jeffrey Hamilton
Environmental Engineer

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FINAL

Smoky Canyon Mine RI/FS

Feasibility Study Technical Memorandum #1: Identification and Screening of Remedial Technologies

December 2019

Prepared for:

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Appendix

A Preliminary Remediation Goal for Soil

LIST OF ACRONYMS

95UCL	95% Upper Confidence Limit
95USL	95% Upper Simultaneous Limit
95-95UTL	95% Upper Tolerance Limit with 95 % Coverage
AMSL	Above Mean Sea Level
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BLM	United States Department of Interior Bureau of Land Management
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm/s	centimeters per second
CO	Consent Order
COD	Chemical Oxygen Demand
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EC	Exposure Concentration
ECOC	Ecological Chemical of Concern
EE/CA	Engineering Evaluation/Cost Analysis
EIS	Environmental Impact Statement
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FBR	Fluidized Bed Bioreactor
FEIS	Final Environmental Impact Statement
FSTM	Feasibility Study Technical Memorandum
FWS	United States Department of Interior Fish and Wildlife Service
GCL	Geosynthetic Clay Liner
GCLL	Geosynthetic Clay Laminate Liner
GM	Geomembrane
gpm	gallons per minute
GRA	General Response Action
HH COC	Human Health Chemical of Concern
IDEQ	Idaho Department of Environmental Quality
IMA	Idaho Mining Association
MCL	Maximum Contaminant Level
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/kg dw	milligrams per kilogram dry weight
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NEPA	National Environmental Policy Act
NOAEL	No Observed Adverse Effect Level
NTCRA	Non-Time-Critical Removal Action

ODA	Overburden Disposal Area
OGC	Office of General Counsel
O&M	Operations and Maintenance
PRB	Permeable Reactive Barrier
PRG	Preliminary Remediation Goal
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROM	Run-of-Mine
SAP	Sampling and Analysis Plan
SEIS	Supplemental Environmental Impact Statement
SeWG	Selenium Working Group
SI	Site Investigation
Simplot	J.R. Simplot Company
SSERA	Site-Specific Ecological Risk Assessment
SSHHRA	Site Specific Human Health Risk Assessment
SSLRA	Site-Specific Livestock Risk Assessment
SOW	Statement of Work
SWPPP	Storm Water Pollution Prevention Plan
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
T/E	Threatened and Endangered
Tribes	Shoshone-Bannock Tribes
TRV	Toxicity Reference Value
UF/RO	Ultrafiltration/Reverse Osmosis
USC	United States Code
USEPA	United States Environmental Protection Agency
USFS	United States Department of Agriculture Forest Service
USGS	United Stated Geological Survey
USMMS	United States Minerals Management Service
WTP	Water Treatment Plant

1.0 INTRODUCTION

The J.R. Simplot Company (Simplot) operates the Smoky Canyon Phosphate Mine (mine or Site) in southeast Idaho (Figure 1-1). The Smoky Canyon Mine is the subject of an Administrative Settlement Agreement and Order on Consent/Consent Order (Settlement Agreement/CO) for Performance of Remedial Investigation and Feasibility Study (RI/FS) entered into by the United States Department of Agriculture, Forest Service Region 4 (Forest Service [USFS]), United States Environmental Protection Agency Region 10 (USEPA), Idaho Department of Environmental Quality (IDEQ), and Simplot (USFS, USEPA, and IDEQ 2009), pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Forest Service is the lead agency, and the USEPA, IDEQ, United States Department of Interior Fish and Wildlife Service (FWS) and Bureau of Land Management (BLM), and the Shoshone-Bannock Tribes (Tribes) participate as support agencies.

The Settlement Agreement/CO provides a mechanism to investigate the potential environmental effects of phosphate mining and milling operations at the Site and develop remedies to address any environmental conditions that represent a risk to human health or the environment. Section 4.1 of the Settlement Agreement/CO (USFS, USEPA, and IDEQ 2009), defines the “Site” as “the Smoky Canyon Phosphate Mine, which includes the areas of overburden disposal associated with the mine…the areal extent of contamination from the mine and overburden disposal areas and all suitable areas in very close proximity to the contamination necessary for response action implementation.” The Settlement Agreement/CO supersedes that portion of the 2003 Administrative Order on Consent/Consent Order (AOC/CO; IDEQ, USFS, and USEPA 2003) associated with the Smoky Canyon Phosphate Mine (Area A) but does not address the Tailings Impoundments (Area B) (Figure 1-2). The 2003 AOC/CO remains in force with respect to Area B.

The general objective of the RI, as stated in the Settlement Agreement/CO (USFS, USEPA, and IDEQ 2009), is to determine the nature and extent of contamination and any threat to the public health, welfare, or the environment caused by the release or threatened release of hazardous substances, pollutants, or contaminants at or from the Site, and to assess risks to human health and the environment. Data collection under the RI site characterization effort was performed from spring 2010 through fall and winter 2012/2013 in accordance with the scope of work presented in the RI/FS Work Plan (Formation 2011a) and sampling procedures and locations described in the Sampling and Analysis Plan (SAP) (Formation 2010) and SAP Addenda 01 through 04 (Formation 2011d, 2011e, 2012b, 2012c). The findings of the investigation, including physical site characteristics, nature and extent of contamination, and fate and transport of chemicals of potential concern (COPCs), were detailed in the RI Report (Formation 2014c).

Three separate baseline risk assessments, a Site-Specific Human Health Risk Assessment (SSHHRA, Formation 2015a), Site-Specific Ecological Risk Assessment (SSERA, Formation 2015b), and Site-Specific Livestock Risk Assessment (SSLRA, Formation 2016a), were

performed and reported following the RI site characterization. The methodology used in the SSHHRA was developed in conjunction with input from the regulatory agencies and was outlined in the SSHHRA Work Plan (Formation 2011b) and a technical memorandum that identified screening levels, exposure factors, and toxicity factors (SSHHRA Technical Memorandum, Formation 2013a). Similarly, for ecological receptors, the methodology used for the SSERA was presented in the SSERA Work Plan (Formation 2011c) and Baseline Problem Formulation (Formation 2013b). The approach used in the SSLRA was based on USEPA Ecological Risk Assessment (ERA) guidance (USEPA 1997, 1998) and is consistent with a screening-level risk assessment that allows for identification of COPCs that could be present at concentrations that are potentially toxic to livestock. Potential risks to human, ecological, and livestock receptors from exposure to contaminants at the Site were evaluated in these risk assessments.

The findings presented in the RI Report (Formation 2014c) and the risk assessments serve as the basis for identifying the Remedial Action Objectives (RAOs) for the Site and are used to support the development of remedial alternatives in this FS. The general objective of the FS, as stated in the Settlement Agreement/CO (USFS, USEPA, and IDEQ 2009), is to identify and evaluate alternatives for remedial action designed to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances from the Site. The FS builds on the analyses presented in the Engineering Evaluation/Cost Analysis (EE/CA) (NewFields 2006a), which identified and evaluated a range of removal action alternatives to address unacceptable environmental conditions identified through the Site Investigation (SI) (NewFields 2005). Two of the removal action alternatives in the EE/CA for the Pole Canyon ODA were implemented as Non-Time-Critical Removal Actions (NTCRAs) (USFS, USEPA, and IDEQ 2006; USFS, IDEQ, and Tribes 2013) to address selenium loading to groundwater prior to and during the RI/FS process.

1.1 Purpose

Per the Settlement Agreement/CO and subsequent correspondence, the FS report is divided into two components, submitted as two separate deliverables (1) the development and screening of remedial alternatives and (2) the detailed analysis of alternatives. The purpose of FS Technical Memorandum #1 (FSTM#1), which is the first component of the FS process, is to identify and screen a range of remedial technologies and process options that will be assembled into Site-wide alternatives and evaluated in the detailed analysis. This technical memorandum, which follows USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA 1988), originally included all of the elements set out in Section 8.a. of the Statement of Work (SOW). In accordance with September 8, 2017 Agency comments (USFS 2017) on Revised Draft FSTM#1, Section 5 of this technical memorandum evaluates technologies by environmental media using effectiveness, implementability, and cost. The rest of the elements in Section 8.a. of the SOW (assemble, refine, and screen remedial alternatives) will be included

with the elements in Section 8.b. of the SOW in FSTM#2, which will document the second component of the FS process.

Alternatives will be developed by assembling combinations of technologies for specific environmental media that address contamination on a Site-wide basis or for specific overburden disposal areas (ODAs) and analyzed with respect to the evaluation criteria in the detailed analysis. The results of the development and detailed analysis of alternatives will be documented in FSTM#2. These two FS components will comprise the FS Report.

1.2 Site Location and Description

The Smoky Canyon Mine is located in Caribou County, Idaho (Figure 1-1), within the Southeast Idaho Phosphate Mining Resource Area. The mine is located approximately 24 miles due east of Soda Springs, Idaho and is accessed by traveling 10 miles generally west from Afton, Wyoming. The mining and milling operations are contained within 2,600 acres of federal phosphate mineral leases (Federal Phosphate Leases No. I-012890, I-026843, I-027801, I-27512, and I-30369) administered by the Pocatello Field Office of the BLM and approximately 1,200 acres of Special Use Permit administered by the Caribou-Targhee National Forest. Phosphate ore is extracted from a series of pits, referred to as mine panels, located on the eastern slope of the Webster Range between Smoky Canyon and South Fork Sage Creek (Figure 1-2). Specific mining and mine-related areas of the Site addressed in this FS include backfilled Panels A, B, C, D, and E; the external ODAs associated with these mine panels; and the Pole Canyon cross-valley fill ODA (Figure 1-3).

The mill and administrative and maintenance facilities are located in Smoky Canyon near the northern end of the mining operations. Mine Panel A is located immediately east of the mill, Panels B and C are north of the mill, and Panels D and E and the Pole Canyon ODA are south of the mill. The tailings ponds, which are not included within the Site as defined by the 2009 Settlement Agreement/CO, are located about 3 miles northeast of the mill in the Tygee Creek drainage on 1,680 acres of private land owned by Simplot. The mill is connected to the tailings ponds by a pipeline that extends through Smoky Canyon.

Mining activities began at Smoky Canyon in 1983 and are ongoing today. Ore is recovered through open pit mining practices that follow the north-south trending Phosphoria Formation outcrop as it dips to the west. Ore is recovered until the amount of overburden that must be removed to expose the ore (stripping ratio) becomes uneconomical. The overburden, which consists of Dinwoody, chert, limestone, and center waste shale, is used to backfill the previously mined pits and has also been placed in external ODAs just east of the pits to maintain efficient material balance as mining has progressed. Reclamation practices have changed over time, in response to the developing understanding of environmental conditions associated with releases

from the overburden. Current practices entail grading to a 3:1 slope, placement of a cover, application of seed and fertilizer, and sometimes planting of shrubs and trees.

1.3 Investigations and Current Site Status

Previous investigations conducted at the Smoky Canyon Mine are described in detail in the RI Report (Formation 2014c) and include the following:

- 1981 Draft Environmental Impact Statement (EIS) – The United States Geological Survey (USGS), then in charge of administering phosphate mining on federal lands, prepared a Draft EIS (DEIS) for mining at Smoky Canyon in conjunction with the Forest Service (USFS and USGS 1981). The DEIS evaluated potential environmental impacts associated with the Smoky Canyon Project Mine and Reclamation Plan, submitted by Simplot in February 1981 (Simplot 1981).
- 1982 Final Environmental Impact Statement – The Final EIS (FEIS) was completed in 1982 (USFS and United States Minerals Management Service [USMMS] 1982), and the approval letter for the Project Mine and Reclamation Plan was signed in January 1983 (BLM 1983). The BLM letter included stipulations for the mine permit.
- 1990s Environmental Assessments (EAs) for Smoky Canyon Mine – Plans for individual mine phases were submitted to the regulatory agencies for review and approval (Panel A-4, BLM 1991; Panel D, BLM and USFS 1992; Panel E, BLM 1997).
- Mid-1990s Idaho Mining Association (IMA) Selenium Committee – The primary mine operators in the region formed the IMA Selenium Committee in order to jointly and voluntarily investigate and address mining-related environmental and public health issues associated with past operations.
- 2000 Area-Wide Administrative Order on Consent (AOC) – The AOC established the process used to conduct investigations and characterize risks associated with historical and active mining at an “Area-Wide” scale (IDEQ, USEPA, USFS, BLM, FWS, Bureau of Indian Affairs, and Tribes 2000).
- 2002 Panels B and C Supplemental EIS – A Supplemental EIS (SEIS) (BLM and USFS 2002) was conducted for the Smoky Canyon Mine Panels B and C areas to evaluate potential environmental impacts related to selenium releases and to establish new mitigation measures as needed to address these impacts. The Record of Decision (ROD) for Panels B and C was signed in 2002 (BLM 2002).
- 2002 Panels B and C Consent Order – A Consent Order was developed by IDEQ and Simplot for the protection of groundwater during Panels B and C mining activities (IDEQ 2002). The 2002 Consent Order provides for compliance with the Idaho Ground Water Quality Rule and also established a number of new monitoring requirements that are specific to the Panels B and C operations.
- 2003 Administrative Order on Consent/Consent Order (AOC/CO) – Simplot entered into an AOC/CO with IDEQ, USFS, BLM, and USEPA to evaluate and address the cumulative environmental and human health risks from current and historical mining operations at Smoky Canyon (IDEQ, USFS, and USEPA 2003). The 2003 AOC/CO established the responsibilities and schedules for performance of an SI and EE/CA for the Smoky Canyon

Phosphate Mine (Area A) and other necessary actions associated with the Tailings Impoundments (Area B) (NewFields 2005, 2006a).

- 2006 Settlement Agreement for Non-Time-Critical Removal Action (NTCRA) for the Pole Canyon ODA – Based on information provided in the SI and EE/CA, the Forest Service selected an NTCRA to address conditions associated with the Pole Canyon cross-valley fill ODA. In October 2006, Simplot entered into a Settlement Agreement with the Forest Service, USEPA, and IDEQ to implement the Pole Canyon 2006 NTCRA (USFS, USEPA, and IDEQ 2006).
- 2009 Administrative Settlement Agreement/CO for RI/FS – Simplot entered into a Settlement Agreement/CO for performance of an RI/FS for the Smoky Canyon Mine, including Panel B where mining is currently active (USFS, USEPA, IDEQ and 2009). The site characterization and risk assessments have been completed.
- 2012 EE/CA for NTCRA Alternatives at Pole Canyon ODA – An EE/CA was completed in 2012 (Formation 2012a) to identify and evaluate NTCRA alternatives that address conditions at the Pole Canyon ODA. Based on the EE/CA, the Forest Service selected a Dinwoody/Chert cover.
- 2013 Settlement Agreement for NTCRA for the Pole Canyon ODA – The Forest Service issued an Action Memorandum (USFS 2013a) to document approval of a Dinwoody/Chert cover for the Pole Canyon ODA as a Removal Action. The Dinwoody/Chert cover NTCRA was implemented under a separate Settlement Agreement for NTCRA entered into by the Forest Service, IDEQ, the Tribes, and Simplot in November 2013 (USFS, IDEQ, and Tribes 2013).

1.4 Document Organization

FSTM#1 is organized as follows:

- Section 2 summarizes information from the RI Report and the risk assessments, including site setting and physical characteristics, nature and extent of contamination, contaminant fate and transport, the conceptual model, and potential risks to human, ecological, and livestock receptors.
- Section 3 summarizes the environmental conditions of concern and presents Applicable and/or Relevant and Appropriate Requirements (ARARs), RAOs, and Preliminary Remediation Goals (PRGs).
- Section 4 identifies the General Response Actions (GRAs), remedial technologies, and process options potentially implementable to address the RAOs and describes the initial screening and evaluation process.
- Section 5 evaluates the remedial technologies/process options retained after the initial screening for the Site media of concern. Technologies/process options retained will be assembled into a range of remedial alternatives in FSTM#2.
- Section 6 lists references and data sources that were used to develop this technical memorandum.

2.0 SUMMARY OF SITE CHARACTERISTICS AND RISKS

This section presents a summary of the conceptual site model (CSM) and site characterization information presented in the RI Report (Formation 2014c) and the risk evaluations presented in the SSHHRA (Formation 2015a), SSERA (Formation 2015b), and SSLRA (Formation 2016a). The focus of this summary is on the important physical and chemical characteristics and transport and exposure pathways relative to remedial alternative development and evaluation. Selenium is the primary contaminant in both solids and soil and groundwater and surface water and is the primary risk driver for ecological and livestock receptors. Selenium and arsenic in groundwater used as drinking water and ingestion of arsenic in water from seeps and detention ponds and arsenic in beef are the primary risk drivers for human receptors. The elevated concentrations of other COPCs coincided with selenium exposures in most cases. Therefore, the discussion in this section focuses on selenium, although when other COPCs are above levels of concern they are also noted.

2.1 Site Setting and Physical Characteristics

The Smoky Canyon Mine is located along the eastern slope of the north-south trending Webster Range just west of Sage Valley. Phosphate ore is extracted from the Phosphoria Formation in a series of pits between Smoky Canyon and South Fork Sage Creek that extend (north to south) for a distance of approximately 6 miles (Figure 1-2). Elevations at the Site range from 6,500 to 8,300 feet above mean sea level (AMSL). Information on the physical characteristics of the Site and surrounding areas has been collected to support the evaluation of the nature and extent of contamination, define potential contaminant transport pathways, and identify receptor populations.

2.1.1 Climate

The area in the vicinity of the Smoky Canyon Mine has a cool and dry climate, with typical prevailing winds and weather patterns moving from west to east. Annual precipitation of 14 to 28 inches has been measured at the Security Building at the mine, with the most abundant rainfall occurring in spring and early summer. In the winter months, snowfall averages 100 inches per year, and snow cover typically remains on the ground from November to April. Summer temperatures in the region normally range from 48 to 62 degrees Fahrenheit, while winter temperatures typically range from 12 to 26 degrees Fahrenheit.

2.1.2 Land Use

Much of the Smoky Canyon Mine is on National Forest System land, including the lease areas where mining takes place. Private ranch land owned by Simplot is located in Sage Valley immediately east of the mine panels. Other private lands (ranches and vacation homes) are located in the Crow Creek Valley south and southeast of the Site. The predominant land uses are associated with agriculture and natural resources and include crop production (primarily hay) on private lands along with cattle and sheep ranching on private and public lands. Phosphate mining, while not a dominant land use in terms of acreage, is economically important. On National Forest System land, recreational activities include hunting, fishing, camping, hiking, skiing, and snowmobiling, among others. Additionally, these lands may be used for Tribal hunting, fishing, and ceremonial activities consistent with the heritage of the Shoshone-Bannock Tribe. No residential use occurs at or adjacent to the Site. The closest population center is the Star Valley community, which includes the town of Afton, Wyoming, and is 10 miles directly east of the Site. The town of Afton has a population of approximately 1,800 (United States Census Bureau 2010).

2.1.3 Geology

The Smoky Canyon Mine is in the Idaho-Wyoming thrust belt and is underlain by the westward-dipping Meade thrust fault (Ralston and Mayo 1983). Movement on the thrust fault was from west to east. Strata within the thrust plate were folded into a series of north-south-trending anticlines and synclines that have been eroded into a series of ridges and valleys. Steep eastward-trending tear faults that developed during thrusting form small canyons dissecting these ridges (Armstrong and Cressman 1963). The mine is located on the west limb of the Boulder Creek Anticline, which is a north-south-trending, north-plunging fold. Figure 2-1 presents a geologic map of the Smoky Canyon Mine area compiled from Montgomery and Cheney (1967) and Connor (1980). Figure 2-2 provides an explanation of the map units. The anticline is truncated on the east by the West Sage Valley Branch Fault, which is an imbricate thrust of the Meade thrust fault (Mayo et al. 1985) and is a barrier to eastward groundwater flow. Thrusting along the fault has displaced older, highly fractured rocks eastward over younger relatively lower hydraulic conductivity rocks.

Sandstone and limestone of the Pennsylvanian/Permian Wells Formation forms the core of the Boulder Creek Anticline. The Wells Formation is overlain by the Permian Phosphoria Formation, which is exposed primarily along the west limb. The Phosphoria is the source of phosphate ore for the mine and is comprised of three members: the Meade Peak Phosphatic Shale Member, Rex Chert Member, and Cherty Shale Member. Seleniferous shale and chert are the primary types of overburden (i.e., run-of-mine [ROM] material) that are removed in order to access the ore. The overlying Triassic Dinwoody and Thaynes formations are composed of shale, siltstone, and limestone, and are exposed west of the mine within the Webster Syncline, north of the mine where the anticline plunges into the subsurface, and east of the mine in Sage Valley. Bedrock in the valley is overlain by silty limestones of the Tertiary Salt Lake Formation and Quaternary

sediments. Colluvial gravel and sand form fan-shaped deposits in South Fork Sage Creek, Sage Creek, and Pole Canyon Creek where the creeks emerge from the foothills and flow into Sage Valley. Alluvial sand and gravel is deposited by North Fork Sage Creek on the floor of Sage Valley.

2.1.4 Groundwater

Groundwater occurs in two aquifer systems at the Smoky Canyon Mine (1) the shallow alluvial groundwater system and (2) the deep Wells Formation aquifer.

The shallow alluvial groundwater system consists of thin, narrow, unconsolidated, surface deposits that are locally present along the natural stream channels that transect the mine area and receive recharge from the surface at and in the vicinity of the Site. Along the west side of Sage Valley, these local stream channel deposits transition to much thicker and laterally extensive colluvial and alluvial deposits that cover the floor of northern Sage Valley and fill in between bedrock highs in lower Sage Valley (Figure 2-1). The valley-fill groundwater system discharges to Sage Creek along several stream segments.

Regional groundwater flow in the deep Wells Formation aquifer is controlled by (1) the elevation of recharge areas on Freeman Ridge and Dry Ridge to the west and Meade Peak to the south (see locations on Figure 1-1), (2) the elevations of two major discharges from the aquifer—Hoopes Spring and South Fork Sage Creek springs—located east of Panel E (see spring locations on Figure 2-1), and (3) the effects of local structural features such as the West Sage Valley Branch Fault. The Wells Formation aquifer receives local recharge from precipitation in outcrop areas along the Boulder Creek Anticline and infiltration from streams crossing outcrop areas (Figure 2-1). In the vicinity of the Site, streams flowing eastward generally gain flow as they cross the Dinwoody outcrop west of the mine, remain constant in terms of flow across the Phosphoria Formation, and then lose flow as they cross the Wells Formation outcrop.

Most of the backfilled pits and ODAs at the mine overlie Wells Formation outcrops and subcrops. The Wells Formation aquifer lies several hundred feet or more below the backfilled pits and ODAs and is separated from them by unsaturated Wells Formation limestone. Groundwater elevations exhibit seasonal fluctuations. Except for the Wells Formation groundwater captured by the Industrial Well, Site groundwater within the Wells Formation aquifer generally flows to the east and south. Groundwater flow in the upper Wells Formation aquifer is controlled by the combined effects of the West Sage Valley Branch Fault, which is a barrier to flow to the east, and the discharge zone created by Hoopes Spring and South Fork Sage Creek springs (the “springs complex”). Discharge from the springs complex comprises the majority of flow in the lower Sage Creek drainage under all flow conditions. The springs complex creates a capture zone that prevents groundwater flow to the south. Figure 2-3 is a potentiometric map that shows groundwater flow directions under current conditions during pumping at the Industrial Well. The flow directions and gradients vary seasonally.

2.1.5 Surface Water

The slopes of the Smoky Canyon Mine generally drain eastward with streams flowing into the Salt River, which joins the Snake River and ultimately the Columbia River. Surface water at the Site occurs within two drainage basins: the Tygee Creek basin in the north end of the Site and the Sage Creek basin in the south end (Figure 2-4).

The Tygee Creek basin includes the drainages of Smoky Creek, Roberts Creek, and Lower Tygee Creek and drains to Stump Creek. Draney Creek and Webster Creek are also within the Tygee Creek drainage basin north of the Site. Panels B and C and the northern portion of Panel A are located in the Tygee Creek basin. Smoky Creek crosses mine-disturbance areas in Panel A but does not receive runoff from these areas. Surface runoff from Panel A is diverted to storm water detention basins. Data collected during the RI showed that no water was discharged from the detention basins in the Panel A area (Formation 2014c).

The Sage Creek basin includes the drainages of North Fork Sage Creek, Pole Canyon Creek, Sage Creek, and South Fork Sage Creek and drains to Crow Creek. Panels D and E, the Pole Canyon ODA, and the southern portion of Panel A are located within the Sage Creek basin. Pole Canyon Creek, Sage Creek, and South Fork Sage Creek cross these mine panels but do not receive runoff from these mine-disturbance areas. However, certain creeks do receive groundwater discharged from either the alluvial flow system or the Wells Formation aquifer. Lower Pole Canyon Creek flows into Sage Valley, but generally loses flow to the alluvial groundwater system before reaching North Fork Sage Creek. Wells Formation groundwater that discharges at Hoopes Spring and South Fork Sage Creek springs continues downstream into Sage Creek and South Fork Sage Creek. Sage Creek flow typically remains constant through lower Sage Valley and into the Crow Creek drainage.

2.1.6 Ecology

Several vegetation or habitat types have been identified within and around the Smoky Canyon Mine (Maxim 2002). Higher elevation areas and north- and west-facing slopes receive sufficient moisture to support subalpine fir and Engelmann spruce, and mid-elevation areas are represented by Douglas-fir and aspen. Forest openings are dominated by a mixed shrub component that includes mountain snowberry and antelope bitterbrush. The warmer and drier lower elevation areas and south-facing slopes are typified by mixed shrub communities of sagebrush and various grassland species. Riparian areas are dominated by willows, sedges, and reed grass, and watercress is commonly found at Hoopes Spring and in Sage Creek.

The diverse vegetation types found at the Site provide habitat for a variety of wildlife species (BLM and USFS 2002). Mammals include bats, rabbits, rodents, black bear, mountain lion, mule deer, elk, and moose. Numerous bird species occur in the area, including raptors and passerines.

Game birds such as grouse are also present. Cutthroat trout, brook trout, rainbow trout, brown trout, dace, sculpin, redside shiner, chub, and a wide variety of macroinvertebrates have been documented in area streams. Amphibian and reptile species known to occur include tiger salamander, rubber boa, and western terrestrial garter snakes.

The only federally listed threatened and endangered (T/E) species in Caribou County is the Canada lynx (*Lynx canadensis*) (FWS 2013). Although potential "linkage" habitat for the lynx is present (Ruediger et al. 2000; USFS 2007), surveys for lynx indicate that this species is not present in the Smoky Canyon Mine area (Maxim 2002, 2004; BLM and USFS 2007). The same habitat is also potentially suitable for the gray wolf (*Canis lupus*). In May 2011, the FWS published a direct final rule delisting the gray wolf in Idaho (FWS 2011).

2.1.7 Status of Mining and Reclamation

The progression of mining and reclamation at the Smoky Canyon Mine is presented in appendices to the RI Report (Formation 2014c) and is based on maps prepared from mine disturbance and reclamation data, elevation information, aerial images, and panel chronology. The status of mining and reclamation in the various mine panels is as follows (using approximate mine panel and ODA reclamation areas from the RI Report):

- Panel A and External ODAs – Panel A covers approximately 245 acres; the external ODAs cover 135 acres. Mining at Panel A took place from 1985 to 1990. Pits A-1, A-2, and A-3 were backfilled shortly after mining and covered with topsoil or reclaimed by direct revegetation. Pit A-3 is partially regraded and will be backfilled and reclaimed as part of ongoing mining operations in Panel B.
- Panel B and External ODA – Panel B covers approximately 155 acres; the external ODA covers approximately 50 acres. Mining at Panel B took place from 2004 to 2010. Overburden from Panel B was used to backfill Pits B-1 and B-3 and the remainder was placed in an external ODA. Reclamation activities for the external ODA and the lower portion of Pits B-1 and B-3 have been completed with a topsoil over chert cover. Mining is continuing in Pits B-2 and B-4.
- Panel C – Panel C covers approximately 105 acres and was mined from 2002 to 2006. Panel C is backfilled with overburden from Panels B and C. The northern end of Panel C (approximately 45 acres) was reclaimed in 2008 and the remainder of Panel C was reclaimed in 2010 with a topsoil-over-chert cover.
- Panel D and External ODA – Panel D covers approximately 270 acres; the external ODA covers 90 acres. Mining at Panel D took place from 1993 to 1998 in three pits (Pits D-1, D-2, and D-3). Panel D overburden was placed in an external ODA as well as in portions of the Pole Canyon ODA. The pits and overburden areas were reclaimed in 2002 by direct revegetation or covered with topsoil only or topsoil over chert.
- Panel E and External ODA – Panel E contains a total of five pits (Pits E-0, E-1n, E-1s, E-2, and E-3) and covers approximately 390 acres; the external ODA covers 120 acres. Mining in Panel E began in 1998 in Pit E-1n and continued through 2006. Reclamation of this pit and the external ODA was completed in 2003 with topsoil-over-chert or a

Dinwoody/Chert cover. Mining began in the other pits in Panel E in 2000 and 2001. Backfilling of Pits E-2 and E-3 began in 2003. Pits E-1s, E-2, and E-3 were reclaimed with a Dinwoody/Chert cover in 2008. Pit E-0 was backfilled with overburden from Panel F in 2010. Pit E-0 was covered with a Deep Dinwoody store and release cover system in 2014.

- Pole Canyon ODA – The Pole Canyon ODA is an external disposal area that covers approximately 130 acres in the Pole Canyon Creek drainage. The Pole Canyon ODA was constructed as a cross-valley fill over Pole Canyon Creek. Most of the overburden originated from Panel A, which was mined from 1985 to 1990. A much smaller portion of the overburden originated from Panel D (Pit D-2) and was placed on the west side of the ODA in 1997. Two NTCRAs were completed at the Pole Canyon ODA in 2008 and 2015, as discussed below. The ODA was reclaimed in 2015 with a Dinwoody over chert cover.

A summary of reclamation areas and cover types is shown on Figure 1-3 and listed in Table 2-1.

2.1.8 Non-Time-Critical Removal Actions

Two NTCRAs have been completed at the Pole Canyon ODA. The first was implemented under a Settlement Agreement/CO (USFS, USEPA, and IDEQ 2006) to reduce the rate of selenium transport from the Pole Canyon ODA to the environment thereby improving downstream and downgradient water quality. This first NTCRA is referred to herein as the “2006 NTCRA.” Construction of the 2006 NTCRA was completed in 2008 and included:

- A bypass pipeline to divert Pole Canyon Creek stream flow around the ODA and directly into Sage Valley
- An infiltration basin that directs clean flow from Pole Canyon Creek in the area between the pipeline diversion inlet and the upstream toe of the ODA to the Wells Formation aquifer
- A channel to prevent run-on to the Pole Canyon ODA from the northern hillside slope.

The second NTCRA, referred to as the “2013 NTCRA,” was implemented under a separate Settlement Agreement/CO entered into by the Forest Service, IDEQ, the Tribes, and Simplot in November 2013 (USFS, IDEQ, and Tribes 2013), to reduce or eliminate the amount of precipitation that infiltrates into the ODA, reduce or eliminate risks due to ingestion of vegetation and direct contact with ODA materials, and eliminate the release of contaminants from the ODA via sediment transport. Construction of the 2013 NTCRA was substantially completed in 2015 and entailed:

- Grading the surface of the ODA,
- Covering the ODA with chert/limestone averaging 2 feet in thickness overlain by 3 feet of Dinwoody material,
- Revegetating the Dinwoody surface with native non-selenium accumulating species, and
- Constructing storm water run-on/runoff controls to convey water off the ODA.

2.1.9 Pilot Studies

Per the RI/FS Settlement Agreement/CO (USFS, USEPA, and IDEQ 2009) requirements, Simplot prepared a technical memorandum to provide an evaluation of available water-treatment technologies and identify the technologies that appear most suitable for the Site (NewFields and Formation 2009). The likelihood for further evaluation of these technologies through the FS process of remedial alternative development was determined based on the level of demonstrated effectiveness, commercial availability, use of resources, and overall ease of implementation at the Site. Based on the findings of the 2009 Surface Water Treatability Study Technical Memorandum, the following pilot studies have been implemented at the Site to evaluate the performance of technologies with the highest potential for use as remedial actions:

- 2009 – GE ABMet® active, anoxic/anaerobic, biological process at the DS-7 seep and also at the nearby Conda Mine
- 2009 – Zero-valent iron technology at South Fork Sage Creek
- 2010 – Reverse osmosis at Hoopes Springs
- 2013-2015 – Semi-passive biological treatment technology at the DS-7 seep.

These treatment technologies are discussed in detail in an addendum (Formation 2014a) to the technical memorandum cited above. The major findings from these studies were as follows:

- Passive treatment of spring discharges by zero-valent iron technology is not effective in meeting the surface water quality criterion for selenium.
- Concentration by reverse osmosis is a viable option to concentrate contaminants for removal by other treatment technologies.
- Passive and semi-passive biological reduction treatment may be an option for seeps that do not discharge into surface waters, and where significant removal of selenium (rather than meeting the surface water quality criterion for selenium) may be an appropriate goal.
- Active treatment by biological reduction is effective and can meet the surface water quality criterion for selenium. Biological oxygen demand (BOD) and chemical oxygen demand (COD) were monitored in the effluent discharged after treatment. Constituents added to the water stream as a result of treatment included ammonia, phosphorus, and total organic carbon. Temperature increased, and pH and dissolved oxygen decreased in the effluent, compared to the influent. The required discharge limits depend on the setting of the system (i.e., discharging to surface water, mixing zones, upstream concentrations, etc.). The BOD/COD levels in the discharge need to be considered to evaluate the effect on dissolved oxygen levels in the receiving stream. Additional polishing of water quality is necessary before treated effluent can be discharged to nearby streams, especially for larger-flow systems.

Two other pilot studies were implemented in 2005 prior to initiation of the RI/FS at seeps associated with external ODAs to isolate seep water that wildlife and livestock may use as drinking water sources. One of the pilot studies was implemented at detention basin DP-10, which is adjacent to a haul road in Panel D. The study involved elimination of the basin by removal of the

constructed berms and installation of a chert cover over the area (NewFields 2004b). Upon completion, the potential for wildlife contact with water in the DP-10 basin and associated vegetation immediately downslope of the basin was eliminated. Visual monitoring indicates that this measure has been effective in eliminating the potential for exposure.

The other pilot study was implemented to address water from snowmelt and storm water that emanated from the southwest toe of the Panel E ODA (seep ES-5) and then flowed along the ground surface before infiltrating. Pilot study work included overburden recontouring to limit future discharge of seep water to the surface in the ES-5 area and placement of a chert cover over the ground surface where seep water flowed (NewFields 2004a). No flow from the ES-5 seep area has been observed after these actions were completed.

2.2 Nature and Extent of Contamination

The RI confirmed previous SI findings that overburden disposed in backfilled mine pits and external ODAs is the source of selenium and other COPCs to the environment. Overburden is removed during active mining to access the underlying phosphate ore. The primary sources of selenium and other COPCs within the overburden are the sulfides and organic matter present in the mudstone and center waste shale from the Meade Peak Member of the Phosphoria Formation. Selenium and other COPCs are released from overburden materials to infiltrating and percolating water. Transport to Wells Formation groundwater and discharge to surface water via Hoopes Spring and South Fork Sage Creek springs is considered the primary mechanism for transport of selenium to the environment.

The physical setting of the different backfilled pits and external ODAs at the Site and the type of reclamation completed on each influences the relative importance of these sources in terms of mass flux of selenium and other COPCs released and transported. Less protective covers (including direct revegetation) allow greater infiltration of precipitation resulting in larger contributions of selenium and other COPCs to the underlying groundwater. More recent Dinwoody/Chert covers are more effective in reducing infiltration. The Pole Canyon ODA is distinct from the other ODAs at the Site because of the cross-valley fill setting (with Pole Canyon Creek flowing through the ODA prior to the 2006 NTCRA) and the presence of an underlying shallow alluvial groundwater system associated with Pole Canyon Creek.

2.2.1 Soil and Vegetation

<u>Soil</u>

Selenium concentrations on the surface of ODAs with less protective covers are elevated due to the presence of seleniferous shale in the ROM overburden. There is no significant physical transport (i.e., erosion) of these materials at the Site. Thicker covers of topsoil or other geologic

material generally result in lower concentrations of selenium at and near the surface. Reclamation areas and cover types for each of the mine panels are shown on Figure 1-3 and listed in Table 2-1. The highest mean selenium concentrations in soil were measured on Panel A Area 2 (topsoil cover), the Pole Canyon ODA prior to the 2013 NTCRA (no cover), Panel D South (topsoil-over-chert cover), and Panel D North (topsoil cover). The lowest mean selenium concentrations were measured on Panel A Area 1 (topsoil over Dinwoody/Chert cover), Panel E Area 1 (topsoil-over-chert cover), and Panel E Area 2 (topsoil over Dinwoody/Chert cover). The mean selenium concentration for soils sampled on Panel A Area 1 and Panel E was similar to the mean concentration for soils sampled in northern Sage Valley. Since the RI was completed in 2014, exposure to overburden material in soils on the Pole Canyon ODA has been addressed under the 2013 NTCRA (USFS, IDEQ, and Tribes 2013) with a Dinwoody/Chert cover, completed in 2015.

Selenium concentrations were generally low in soils adjacent to the ODAs, with exceptions in some of the seep areas. Sheet or rill erosion does not lead to widespread contamination of soils that are downgradient from the ODA source areas either during mining or shortly after mining is completed before reclamation occurs.

Surface transport of selenium from surface water to soil is limited to the immediate areas of overburden seepage and was not observed in northern Sage Valley, with the exception of elevated concentrations within a small occasionally wet area that may either periodically receive surface water flow from Pole Canyon Creek or exhibit periodic expressions of shallow groundwater.

Vegetation

Terrestrial vegetation was collected at many of the same locations where soil samples were collected including vegetation growing on ODAs and in adjacent soils. Uptake of selenium by vegetation growing on ODAs with less protective covers was identified as a potential exposure pathway for ecological receptors specifically in the Panel A Area 2, Pole Canyon ODA (prior to the 2013 NTCRA), Panel D South, and Panel D North areas. Plant uptake of selenium also occurs in soils that are saturated with water originating from overburden seeps, with localized effects of seeps on selenium concentrations in vegetation focused on vegetation where the root zone is consistently saturated with seep water.

Selenium concentrations in vegetation are generally correlated with selenium concentrations in the soil. The highest mean selenium concentrations in soil on overburden areas were measured on Panel A (27 milligrams per kilogram [mg/kg]), the Pole Canyon ODA (19 mg/kg; note that this was before the NTCRA cover was constructed), and Panel D (14 mg/kg). Similarly, the highest mean selenium concentrations from composite vegetation samples were measured on Panel A (24 mg/kg), the Pole Canyon ODA (10 mg/kg), and Panel D (13 mg/kg). Selenium concentrations in vegetation are lower when the mine pit or ODA has been reclaimed using a cover system

comprised of non-seleniferous materials, such as the Dinwoody/Chert cover which has been constructed on Panel E. Mean selenium concentrations in soil (0.32 mg/kg) and vegetation (0.15 mg/kg) at Panel E Area 2 were significantly lower. Elevated concentrations of arsenic are present in vegetation where overburden is at the surface, and this was identified as posing a potentially unacceptable risk to human receptors consuming beef from livestock that graze in these areas.

Selenium accumulation into plants is of particular interest at the Site. Based on surveys conducted during site characterization for the RI, selenium hyperaccumulator (e.g., *Astragulus*) and accumulator (e.g., *Aster*) plant species are absent from much of the Site which may be due in part to an herbicide program. None of the species listed by Mackowiak and Amacher (2010) as hyperaccumulators (plants accumulating selenium at concentrations greater than 500 mg/kg) or accumulators (plants accumulating selenium at concentrations from 50 to 100 mg/kg) were observed in any of the transect locations nor in any of the composite samples collected for the RI (Formation 2014c). However, alfalfa (*Medicago sativa*) is common in some of the reclaimed areas of the Site and elsewhere in the region and is considered a selenium accumulator.

Two vegetation samples collected at seeps at the Pole Canyon ODA and at Panel E contained selenium between 100 and 500 mg/kg. These included a forb sample collected downstream from LP-1 (with 153 mg/kg selenium) that contained yellow sweet clover (*Melilotus* spp.), which is considered a probable selenium accumulator by Guo and Wu (1998), Hambuckers et al. (2008), and Kostopoulou et al. (2010), and a forage sample collected at ES-4 (with 149 mg/kg selenium) that did not contain any selenium hyperaccumulator or accumulator species.

2.2.2 Wells Formation and Alluvial Groundwater

Exceedances of the Maximum Contaminant Level (MCL), also the Idaho drinking water standard, of 0.05 milligrams per liter (mg/L) for selenium were observed in Wells Formation groundwater and alluvial groundwater downgradient of source areas, for example, at several wells immediately downgradient of the Pole Canyon ODA. However, selenium concentrations in groundwater from all other locations were lower than the drinking water standard. These wells downgradient of the Pole Canyon ODA also contained arsenic concentrations that exceeded the Idaho drinking water standard (0.01 mg/L) and are known to be affected by past infiltration of water into the ODA, and downgradient transport in alluvial and Wells Formation groundwater.

<u>Wells Formation Groundwater</u>

Specifically, for the Wells Formation groundwater aquifer, selenium is present above the 0.05 mg/L groundwater MCL downgradient of source areas (at the Industrial Well and for monitoring wells GW-16 and GW-25), and above the State of Idaho Surface Water Quality Criterion for Aquatic Life (aquatic water quality standard) of 5 micrograms per liter (µg/L) where groundwater discharges to surface water at Hoopes Spring and South Fork Sage Creek springs. Selenium

concentrations in the springs have been increasing recently, with individual measurements within the springs complex over the past several years ranging from approximately 0.03 to 0.134 mg/L (Hoopes Spring) and from less than 0.01 to 0.099 mg/L (South Fork Sage Creek springs).

In the Panels A and C area, samples collected at the Industrial Well since the early 2000s indicate a slowly increasing baseline selenium concentration and a pattern of concentration spikes that typically occur in the middle of the calendar year, during late spring and early summer recharge conditions. The total selenium concentration in the Industrial Well reached a high of 0.126 mg/L in the sample collected in June 2011, but the concentration has remained at approximately 0.03 mg/L since then.

For Wells Formation groundwater, exceedances of groundwater MCLs for non-selenium COPCs were observed for aluminum, arsenic, iron, and manganese for some of the samples collected at several of the monitoring wells. However, these exceedances were not as consistent as those identified for selenium in Wells Formation groundwater and were typically co-located with elevated selenium concentrations.

Alluvial Groundwater

The extent of the alluvial groundwater system is limited to the lower portions of Pole Canyon, South Fork Sage Creek, and Sage Valley; therefore, the Pole Canyon ODA is the only source area that contributes water to the alluvial groundwater flow system. Selenium concentrations are highest in shallow groundwater immediately downgradient of the Pole Canyon ODA adjacent to lower Pole Canyon Creek (see GW-15 on Figure 2-1). Selenium concentrations in alluvial groundwater decrease southward from the lower Pole Canyon area toward the north-central portion of Sage Valley.

Gain-loss surveys for Sage Creek identified several stream segments where discharge from the valley alluvial flow system to Sage Creek was occurring. However, no increase in the Sage Creek selenium load could be attributed to discharging alluvial groundwater. The selenium load to alluvial groundwater has decreased significantly as a result of the 2006 NTCRA at the Pole Canyon ODA.

For alluvial groundwater, exceedances of groundwater MCLs for non-selenium COPCs were observed for aluminum and arsenic for some of the samples collected at several of the monitoring wells. However, these exceedances were not as consistent as those identified for selenium in alluvial groundwater and were typically co-located with elevated selenium concentrations.

2.2.3 Surface Water

Streams

The primary potential source areas within the Sage Creek basin are Panel A (southern portion), Panels D and E, and the Pole Canyon ODA. The primary potential source areas within the Tygee Creek basin are Panel A (northern portion), and Panels B and C. Concentrations did not exceed surface water quality criteria for any COPCs at the RI stream monitoring locations within the Tygee Creek basin; therefore, the following discussion focuses on surface water contamination in the Sage Creek basin.

The Pole Canyon ODA is distinct from the other Smoky Canyon Mine ODAs because of the cross-valley fill setting and the presence of an underlying shallow alluvial groundwater system associated with Pole Canyon Creek. Prior to implementation of the 2006 NTCRA, Pole Canyon Creek water entered the upstream side of the ODA and then was either lost to Wells Formation bedrock and alluvial deposits beneath the ODA or discharged at the downstream end, or toe, of the ODA. During the relatively dry months from late summer through early spring, most of the creek flow was lost under the ODA. Any creek water that did emerge from the ODA was quickly lost to alluvial deposits before the creek entered Sage Valley. During the fall of very dry years, all Pole Canyon Creek flow was lost underneath the ODA, with no flow discharging from the toe of the ODA. During typical spring runoff (i.e., high-flow) conditions, discharge from the toe of the ODA flowed into Sage Valley where it was still lost to alluvial deposits; occasionally, however, a portion of the creek flowed across Sage Valley and eventually flowed into North Fork Sage Creek and then to Sage Creek. Selenium concentrations in the water discharged at the toe of the ODA typically ranged from 0.5 to 1.5 mg/L, which exceeded the aquatic water quality standard (0.005 mg/L).

Implementation of the 2006 and 2013 NTCRAs has significantly reduced the transport of selenium from the Pole Canyon ODA to the environment. The 2006 NTCRA isolated the ODA from contact with flow in Pole Canyon Creek by conveying creek water around the ODA in a pipeline and discharging the water downstream of the ODA. In addition, storm water that previously flowed onto the ODA is now conveyed to the toe in a control ditch without contacting overburden. The 2013 NTCRA cover system has reduced the amount of water that infiltrates into the surface of the ODA. The significant reduction in water contacting overburden materials has reduced the mass of selenium released from the ODA to the environment.

As described in the Pole Canyon NTCRA 2017 Annual Report (Formation 2018b), since implementation of the 2006 NTCRA, selenium concentrations in water discharging from the toe of the ODA at LP-1 have increased (from 0.5 to 1.5 mg/L before the NTCRA to 3 to 6 mg/L after the NTCRA) because creek water is no longer available to dilute the infiltrated rainfall and snowmelt. However, the magnitude and duration of flow has decreased substantially and toe seep water, if any, infiltrates to the subsurface immediately downstream of the toe and generally does

not reach lower Pole Canyon Creek downstream from the bypass pipeline discharge. As a result, most of the selenium mass load associated with toe seep flow is now transported to the underlying alluvial groundwater (and potentially the deeper Wells Formation aquifer) rather than directly to surface water that flows into Sage Valley.

The annual selenium load from the Pole Canyon ODA to the environment is calculated by multiplying the annual volume of water leaving the ODA (via the surface water, alluvial groundwater, and Wells Formation groundwater pathways) by the annual average selenium concentration in surface water or groundwater (Formation 2018b). The estimated annual flow from the ODA to surface water, alluvial groundwater and Wells Formation groundwater is shown in Table 2-2. The water balance model provides estimates for the current condition (i.e., with the NTCRAs) and for a hypothetical scenario where no actions were implemented. In 2017, the NTCRAs were estimated to have reduced water flow from the ODA to surface water by 98%; to alluvial groundwater by 90%; and to Wells Formation groundwater by 98% (Table 2-2). On a mass basis (combining flow estimates and measured selenium concentrations) the NTCRAs were estimated to have resulted in a reduction in selenium load from the ODA to the environment of 94% in 2017 (94% in surface water, 90% to alluvial groundwater and 98% to Wells Formation groundwater) (Table 2-3).

Surface discharge of Wells Formation groundwater at Hoopes Spring and South Fork Sage Creek springs, with flow continuing downstream in lower Sage Creek, is the primary transport pathway for selenium leaving the Site. Water discharging from the springs provides the majority of the flow in lower Sage Creek under all flow conditions and contains selenium at concentrations that exceed the aquatic water quality standard (0.005 mg/L). Selenium concentrations over the past several years at individual spring discharge locations have been as high as 0.134 mg/L at Hoopes Spring location HS in 2015 and 0.099 mg/L at South Fork Sage Creek springs location LSS-SP-N in 2017, although these concentrations have remained relatively constant over this period (Formation 2016c, 2018b). Immediately downstream from the springs complex, the highest selenium concentrations in creek water have been 0.106 mg/L (HS-3, downstream of Hoopes Spring) and 0.0278 mg/L (LSS, downstream of South Fork Sage Creek springs) (Formation 2018b).

The selenium load from these springs has been increasing over the past several years as selenium transported from the southern portion of Panel A, the Pole Canyon ODA, Panel D, and Panel E arrives, with recent loads of 3 to 4 pounds per day at Hoopes Spring and 0.7 to 0.8 pounds per day at South Fork Sage Creek springs. The selenium load does not show significant seasonal trends and, therefore, in a given year the relatively constant load results in higher selenium concentrations in immediately downgradient streams (i.e., lower Sage Creek and Crow Creek) during low-flow conditions (late summer, early fall) and lower concentrations in high-flow conditions (spring runoff). As unaffected water enters the stream system from groundwater discharge and surface water from other creeks (e.g., Crow Creek upstream of the confluence with

Sage Creek), selenium concentrations decrease, and the selenium load remains relatively constant downstream of the inflow from the springs complex. However, selenium concentrations are still above the aquatic water quality standard (0.005 mg/L) at the Wyoming border during low-flow conditions.

For surface water in streams, exceedances of surface water benchmarks for non-selenium COPCs was observed only for cadmium at several of the surface water monitoring locations. However, these exceedances were generally also associated with selenium exceedances. For springs at the Site (Hoopes Spring and South Fork Sage Creek springs), selenium was the only COPC that exceeded benchmarks or criteria.

Seeps and Detention Basins

Surface water sampling at the Site included surface expressions of seepage from the ODAs and detention basins that collect seepage and runoff from the pits and external ODA. Runoff from roadways is addressed under active mine operations which includes management of runoff and receiving detention basins. Storm water runoff is addressed under the Smoky Canyon Mine Storm Water Pollution Prevention Plan (SWPPP).

Flow rates at some seeps can vary substantially seasonally, and at some locations surface seeps are only present in the spring. Evaluation of data collected before and/or during the RI showed elevated selenium concentrations in surface water features at five overburden seep areas (AS-2, DS-7, DS-10, ES-4, and ES-5; note that only DS-7 now flows with any regularity) and the associated detention basin waters downgradient from those seeps (AP-2, DP-7, DP-10, EP-4, and EP-5). Of the seeps currently flowing, DS-7 and LP-1 have the highest selenium concentrations. Detention basins receiving seep water with elevated selenium concentrations from the overburden areas also exhibit the highest selenium concentrations. Where selenium concentrations are elevated, other COPCs including arsenic are also elevated. Although elevated, the basin-water selenium concentrations are lower than in the nearby seep waters.

In addition to arsenic, exceedances of benchmarks for other non-selenium COPCs were observed for cadmium, chromium, nickel, vanadium, and zinc. However, these exceedances were not as consistent as those identified for selenium in seeps and detention basins and were typically co-located with elevated selenium concentrations.

The transport of solids by erosion and sediment transport is limited by the coarse texture of the overburden and the best management practices (BMPs) (e.g., soil cover, revegetation, etc.) that have been implemented during mining operations to control runoff and erosion from the ODAs. To the extent that COPC transport takes place by erosion of the source materials via surface water runoff from ODAs, those surface pathways end at the detention basins and do not extend to native soils or sediments or to Site streams. With the exception of a few isolated events where

local failures of overburden fill resulted in overtopping of detention basins, overburden erosion and transport to native soils or sediments in stream drainages has not occurred.

2.2.4 Stream Sediment

Potential sediment transport pathways from source areas to local surface water drainages were evaluated in the RI by comparing selenium concentrations from upstream to downstream monitoring locations in streams. As described above, runoff from roadways is addressed under active mine operations and storm water runoff is addressed under the Smoky Canyon Mine SWPPP. For stream sediments, selenium exceeded the screening-level benchmark for sediment (2 mg/kg) at the following locations, which are all downstream from mine-disturbance areas: lower Pole Canyon Creek (LP-PD), the stream downstream from Hoopes Spring (HS-3), North Fork Sage Creek in northern Sage Valley (NSV-6), and lower Sage Creek (LSV-2C, LSV-3, LSV-4).

Elevated concentrations of selenium in stream sediments in the locations noted above are a result of selenium transport in surface water (from groundwater discharging at Hoopes Spring and South Fork Sage Creek springs) and sorption of the dissolved selenium to stream sediments. The presence of elevated selenium and other COPC concentrations in lower Pole Canyon Creek sediment samples is also due to the deposition of overburden slope materials into the creek during a past slope failure at the toe of the ODA in spring 1996. The slope has since been stabilized, but residual sediments remain in the creek bed below the ODA. Except for Pole Canyon Creek immediately downstream of the Pole Canyon ODA, there are no surface transport pathways for sediment from source areas to streams. Sediment that is eroded in storm water runoff from the ODAs is collected in detention basins and therefore prevented from entering streams.

2.2.5 Terrestrial and Aquatic Biota

Terrestrial and aquatic biota data were collected during the RI for characterization of selenium in fish tissues, benthic invertebrate tissues, aquatic vegetation, small mammals, and terrestrial invertebrates.

Terrestrial invertebrate and small mammal tissue selenium concentrations from ODAs with minimal or no cover material and from certain overburden seep areas are elevated in comparison to samples from adjacent areas. The elevated concentrations are related to the abiotic selenium levels and may indicate bioaccumulation of selenium in the food chain. This is particularly apparent in Panel A, Panel D, and the Pole Canyon ODA where selenium concentrations in both terrestrial invertebrates and small mammals were elevated relative to the areas of the Site where selenium concentrations in soil are lower (i.e., Panel E, northern Sage Valley, and the samples collected from areas adjacent to mine disturbances). Other chemicals with elevated concentrations that may pose potentially unacceptable risks to terrestrial biota included cadmium, chromium, copper, lead, manganese, molybdenum, vanadium, and zinc. However, the risks from

these COPCs were lower than from selenium and were generally co-located with areas of selenium risk.

Copper concentrations in small mammal tissue collected during the RI ranged from 11.9 to 3,900 mg/kg (Formation 2014c), and concentrations ranged from 10.7 to 936 mg/kg in follow-up samples collected in 2016 (Formation 2016d, 2018a). After outliers (concentrations greater than 1,100 mg/kg) and results greater than the maximum tissue concentration observed in the literature (622 mg/kg) were removed, the range of copper concentrations in small mammals was lower (10.7 to 619 mg/kg). Based on copper concentrations in soil and other tissue samples collected from the same areas, concentrations measured in small mammals collected from other southeast Idaho phosphate mine sites, and concentrations reported in the literature for copper-contaminated sites, elevated copper concentrations at Smoky were considered anomalous (Formation 2018a). Copper contamination is not associated with phosphate mining and copper was not identified in the Smoky Canyon Mine RI at elevated concentrations in soils. Although the source of copper to small mammals remains uncertain, copper concentrations are considered anomalous.

Elevated selenium concentrations in fish tissue immediately downstream from Hoopes Spring and in lower Sage Creek appear to be directly correlated with surface water concentrations in these stream reaches. Dietary sources may also contribute, as selenium concentrations in benthic macroinvertebrates at these locations were slightly elevated with respect to background. Selenium concentrations in macrophytes and periphyton also followed a similar pattern, with the highest selenium concentrations in lower Pole Canyon Creek.

2.3 Fate and Transport Summary

As identified in the RI, pathways for transport of selenium identified at the Site are:

- Release from backfilled pits and external ODAs and transport downward to the underlying Wells Formation groundwater at the Site. Transport in the groundwater and discharge to surface water via springs and, when pumping, discharge at the Industrial Well in the northern portion of the Site.
- Release from the Pole Canyon ODA to alluvial groundwater beneath the Pole Canyon Creek channel. This alluvial groundwater continues into northern Sage Valley and likely discharges to downgradient surface water, but the associated selenium load addition is too small to detect.
- Surface water flow through the base of the Pole Canyon ODA and into Pole Canyon Creek prior to implementation of the 2006 NTCRA and during an isolated event in 2011 when the bypass pipeline was operated at less than design capacity. Surface water runoff from other ODAs (i.e., storm water runoff and seeps from ODA toes) is contained in ponds and does not reach Site streams via the surface pathway.
- Sediment transport from ODAs primarily during active mining and immediately afterwards (before reclamation). Sediment is contained in storm water detention basins and does not

reach Site streams. The exception is Pole Canyon ODA where sediment was transported to the Pole Canyon Creek channel, primarily by a slope failure in spring 1996.

- Direct uptake by plants growing on overburden.

During scoping of the RI, as summarized in the RI/FS Work Plan (Formation 2011a), the wind dispersion and air deposition potential pathway was identified as insignificant at the Site based on findings of the SI (NewFields 2005). Therefore, this potential pathway was not addressed in the FS.

2.4 Conceptual Model

CSM diagrams for human, ecological, and livestock receptors are presented in the Site-specific risk assessment reports (Figure 4-1 in SSHRA [Formation 2015a], Figure 2-11 in SSERA [Formation 2015b], and Figure 3-1 in SSLRA [Formation 2016a], respectively). Information on contaminant sources, migration routes, exposure pathways, and receptors were used to develop an understanding of the Site and to evaluate potential risks.

2.4.1 Contaminant Sources

Overburden disposed in backfilled mine pits and external ODAs is the source of selenium and other COPCs to the environment. Overburden is removed during active mining to access the underlying phosphate ore. The primary sources of selenium within the overburden are the sulfides and organic matter present in the mudstone and center waste shale from the Meade Peak Member of the Phosphoria Formation. The source areas of the Site include the backfilled mine pits and external ODAs of Panels A through E.

The release of selenium from overburden materials occurs by (1) interaction with infiltrating water/leaching and (2) weathering of overburden. Dissolution of soluble solids and release of associated selenium to infiltrating water represents a relatively short-term release mechanism that takes place primarily during overburden handling and initial disposal. Weathering operates by oxidation of minerals or organic matter to release selenium. Oxidation processes may begin as soon as overburden is excavated and continue in the final disposal setting.

2.4.2 Migration Routes

Pathways for migration of selenium from source areas to groundwater and surface water are described below.

Groundwater

Groundwater pathways for transport of selenium include (1) transport by alluvial groundwater and (2) transport by Wells Formation groundwater.

A valley-fill alluvial groundwater system exists in Sage Valley. The water table in this system is typically less than 30 feet below the ground surface and, at some locations, is intercepted seasonally by Sage Creek. The valley system is connected with shallow alluvial deposits at the mouths of the tributary drainages, and specifically is affected by transport of selenium from the alluvial system underlying and immediately downgradient of the Pole Canyon ODA. The alluvial groundwater system in Pole Canyon is connected to the Wells Formation aquifer; however, the Sage Valley alluvial groundwater flow system is isolated from the Wells Formation by the West Sage Valley Branch Fault that parallels the western side of Sage Valley. In essence, the valley alluvial system has the configuration of a large basin, with flow contributions coming primarily from tributaries along the west side of the valley.

Groundwater flow in the upper Wells Formation aquifer is controlled by the combined effects of the West Sage Valley Branch Fault, which is a barrier to flow to the east, and the discharge zone created by the springs complex to which local and regional Wells Formation groundwater ultimately flows. Together, these springs discharge Wells Formation groundwater in excess of 10 cubic feet per second (cfs) to the Sage Creek drainage; the spring discharge comprises the majority of flow in the lower Sage Creek drainage under all flow conditions. In the north end of the Site, groundwater flow paths within the Wells Formation are also influenced by pumping at the Industrial Well, which generates a large area of hydraulic influence when operated at typically high pumping rates.

As part of the RI, analytical and numerical models were developed to characterize the transport of selenium in groundwater in the Wells Formation aquifer in the southern and northern portions of the Site. An analytical model was developed for the southern groundwater flow system (south-end model), to evaluate the relative contribution from source areas to the selenium mass load discharged at the springs complex. An analytical model and numerical models were also developed for the northern groundwater flow system (north-end models) to estimate potential groundwater concentrations at the northern lease boundary. The models provide a line of evidence in evaluation of the dynamic nature of varying historical Site conditions that have influenced selenium transport over time.

The RI (Formation 2014c) stated that the specific objectives of the models were as follows:

- Identify the relative selenium contribution to the springs complex from each mine panel on a year-by-year basis and estimate the future contributions based on past, current, and future reclamation activities or removal actions.
- Estimate potential selenium impacts at the northern lease boundary based on past, current, and future reclamation activities or removal actions.
- Account for Site conditions that change with time due to disturbance and reclamation activities.

The results of the modeling are reported in Appendix H of the RI Report (Formation 2014c). The key findings with respect to the identification of remedial alternatives are summarized here. In the south end of the Site, Wells Formation groundwater discharges at the springs complex. The models developed for the RI estimate selenium loading to Wells Formation groundwater resulting from leaching from the seleniferous overburden by infiltrating precipitation and by storm water run-off where detention basins occur over seleniferous backfill material. This loading is shown as the black dotted line on Figure 2-5. The model is currently being updated for the FS.

In general, the maximum selenium loading from an ODA to groundwater occurs during active mining and prior to completion of reclamation. Once an area is reclaimed, selenium loading to groundwater reduces over time due to the reduction of releases from the overburden (i.e., the source term characteristics). For example, mining at Panel D began in 1993 and continued through 1998. Reclamation at Panel D began in 1996 and was completed in 2002. Mining at Panel E occurred in 1998 through 2006. Portions of Panel E remained open through 2011 to receive backfill from Panel F. Most of the reclamation was competed in 2013. Each of these mine panels have the similar characteristics of peak loading during active mining and reduced loading after reclamation. The relative magnitude of loading after reclamation is affected by the reclamation type; infiltration-reduction covers result in lower levels of loading.

The Pole Canyon ODA, which received seleniferous backfill from 1985 through 1990, is a unique setting because it is a cross-valley fill with surface water flowing through the ODA. Prior to backfilling, a coarse-grained chert material was placed at the base of the ODA to create of a zone of higher hydraulic conductivity through which Pole Canyon Creek flowed. Selenium was mobilized from the overburden by the creek water as it passed through the ODA (1985 through 2007). The first NTCRA at the Pole Canyon ODA included a pipeline to divert a portion of the Pole Canyon Creek stream flow around the ODA, an infiltration basin that directs the remaining clean Pole Canyon Creek flow to the Wells Formation aquifer upstream of the ODA, and a channel that controls run-on to the Pole Canyon ODA. These actions were completed in 2008 and significantly reduced the mobilization of selenium and subsequent loading to groundwater (see Figure 2-5). The second NTCRA included storm water controls and a Dinwoody/Chert cover system completed in 2015, further reducing selenium loading to groundwater.

The estimated loads from each panel to groundwater are transported to the springs complex based on the travel time as shown by the blue lines on Figure 2-5. The loading from panels that are farther away (i.e., Panel A) take longer to reach the springs than the loads that are closer (i.e., Panel E) The loads are then added to estimate the total selenium load at the springs complex over time, as shown on Figure 2-6. Overall, the RI modeling effort found that selenium released during active mining began to arrive at the springs complex in the late 1990s and was predicted to peak in the 2015/2016-time frame (Appendix H, Formation 2014c). Because mining began farther north and has progressed south, these arrival signatures have overlapped (Figure 2-6). In each case, the estimated loading curves from a given panel peak due to the effects of active mining and then reduce to a steady-state loading reflecting the post-mining/reclaimed condition. For the Pole Canyon ODA, diversion of Pole Canyon Creek around the ODA starting in 2007 and completion of the NTCRA cover in 2015 are predicted to begin reducing loading at the springs complex in the late 2020s. As noted previously, the modeling is being updated to reflect the latest understanding of the Site for use in the FS.

The predicted loading estimate from key areas to the springs complex in 2050 (i.e., after the effect of all completed actions is realized) is due to infiltration into the ODAs and subsequent release and transport of selenium shown in Table 2-4. These values show the relative importance of each source area to selenium loading and can be used to identify where remedial actions might be needed to meet RAOs. As shown, most of the loads are predicted to come from the Panel A area and Panel D area. The Panels A and D areas have relatively less protective covers than the more recent covers installed on portions of Panel E and the Pole Canyon ODA, and therefore, these will be the focus of the evaluation of remedial alternatives in this FS.

North-end modeling analyses were conducted to evaluate two issues regarding the influence of mining activity on selenium concentrations in the Wells Formation groundwater:

- Extent of containment provided by pumping at the Industrial Well (GW-IW).
- Potential north-end source area influence on groundwater not captured by the Industrial Well.

An analytical model and a numerical model were developed to address these issues. Both north-end models used results of the GIS-based source term model to account for the spatial and temporal distribution for multiple source areas and associated selenium loading to the Wells Formation aquifer.

Assessment of containment provided by pumping at the Industrial Well resulted in a structural influence (e.g. faulting) capture zone assumption. Figure 2-7 illustrates the capture zone and seleniferous backfill areas inside the capture zone. The applicability of the structural control assumption suggests that sources in Panels A and C are captured by the Industrial Well.

As noted previously, the modeling is being updated to reflect the latest understanding of the Site for use in the FS. The conceptual model for north end groundwater, in particular has changed significantly since the RI. This updated model will be presented in an appendix to FSTM#2 and used to evaluate remedial alternatives in the detailed analysis.

Surface Water

Surface water pathways for transport of selenium include (1) transport by runoff from ODAs, (2) transport by seep flow from ODAs, and (3) transport by stream flow.

Based on the RI (Formation 2014c), there is no evidence that storm water runoff transports selenium to surface waters in the drainages that cross mining-disturbed areas. However, runoff from ODAs to detention basins and subsequent infiltration to Wells Formation groundwater is a potential transport pathway.

The seeps represent a transport pathway for selenium from the ODAs to soil below ODA seeps and, for DS-7 and ES-3, to detention basins below these ODA seeps. At the seeps where flow was present during RI data collection (LP-1, DS-7, and ES-3 for only a portion of the time), ongoing infiltration of seep water into the subsurface also represents a potential transport pathway to groundwater. The highest potential selenium loading to groundwater is associated with seeps LP-1 and DS-7 which have the highest selenium concentrations and mass loading rates. These two seeps have the potential to infiltrate into the underlying deep Wells Formation aquifer. Seep LP-1 also infiltrates into the shallow alluvial groundwater flow system that overlies the Wells Formation.

The RI (Formation 2014c) indicated that Smoky Creek, Pole Canyon Creek, Sage Creek, and South Fork Sage Creek have not received runoff from mine-disturbance areas. However, the Wells Formation aquifer discharges groundwater to surface water at Hoopes Spring and South Fork Sage Creek springs; the selenium mass load discharging at the springs complex originates entirely from Wells Formation groundwater. The flow from Hoopes Spring continues downstream into Sage Creek upstream of its confluence with South Fork Sage Creek. The flow from South Fork Sage Creek springs enters South Fork Sage Creek near the groundwater discharge locations.

2.4.3 Exposure Pathways

The risk assessments evaluated numerous exposure pathways and receptors.

Potentially complete significant human exposure pathways are:

- Ingestion of surface water and groundwater for domestic drinking water supply

- Ingestion of livestock that grazed at the Site (beef)

Potentially complete significant exposure pathways for terrestrial ecological receptors are:

- Incidental ingestion of overburden material and soil
- Ingestion of small mammals
- Ingestion of terrestrial plants growing on overburden material and soil

Potentially complete significant exposure pathways for riparian and aquatic receptors are:

- Ingestion of surface water and incidental ingestion of soil (riparian only) and sediment (fish and riparian receptors)
- Ingestion of aquatic plants, periphyton, zooplankton, and benthic invertebrates (fish and riparian receptors)
- Ingestion of fish and amphibians (riparian receptors)

Potentially complete significant exposure pathways for livestock are:

- Ingestion of terrestrial plants as forage
- Ingestion of surface water as drinking water
- Ingestion of groundwater would represent an exposure risk only if wells are developed for stock watering.

2.4.4 Potential Receptors

The risk assessments identified the following potential receptors that had the potential to be exposed to selenium and other COPCs at levels that could present an unacceptable risk:

Human: Current and potential future seasonal ranchers and Native Americans, and potential future recreational campers and hypothetical residents (assumed only on private lands).

Ecological: Terrestrial vegetation and terrestrial and riparian wildlife such as mice, vole (riparian only), rabbits, mink (riparian only), raccoons (riparian only), ducks (riparian), birds, coyotes, and mule deer. Aquatic receptors are fish, amphibians, and benthic invertebrates in lower Sage Creek.

Livestock: Sheep. Cattle and horses may also potentially be exposed.

2.5 Risk Assessments

The primary objectives of the SSHHRA (Formation 2015a) and SSERA (Formation 2015b) were to evaluate the possible human health and ecological risks associated with potential exposure to environmental media at the Site to help determine the need for remedial action. The primary

objective of the SSLRA (Formation 2016a) was to evaluate potential livestock risks associated with potential exposure to environmental media to provide the regulatory agencies with the information necessary to make informed decisions regarding range management.

2.5.1 Human Receptors

Arsenic was the only chemical for which cancer risk estimates exceeded the target cancer risk goal of 1E-05, and arsenic was identified as a human health chemical of concern (HH COC) for the seasonal rancher, recreational camper, Native American, and hypothetical resident receptor scenarios, with contributions from several environmental media (Formation 2015a).

Seasonal Rancher

Potentially unacceptable current and future risks are from:

- Beef – arsenic

Ingestion of beef was the primary contributor of cancer risk for the seasonal rancher and arsenic was the only chemical for which cancer risk estimates exceeded the target cancer risk goal of 1E-05. The exposure point concentration (EPC) for beef was modeled based on Site-wide arsenic concentrations in samples of soil, forage plants, and/or water. Concentrations of arsenic in vegetation are elevated in areas of the Site that have overburden at the surface, and livestock may be exposed if they graze in those areas.

Thallium exposures exceeded the USEPA non-cancer threshold for ingestion of beef by the seasonal rancher, with elevated thallium concentrations in overburden within the mine area influencing the calculated uptake. However, data from regional studies suggest that thallium concentrations in soils at the Site are within the range of natural background concentrations. Therefore, risks from thallium would be considered only within the context of natural background exposure along with the considerable uncertainty in the uptake coefficient used to model beef concentrations.

Recreational Camper and Native American

Potentially unacceptable future (recreational camper) and current and future (Native American) risks are from:

- Surface water (domestic drinking water supply) – arsenic

Surface water locations associated with seeps (DS-7 and LP-1) and detention basins (DP-7 and EP-2) contain arsenic concentrations that exceed the Idaho drinking water standard (0.01 mg/L). These locations contributed to exposure and lifetime cancer risks in excess of 1E-05. Arsenic

concentrations at all other surface water and groundwater sampling locations are lower than the drinking water standard.

Hypothetical Resident

Potentially unacceptable future risks are from:

- Groundwater (domestic drinking water supply) – selenium and arsenic

Although land use and population statistics indicate that the Site is unlikely to convert to residential use, the hypothetical resident receptor was assessed for private lands in accordance with Forest Service guidance (USFS 2013b). Potentially unacceptable risks (cancer risks in excess of 1E-05) from selenium and arsenic were estimated for the hypothetical resident scenario in which groundwater is used for domestic drinking water supply. Selenium concentrations in groundwater exceeded the Idaho drinking water standard (0.05 mg/L) at several wells immediately downgradient of the Pole Canyon ODA, but concentrations in groundwater from all other locations were lower than the drinking water standard. These wells also contained arsenic concentrations that exceeded the Idaho drinking water standard (0.01 mg/L). Both locations are immediately downgradient of the Pole Canyon ODA and are known to be affected by past infiltration of water into the ODA, and downgradient transport in alluvial and Wells Formation groundwater.

2.5.2 Ecological Receptors

Selenium is the primary risk driver for both current and future aquatic and terrestrial biota (Formation 2015b). Conclusions for aquatic receptors are presented by media type to reflect the risk analysis organization and regulatory framework for aquatic environments. Terrestrial risk analysis is based on ingestion of ecological chemicals of concern (ECOCs) from multiple exposure media within each habitat.

Aquatic

Potentially unacceptable current and future risks for aquatic receptors are from:

- Surface water – selenium
- Fish tissue – selenium

Selenium is the primary risk driver in surface waters across several drainages. Other ECOCs that exceeded Toxicity Reference Values (TRVs) primarily in surface waters included aluminum, arsenic, cadmium, iron, nickel, and zinc (Formation 2015b). Where elevated, these ECOCs do not likely represent unacceptable risk because of the very limited potential for exposure (e.g., seeps or ephemeral habitats) of receptors to these environments. Locations where elevated selenium concentrations exist and pose risk to aquatic receptors correspond to areas of known

inputs such as Hoopes Spring and South Fork Sage Creek and their downstream receiving waters, and Pole Canyon Creek.

Selenium in fish tissue is the most reliable measure of exposure and potential risk for fish and other aquatic receptors. Whole body selenium fish tissue concentrations downstream of Hoopes Spring and South Fork Sage Creek springs exceed the Idaho site-specific whole body fish tissue criterion for Sage Creek and Hoopes Spring (13.6 mg/kg dw) (IDAPA 58.01.02.287, July 2019)[1]. The site-specific whole body fish tissue criterion for Crow Creek is 12.5 mg/kg dw, which is currently exceeded at Crow Creek locations downstream of Sage Creek. As described in the SSERA (Formation 2015b), Pole Canyon Creek at the LP-1 seep poses unacceptable risks to higher trophic level organisms that may obtain food or water from that location; however, the physical habitat does not support any fish due to lack of connectivity to fish bearing waters. North Fork Sage Creek (NSV-6) likely supports fish, but tissue levels were not quantified for this stream due to flow limitations during sampling. Historical data indicates that North Fork Sage Creek has supported fish as far up as NSV-5. Simplot plans to collect additional supporting data for North Fork Sage Creek and Pole Canyon Creek in order to derive site-specific selenium criteria for those creeks. For now, the effective selenium criterion for North Fork Sage Creek and Pole Canyon Creek is 9.5 mg/kg-dw (whole body selenium fish tissue) (USEPA 2019).

Other ECOCs that were elevated in fish tissues where data have been collected included aluminum and essential micronutrients copper, iron, and zinc. The contributions of background to tissue concentrations, as well as the reliability of the TRVs used to assess potential risks (particularly aluminum), were discussed in the Uncertainty Analysis of the SSERA (Formation 2015b). The key ECOPC for fish tissues in this system is selenium.

Selenium in sediments from Hoopes Spring (HS-3) and North Fork Sage Creek (at NSV-6), and at Pole Canyon Creek (LP-PD, LPT-1, LPT-2, and LPT-3) exceeded the sediment TRV. However, the TRVs for selenium in sediments are not based on effects to benthic invertebrates, but rather as potential bioaccumulation effects to organisms that consume those benthic invertebrates. Literature-derived tissue TRVs for benthic invertebrates, compared to concentrations measured for invertebrate tissues collected from across the Site, indicate selenium in invertebrate tissues potentially poses a risk only in lower Sage Creek. Although sediment in upper Sage Creek (upstream of inflow from Hoopes Spring) was identified as posing a risk, it was clearly a function of a single location (SV-1, an irrigation ditch) where consistently higher selenium concentrations were found. However, as mentioned above, the pathway for exposure is incomplete, as connectivity to downstream waterbodies is limited and inconsistent. In addition to selenium in sediments, other ECOCs that were elevated above TRVs included barium, cadmium, chromium, nickel, manganese, silver, and zinc.

[1] Idaho Administrative Code Section for Water Quality Standards as adopted based on USEPA approval letter of site-specific criteria, Dated July 9, 2019 [USEPA 2019]. IDAPA 58.01.02.287. Whole body selenium fish tissue criteria were approved by USEPA for Hoopes Spring and Sage Creek as well as Crow Creek. USEPA did not approve these criteria for North Fork Sage Creek and its tributaries or for Pole Canyon Creek.

The concentration of selenium in biotic and abiotic media exceeds TRVs for aquatic receptors at certain locations (Formation 2015b). ECOCs at the LP-1 seep and at LSV-1 pose unacceptable risks; however, whether these concentrations represent significant ecological risk is often a function of habitat and connectivity of surface water to source areas or accessibility by terrestrial organisms. As discussed in the SSERA, the LP-1 seep at the toe of the Pole Canyon ODA is isolated and typically disconnected from the main stream due to installation of the Pole Canyon Creek bypass pipeline (under the 2006 NTCRA). Therefore, the potential for exposure to these concentrations is extremely limited for aquatic ecological receptors. For LSV-1, which is located in an irrigation ditch near Sage Creek, downgradient of detention basin DP-2, flow is ephemeral at best and no appreciable aquatic habitat is present. Because permanent aquatic habitat is limited or absent, no adverse effects on aquatic populations is likely due to the lack of exposure.

Terrestrial Upland

Potentially unacceptable current and future risks to terrestrial upland receptors are from:

- Food/Soil/Surface Water (Panel A Area 2, Panel D North and South) – selenium

Selenium in soils, vegetation, and terrestrial invertebrates and small mammals is the primary risk driver at the Site (Formation 2015b). HQs based on the geometric mean no observed adverse effect level (NOAEL) ranged from less than 1 to as high as 20 for selenium in upland receptors. Other chemicals identified as posing potentially unacceptable risks in the Tier 1/Tier 2 analysis included cadmium, copper, lead, vanadium, and zinc; however, the risks from these ECOCs were lower than from selenium and were generally co-located with areas of selenium risk. Geometric mean HQs for all other ECOCs were 2 or less.

Elevated concentrations of ECOCs were observed primarily in mined areas with either no cover (i.e., direct revegetation of overburden) or topsoil-only reclamation and elevated concentrations of ECOCs in soils corresponded with higher exposure and risks. Risks are highest in Panel A Area 2, Panel D North and South, and on the Pole Canyon ODA (prior to construction of the cover system in 2015 under the 2013 NTCRA) which represent areas where exposure to selenium-bearing overburden materials is expected to be highest. Exposure and risks were considerably lower for northern Sage Valley, Panel A Area 1, and Panel E (Figure 2-8). Risks were lowest in the areas with a Dinwoody/Chert cover and highest in the areas with no cover.

Based on the SSERA conclusions, risks to sub-populations of small mammal (deer mouse, eastern cottontail) and bird (northern harrier, northern bobwhite, American robin) receptors inhabiting Panel A Area 2, and Panel D North and South could not be ruled out using the available data. Exposure to the terrestrial receptors and potential risk is elevated compared to the surrounding areas, but it is unknown whether any actual effects are occurring to the populations inhabiting those areas. No data are currently available to address the presence or absence of population-level effects from selenium as predicted in the SSERA (Formation 2015b). While no

detailed population studies were conducted in those areas, small mammal sampling was successful in both 2010 and 2016 suggesting the presence of a functioning small mammal community (Formation 2010, 2016e). In 2010, a total of seven species of small mammals, dominated by deer mice (*Peromyscus maniculatus*) and, to a lesser extent, three vole species (meadow, long-tailed, and montane), were captured in the upland areas of the mine and in Sage Valley (Formation 2014c). Both male and female deer mice and voles were captured. For the more abundant deer mice, representative animals from the juvenile, sub-adult, and reproductive adult age classes were captured. In limited sampling during 2016, both deer mice and meadow voles were captured that included age classes of both species ranging from juvenile to reproductive adults (Formation 2018a). These data suggest that an adequate source of food and habitat is present on the ODAs to support a small mammal community containing all age classes of animals. The presence of a small mammal community does not preclude the SSERA conclusions, but it does represent an uncertainty regarding the predictive ability of the risk-models used in predicting population-level effects to the small mammal receptor.

Riparian

Potentially unacceptable current and future risks to riparian receptors are from:

- Food/Soil/Sediment/Surface Water (seeps and springs) – selenium

Similar to the upland areas of the Site, selenium is the primary risk driver; however, other ECOCs were identified for riparian receptors including cadmium, chromium, copper, lead, manganese, molybdenum, vanadium, and zinc (Formation 2015b). HQs based on the geometric mean NOAEL ranged from less than 1 to as high as 108 for selenium in riparian receptors. As indicated for the upland areas, exposure and risk associated with the non-selenium ECOCs is lower than risks predicted from selenium. Geometric mean HQs for all other ECOCs were 1.1 or less. Elevated selenium concentrations in semi-aquatic habitats at the Site were limited to a few sampling locations. Selenium exposures were much higher than elsewhere at seeps DS-7 (east of Panel D) and ES-4 (east of Panel E), as well as riparian location LP-PD (Pole Canyon). Risk was lowest at seep ES-3 (east of Panel E). As described in the SSERA, wildlife at risk in riparian habitats included mammals (coyote, deer mouse, meadow vole, mink, mule deer, raccoon), waterfowl (belted kingfisher, mallard), raptors (northern harrier), game birds (northern bobwhite), and other birds (American robin, red-winged blackbird, song sparrow) (Formation 2015b).

2.5.3 Livestock Receptors

Potentially unacceptable current and future risks to livestock are from:

- Vegetation – selenium
- Surface water – selenium

Selenium is the primary risk driver for livestock (Formation 2016a). While exposure to several other chemicals of concern (COCs) including barium, iron, manganese, and molybdenum exceeded risk benchmarks in some areas, the elevated concentrations coincided with selenium exposures in most cases. Exposure to these other COCs was described as likely representing background conditions. Potentially unacceptable risks to livestock from selenium were calculated for vegetation, surface water, and groundwater (if used for stock watering in the future).

The greatest potential for adverse effects from vegetation is from sampling locations in mine-disturbance areas in the Pole Draney and Sage Valley grazing allotments (Figure 2-9) where selenium concentrations exceeded the acute TRV (Formation 2016a). Of the five grazing allotments that overlap the Site, only the Sage Valley Allotment contained average concentrations that exceeded the chronic TRV. Site-specific risks from selenium in surface water are restricted to seep and spring locations immediately downgradient of the Pole Canyon ODA and Panel D; however, these seep areas are typically fenced to prevent access. Overall chronic and acute risks from selenium are unacceptable primarily due to surface water and vegetation associated with backfilled pits and ODAs in the Sage Valley and Pole Draney grazing allotments. Exposure in other allotments was within acceptable levels.

3.0 REMEDIAL ACTION OBJECTIVES

This section provides Site-specific objectives and goals for remedial actions at the mine. Preliminary RAOs were identified in the RI/FS Work Plan (Formation 2011a), based on the findings from the SI (NewFields 2005). These Preliminary RAOs have been updated in this section to incorporate the findings of the RI and risk assessments and the evaluation of ARARs.

Section 300.430(e) of the 1990 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that the remedial alternative development process be initiated by developing RAOs, identifying GRAs that address the RAOs, and performing an initial screening of applicable remedial technologies. The overarching goal of the remedy evaluation process is to provide the basis for selection of a remedy that is protective of human health and the environment and meets ARARs.

3.1 Environmental Conditions of Concern

Based on the key findings of the RI and risk assessments (see Section 2), the following environmental conditions of concern have been identified to be addressed by the Site remedy:

- Releases of selenium from overburden (both during mining and after mining) stored in backfilled pits and external ODAs with minimal or no covers that have resulted in MCL exceedances in groundwater in the Wells Formation aquifer including discharges at Hoopes Spring and South Fork Sage Creek springs and occasionally at the pumping Industrial Well (GW-IW) (Figure 3-1). The transport modeling for the RI Report (Appendix H, Formation 2014c), summarized in Figures 2-4 and 2-5, show relatively large releases of selenium to groundwater during active mining. The rate of release after mining depends on location specific conditions; primarily the aerial extent and the cover placed on the overburden. The relative magnitude of selenium loading from the sources to the springs in 2050 (i.e., after reclamation and NTCRA actions are fully effective) shows that Panel A Area 2 and Panel D (including the external ODA) are the primary sources (see the central panel on Figure 2-6, which shows selenium loading from these areas being higher than those predicted from Panel E and the Pole Canyon ODA). These areas are the focus of the FS evaluation for additional source control. Arsenic is also present at concentrations above the MCL in groundwater at some alluvial and Wells Formation wells (GW-15, GW-16) due to releases from the ODAs. These wells also have elevated selenium concentrations.
- Releases of selenium from overburden in the Pole Canyon ODA that have resulted in MCL exceedances in groundwater in the alluvial groundwater system in lower Pole Canyon and northern Sage Valley (GW-26, GW-15, GW-22) (Figure 3-1). These releases have been reduced as a result of the Pole Canyon ODA NTCRA cover constructed in 2015.
- Migration and discharge of Wells Formation groundwater to surface water at Hoopes Spring and South Fork Sage Creek springs resulting in selenium concentrations above the State of Idaho Surface Water Quality Criterion for Aquatic Life at the springs (HS-3, LSS) and downstream in lower Sage Creek (LSV-2, LSV-3, LSV-4) and Crow Creek (CC-

1A, CC-WY-01) (Figure 3-3). Other COCs that exceeded TRVs primarily in surface waters included aluminum, arsenic, cadmium, iron, nickel, and zinc.

- Other COCs that were elevated in fish tissues included aluminum and essential micronutrients copper, iron, and zinc. However, risk related to these COCs may be overstated due to the contributions of background to tissue concentrations, as well as the reliability of the TRVs used to assess potential risks (Formation 2015b).
- Risk to terrestrial biota from soil/overburden and biotic media (vegetation, invertebrates, and small mammals) with elevated selenium concentrations in overburden on backfilled pits and external ODAs with minimal or no covers in the Panel A Area 2 (south of mill) and Panel D areas, and in overburden seep/riparian areas downgradient (east) of Panel D (DS-7), Panel E (ES-4), and the Pole Canyon ODA (LP-PD) (Figure 3-3). For terrestrial biota, risk from Pole Canyon ODA has been eliminated as a result of the Pole Canyon ODA NTCRA cover constructed in 2015. Other COCs were identified for terrestrial receptors including cadmium, chromium, copper, lead, manganese, molybdenum, vanadium, and zinc. However, exposure and risk associated with the non-selenium COCs are lower than predicted from selenium and were generally co-located with areas of selenium risk, primarily in mined areas with either no cover (i.e., direct revegetation of overburden) or relatively thin topsoil-only reclamation.
- Future risk to human receptors (recreational camper or Native American) and current risk to human receptors (Native American) from ingestion of surface water where arsenic concentrations exceeded the Idaho drinking water standard in surface water seeps downgradient (east) of Panel D (DS-7) and the Pole Canyon ODA (LP-1), and surface water in detention basins downgradient of Panel D seep DS-7 (DP-7) and Panel E (EP-2) (Figure 3-4).
- Future risk to human receptors (hypothetical resident) in which groundwater from wells on private lands is used for domestic drinking water supply, where arsenic concentrations in groundwater exceeded the MCL immediately downgradient of the Pole Canyon ODA (GW-15, GW-16) (Figure 3-4).
- Future and current risk to human receptors (seasonal rancher) from ingestion of beef as the primary contributor of cancer risk, based largely on arsenic concentrations (calculated on a Site-wide basis) for soil with the highest concentrations in Panel A Area 2, detention basin AP-3 (adjacent to west end of Pole Canyon ODA), Panel D seep DS-7 area, detention basin DP-7, and detention basin EP-4 (Figure 3-4). As noted in Section 2.5, thallium exposures to human receptors (Seasonal Rancher) from beef consumption were elevated (with considerable uncertainty in the uptake coefficient), although data from regional studies suggest that thallium concentrations in soils at the Site are within the range of natural background concentrations.
- Future risk to human receptors (hypothetical resident) in which groundwater from wells on private lands is used for domestic drinking water supply, where selenium concentrations in groundwater exceeded the MCL immediately downgradient of the Pole Canyon ODA (GW-15, GW-16) and downgradient of Pole Canyon in northern Sage Valley (GW-22, MP01, MP02, and MP03) (Figure 3-5).

USEPA has stated that domestic species, like cattle, are a commodity as well as alfalfa hay (USEPA 2018a). By extension, grazing plants can also be considered a commodity. USEPA's

Office of General Counsel (OGC) has opined that CERCLA actions should not establish cleanup numbers for a commodity. Therefore, livestock are not considered further in this FS.

3.2 Applicable or Relevant and Appropriate Requirements

Identification and evaluation of ARARs are integral components of the FS process to determine whether remedial alternatives can protect human health and the environment. The development of remedial alternatives under CERCLA relies, in part, on the identification of the ARARs which any action must meet, unless specific ARARs qualify for a waiver and are waived.

Applicable, Relevant and Appropriate, and To-Be-Considered Standards

For onsite activities, CERCLA requires compliance with both applicable requirements (i.e., those that would apply to a given circumstance at any site or facility) and those that the Forest Service deems to be relevant and appropriate (even though they do not apply directly), based on the unique conditions at a site. Applicable requirements are cleanup standards; standards of control; and other substantive requirements, criteria, or limitations promulgated under federal or state laws that specifically address a hazardous substance, constituent, removal action, location, or other circumstance found at a site. Relevant and appropriate requirements, while not applicable to a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the site such that their use is well-suited (40 Code of Federal Regulations [CFR] 300.5).

ARARs are potential or preliminary until finalized in the ROD. The NCP provides for the waiver of ARARs under certain circumstances as per 40 CFR 300.415(f)(1)(i)(C). Because this is a preliminary evaluation of potential ARARs, with remedial alternatives still being developed, any identification of the need for ARAR waivers is preliminary.

In addition to ARARs, the NCP states that where ARARs do not exist, agency advisories, criteria, or guidance are to be considered useful “in helping to determine what is protective at a site or how to carry out certain actions or requirements” (55 Federal Register 8745). These sources of information are referred to as “To-Be-Considered” (TBC) standards.

The NCP preamble states, however, that provisions in the TBC category “should not be required as cleanup standards, because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs.” Although not enforceable requirements, these documents are important sources of information that the regulatory agencies may consider during selection of the remedy, especially regarding the evaluation of public health and environmental risks, or which will be referred to, as appropriate, in selecting and developing cleanup actions (40 CFR § 300.400(g)(3), 40 CFR § 300.415(l)).

State Regulations

State requirements are potential ARARs for CERCLA response actions as long as they meet the following eligibility criteria:

- State law or regulation
- Environmental or facility siting law or regulation
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than federal requirements
- Identified in a timely manner
- Consistently applied

Many state requirements listed as ARARs are promulgated with identical or nearly identical requirements to federal law pursuant to delegated environmental programs administered by federal agencies and the state.

Types of ARARs

There are three primary types of ARARs: chemical-specific, location-specific, and action-specific. An ARAR can be one or a combination of all three types.

Chemical-specific requirements address chemical or physical characteristics of compounds or substances at sites. These values establish acceptable amounts or concentrations of contaminants that may be found in, or discharged to, the ambient environment.

Location-specific requirements are restrictions placed on the concentrations of hazardous substances or the conduct of cleanup activities, because they are in specific locations. Location-specific ARARs relate to the geographical or physical positions of sites rather than the nature of contaminants at sites.

Action-specific requirements are usually technology-based or activity-based requirements, or limitations on actions taken with respect to hazardous substances, pollutants, or contaminants. A given cleanup activity will trigger an action-specific requirement. Such requirements do not themselves determine the cleanup alternative but define how chosen cleanup methods should be performed.

ARAR Waivers

CERCLA Section 121(d)(4) authorizes that any ARAR may be waived per one of the following six conditions if the protection of human health and the environment is ensured:

- It is part of a total remedial action that will attain such level or standard of control when completed (i.e., interim action waiver).
- Compliance with the ARAR at a given site will result in greater risk to human health and the environment than alternative options that do not comply with the ARAR.
- Compliance with such a requirement is technically impracticable from an engineering perspective.
- The remedial action will attain a standard or performance equivalent to that required by the ARAR through use of another method or approach.
- The ARAR in question is a state standard and the state has not consistently applied (or demonstrated the intention to consistently apply) the ARAR in similar circumstances at other sites.
- In meeting the ARAR, the selected remedial action will not ensure a balance between the need for protection of public health and welfare and the environment at the site and the availability of Superfund monies to respond to other facilities.

NEPA Permits

Mining operations at Smoky Canyon are permitted under the National Environmental Policy Act (NEPA) (42 U.S.C §4321 et seq.) to ensure that environmental standards are maintained from the beginning to the end of mining operations. The NEPA process requires an EIS to evaluate the potential environmental and human consequences of the federal actions required to authorize mining operations and the site-specific mitigation measures and environmental monitoring required for protection of the environment. Currently, active permitted mining areas are Smoky Canyon Mine Panels A through G. A new East Smoky Panel located east of Panel B is in the final EIS phase of the NEPA process and has not been permitted.

CERCLA Permit Exemption

CERCLA Section 121(e)(1), 42 United States Code (U.S.C). § 9621(e)(1), states, “No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with this section.” The onsite activities must, however, comply with substantive permit requirements. The term “onsite” is defined in the NCP as “the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action” (40 CFR § 300.5).

Simplot conducted a preliminary identification of potential ARARs (chemical-specific, location-specific, and action-specific) as presented in the RI/FS Work Plan (Formation 2011a). This analysis has been refined relative to findings of the RI and risk assessments and the scope of potential actions to be performed. A summary of potential ARARs and TBCs are presented in Tables 3-1 and 3-2.

3.3 Remedial Action Objectives

This section presents the RAOs to address the key environmental issues described in Section 3.1 and the evaluation of ARARs in Section 3.2. The RAOs specify COCs and environmental media of concern, exposure routes, and receptors, and are intended to provide protection of human health and the environment.

Groundwater

- Prevent future use of alluvial or Wells Formation groundwater with arsenic or selenium concentrations above MCLs as a drinking water source.
- Reduce or eliminate concentrations of arsenic and selenium in contaminated Wells Formation and alluvial groundwater to below MCLs within a reasonable time frame given the circumstances of the Site.[2]
- Reduce or eliminate loading of selenium from groundwater to surface water so that it does not result in concentrations that represent an unacceptable risk to aquatic life and comply with ARARs (IDAPA 58.01.02 – Water Quality Standards) in the lower Sage Creek and Crow Creek watersheds.

Soils/Overburden

- Reduce or eliminate unacceptable risks to future Seasonal Ranchers from ingestion of beef from livestock grazing on ODAs as the primary contributor of cancer risk, due to arsenic concentrations (calculated on a Site-wide basis) for soil.
- Reduce or eliminate unacceptable risks to terrestrial biota from soil with elevated selenium concentrations on overburden or backfilled pits and external ODAs with minimal or no covers and in overburden seep/riparian areas downgradient of ODAs.

Surface Water

- Reduce or eliminate unacceptable risks to human receptors from ingestion of non-regulated surface water (seeps and detention ponds) due to arsenic.

[2] The detailed analysis will provide an evaluation of the predicted future changes in selenium concentrations in groundwater at key locations (and changes in concentration and load at the springs complex) for the No Further Action alternative and the different action alternatives. This evaluation will provide the basis for establishing a “reasonable time frame”.

- Reduce selenium concentrations in lower Sage Creek and Crow Creek watersheds to below levels that pose unacceptable risks for aquatic life and comply with ARARs (IDAPA 58.01.02 – Water Quality Standards).

3.4 Preliminary Remediation Goals

PRGs specify quantifiable goals for COCs in environmental media to address the RAOs. Remedial action implemented for the purpose of meeting PRGs usually results in attainment of RAOs. A summary of the PRGs is provided in Table 3-3.

Regulated Surface Water: Idaho Water Quality Standard for Selenium

Elevated selenium concentrations in Hoopes Spring, lower Sage Creek, and lower Crow Creek pose unacceptable risks for aquatic life (Formation and HabiTech 2012). The Idaho site-specific whole body fish tissue criterion for Sage Creek and Hoopes Spring is 13.6 mg/kg dw and is 12.5 mg/kg dw for Crow Creek (IDAPA 58.01.02.287, 2019)[3].

Groundwater

The primary goals for groundwater are based on the selenium (0.05 mg/L) and arsenic (0.01 mg/L) MCLs. These levels have been developed to protect the aquifer or drinking water source and to protect human health.

Non-Regulated Surface Water

The SSHHRA identified potentially unacceptable risks to humans from drinking water in seep areas or from detention ponds. The PRG for this pathway was set at the drinking water MCL for arsenic (0.01 mg/L), applicable at each seep or detention basin.

Soils and Overburden

Estimated potential risks to wildlife populations from exposure on Panels A and D were mainly from the potential for selenium to accumulate in vegetation or invertebrates and in small home range receptors. Although HQs greater than 1 were calculated for the large home range receptor, the SSERA concluded that risks of impact from chronic selenium exposure to wide-ranging species such as deer, elk, coyotes, and raptors is relatively lower than for the small home range receptors because these species feed over wide areas and would be exposed to soils, vegetation, terrestrial invertebrates, and small mammalian prey items on the panels for short periods.

[3] Idaho Administrative Code Section for Water Quality Standards as adopted based on USEPA approval letter of site-specific criteria, Dated July 9, 2019 [EPA 2019]. IDAPA 58.01.02.287. Whole body selenium fish tissue criteria were approved by EPA for Hoopes and Sage Creek as well as Crow Creek. EPA did not approve these criteria for North Fork Sage Creek and its tributaries and Pole Canyon Creek.

Segments of populations of smaller-bodied wildlife such as rodents and songbirds may experience more chronic exposure to soils and vegetation on the mine panels. Risk of adverse effects from selenium exposure is greater for the individuals that spend most or all of their time on the mine panels. However, although uncertain, risk to overall Site populations is low because most of the Site and adjacent areas are not affected by mine disturbances and contain natural selenium concentrations.

Technical analysis to support the selenium PRG for soil is provided in Appendix A. For an HQ of 1, the PRG for selenium in soil was estimated at 0.9 mg/kg for small mammal populations and 1.4 mg/kg for bird populations; below the soil background concentration identified for the nearby Ballard Mine Site (6.67 mg/kg for the 95% upper confidence limit [95UCL] of the mean). This result indicates that the exposure model in conjunction with the geometric mean NOAEL TRV is overly conservative for use in PRG calculations. Consequently, other PRG values were calculated for a range of HQs, as shown in Table 3-3. Note that the soil selenium 95% upper simultaneous limit (95USL) and 95% upper tolerance limit with 95% coverage (95-95UTL) of 29 mg/kg is the value that has been determined to be representative for the upper range of background levels and was used to establish the cleanup level in the Ballard Mine Proposed Plan (USEPA 2018b). This information will help inform the detailed analysis of Site-wide remedial alternatives and ultimately the risk management decisions to be made by the agencies.

The RAO for ingestion of beef at the Site focuses on prevention of unacceptable risks to future seasonal ranchers due to arsenic concentrations in surface soil (calculated on a Site-wide basis). Section 6.2.1 of the Smoky SSHHRA described the estimated risks to seasonal ranchers from ingestion of beef. The background arsenic concentration in soils was estimated at 11.5 mg/kg as the 95USL for pooled values (all background samples combined) (MWH 2015), as also presented in the Smoky SSHHRA (Formation 2015a). The 95UCL for arsenic concentrations in soil were 5.6 mg/kg on private lands and 16.2 mg/kg Site-wide. The highest upper-bound estimates of average concentrations were on the uncovered ODAs, on Panel A Area 2 (27.5 mg/kg) and D Panel (14.7 mg/kg). Based on the risk estimation approach and the Site data, a PRG of 11.5 mg/kg mean arsenic concentrations for the Site-wide concentration has been established. The upper estimate of the average (e.g., 95UCL of the mean) arsenic concentration will be compared to the PRG.

4.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

This section identifies GRAs, remedial technologies, and process options that are potentially implementable to address the RAOs identified in Section 3 for the contaminated media and exposure pathways of concern. GRAs are general categories of remedial activities (e.g. no action, institutional controls, containment, source controls, flow controls and routing, removal/disposal, and treatment) that may be used, either singly or in combination, to satisfy RAOs. Remedial technologies and process options are more specific applications of the GRAs.

This section presents the initial screening of remedial technologies and process options in accordance with the NCP to retain representative technologies and process options that can be further screened by media, as discussed in Section 5.

The identification and screening process consist of the following general steps:

- Identify the contaminants and affected environmental media that pose risks to human health and the environment and group these into a category or categories of contaminated media (e.g., solids and soils and groundwater and surface water) for FS evaluation.
- Identify GRAs for the contaminated environmental media that will satisfy the RAOs.
- Compile remedial technologies and process options for each GRA that are potentially viable for remediation of the contaminated environmental media.
- Screen the remedial technologies and process options with respect to technical implementability for the contaminated media at the site. Technologies and process options that are not technically implementable relative to the contaminated media are eliminated from further consideration in this FS.
- Evaluate and screen the retained remedial technologies and process options with respect to effectiveness, ease of implementability, and relative cost. Technologies and process options that have low effectiveness, low implementability, or high cost are eliminated from further consideration in this FS.
- Perform a final screen of retained remedial technologies/process options by media and select a representative process option for each technology type in accordance with September 8, 2017 Agency comments (USFS 2017) on the Revised Draft FSTM#1, that will be used for development, screening, and detailed analysis of alternatives in FSTM#2.

The remainder of this section describes the contaminated media and evaluates GRAs, technologies, and process options that are potentially viable for addressing them to meet the RAOs and ARARs discussed in Section 3.

4.1 Contaminants and Affected Media

Selenium is the primary contaminant of interest in solid media, which includes soils and overburden in ODAs. Arsenic is also a primary contaminant of interest in solid media because of potentially unacceptable risks to future seasonal ranchers due to ingestion of beef from livestock grazing at the Site. The weathered shales in the overburden material are susceptible to leaching as water from rain and snowmelt infiltrates through these materials. ODAs with minimal or no covers allow infiltration and subsequent releases of selenium and other COCs to Wells Formation groundwater. The potential sources considered are shown in Table 2-1. The RI groundwater transport modeling indicated that the principal sources of selenium and other COCs to groundwater are: Panel A Area 2 and External ODA; and Panel D and External ODA (Table 2-4).

The contaminants of interest in aqueous media, which include groundwater and surface water in springs, are selenium and arsenic. Seepage generated within ODAs is discharged as surface seeps or migrates downward to the Wells Formation aquifer or the Sage Valley alluvial groundwater system. Wells Formation groundwater is transported to the springs complex where it discharges and is transported downstream to Sage Creek and Crow Creek. Groundwater may also be extracted from wells at the Site.

The extent of groundwater with selenium concentrations above the MCL is illustrated in Figure 3-1. Because of the complex fractured flow system in the Wells Formation aquifer at the Site it is not possible to make an accurate estimate of area and volume of groundwater with selenium concentrations above the MCL. Groundwater discharges at the springs complex, where the typical flows are in the range of 14 cfs. Selenium loading from the springs results in concentrations above the aquatic water quality standard for selenium in Hoopes Spring, South Fork Sage Creek springs, Sage Creek, and Crow Creek.

There are also seeps and detention basins downgradient of the ODAs with elevated arsenic concentrations that pose potential future risks to human receptors (LP-1, DP-7, DS-7, and EP-2). Selenium concentrations and flows for ODA seeps are provided in Table 4-1. Selenium concentrations in surface water in detention basins are provided in Table 4-2.

4.2 General Response Actions

GRAs describe those actions that alone, or in combination, may be applied to areas of concern. GRAs are used to organize and structure potential remedial actions and are divided into remedial technology groups consisting of specific process options. This section identifies and describes the GRAs that may satisfy the RAOs presented in Section 3.

As described above, there are two media of concern within the Site: solid and aqueous. The solid media category includes contaminated soils and overburden in ODAs (referred to as solids and

soils), and any residual solid material remaining after treatment. The aqueous media category includes groundwater and surface water. GRAs and remedial technologies have not been developed for the air medium because airborne transport of contaminants is an incomplete pathway (Formation 2015a, 2015b, 2016a).

The GRAs identified for the Site are:

- No Action
- Institutional Controls
- Access Controls
- Containment
- Source Control, Flow Control and Routing
- Removal and Disposal
- Treatment
- Monitored Natural Attenuation

The remedial technologies and process options associated with these GRAs are shown in Figure 4-1. GRAs and remedial technologies are briefly described in Section 4.3. More detailed descriptions of remedial technologies and process options and the results of the initial screening process for technical implementability are provided in Section 4.4 and Figure 4-2.

4.3 Identification of Remedial Technologies and Process Options

Remedial options are generally grouped by how they minimize contaminant release, contaminant transport, or risks associated with contaminants. Source control and containment remedial options reduce the release and/or transport of selenium and other COCs from the ODAs. Removal remedial options remove and dispose of waste material, contaminated soil, and or contaminated surface water and groundwater. Treatment remedial options are applied to reduce concentrations of selenium and other COCs in impacted surface water and groundwater. Monitored natural attenuation (MNA) is a natural process that may be used in conjunction with other technologies and process options. Institutional controls limit the potential for human activities to result in exposure to impacted media (e.g., water, soil, and vegetation). Access controls may be used to prevent access to source areas. In practice, it will take a combination of remedial options from all of these groups to effectively minimize the impact and risk associated with the ODAs.

This section describes typical approaches and methods that could be used to control selenium releases from overburden and available treatment technologies for removing selenium and other COCs from impacted waters.

4.3.1 No Action

The No Action GRA is required by the NCP as a baseline for comparison; however, because early actions have been implemented at the Pole Canyon ODA, this alternative becomes No Further Action.

Two NTCRAs were implemented at the Pole Canyon ODA to divert Pole Canyon Creek stream flow around the ODA, prevent run-on to the ODA from the northern hillside slope, and reduce or eliminate infiltration into the ODA. Under the No Further Action GRA, the operations and maintenance (O&M) activities for the NTCRAs would continue as required by the Settlement Agreements (USFS, USEPA and IDEQ 2006; USFS, IDEQ, and Tribes 2013). Water treatment at the pilot treatability study at the springs complex would be terminated.

4.3.2 Institutional Controls

Institutional controls are non-engineering mechanisms that provide the means by which federal, state and local governments or private parties can prevent or limit access to or use of contaminated environmental media, the use of areas impacted by contaminants, and/or to provide for the integrity and maintenance of engineered remedial components. The NCP emphasizes that institutional controls are meant to supplement engineering controls and may be a necessary component of the selected remedy. The NCP also cautions against the use of institutional controls as the sole remedy unless active response measures are determined to be impracticable. The USEPA recognizes four types of institutional controls (1) government controls, (2) proprietary controls, (3) enforcement and permit tools, and (4) information devices (USEPA 2000, 2012). Institutional controls may be applied on a stand-alone basis or implemented in conjunction with other response actions as part of an overall remedy.

4.3.3 Access Controls

Access controls are physical barriers to limit access to source areas. Physical barriers may include fences and gates. Fences and gates are fixed structures that function as boundaries, barriers, or other means of security. Access controls may be temporary or permanent and may be implemented as separate, unconnected technologies or applied along with other remedial technologies as part of an overall remedy.

4.3.4 Containment

The containment GRA includes technologies and process options resulting in the physical containment or isolation of source areas to limit exposure and reduce the transport of selenium and other COCs. Containment technologies include (1) engineered covers, (2) barriers, and (3)

sediment control features. Long-term maintenance requirements, including periodic inspection and monitoring, may be required for containment options.

4.3.5 Source Control, Flow Control and Routing

The source control GRA consists of active measures to manage sources and reduce the flow of water to source areas and subsequent release of selenium and other COCs into surrounding soils, groundwater, and surface water. Source controls include surface controls and slope stabilization. Grading, vegetation, and erosion protection are examples of source controls. Slope stabilization includes reducing slope grades and constructing retaining walls. At the Site, this GRA may be implemented alone or combined with other actions.

The flow control and routing GRA applies to surface water and consists of diversion via open channels or closed conduits. Flow control and routing has already been implemented by the 2006 NTCRA where Pole Canyon Creek flow is collected above the Pole Canyon ODA and piped to the valley below the ODA. An infiltration basin, installed just uphill from the ODA, allows any creek water from below the pipeline diversion to infiltrate before reaching the ODA. A run-on control ditch was also installed on the uphill side of the ODA. These actions prevent water from contacting ODA material and subsequently mobilizing selenium and other COCs. Other actions that have been implemented at the Site are routing and collection of ODA seeps and storm water runoff in detention ponds, and installation of ditches to convey storm water away from source materials. Additional flow control and routing actions may be implemented along with other actions.

4.3.6 Removal and Disposal

This GRA involves the removal and disposal of solid or aqueous media with concentrations of selenium or other COCs exceeding specified action levels or standards. Several technologies and process options exist within the removal GRA for remediation of overburden solids and soils and groundwater and surface water at the Site. Removal technologies include excavation of solids and collection of surface water or groundwater using extraction wells or trenches. Disposal technologies involve onsite consolidation, onsite or offsite disposal of treatment residuals and/or other solids, and onsite or offsite discharge of groundwater and/or surface water or injection. This GRA is often combined with other GRAs such as institutional controls, containment, flow control and routing, or treatment. Long-term maintenance requirements, including periodic inspection and monitoring, may be required for removal options.

4.3.7 Treatment

This section presents the ex-situ and in-situ treatment options evaluated for groundwater and surface water and for solids and soils at Smoky Canyon Mine.

4.3.7.1 Ex-Situ Treatment

Ex-situ treatment technologies are remediation options where the affected medium is removed from its original location for processing.

Groundwater and Surface Water

Physical treatment methods involve removing contaminants from water without chemically altering them. These methods typically employ processes such as separation (mechanical, gravity and media filtration), or demineralization (ion exchange, reverse osmosis, ultrafiltration, and electrodialysis). Physical treatment may be applied on a stand-alone basis or implemented in conjunction with other treatment technologies.

Chemical treatment involves processes where contaminants are altered or precipitated from solution. Most chemical treatment methods have a secondary waste stream that requires further treatment and disposal. Chemical treatment methods included for initial screening are adsorption (activated carbon and metal oxide), solvent extraction, chemical precipitation, and oxidation/reduction.

Biological reduction removes inorganic constituents by reducing oxidized forms to elemental forms, which are typically less mobile and easier to precipitate out of water. For organic constituents, microbial activities can transform organic components to intermediate products and basic constituents such as carbon dioxide and water.

Thermal treatment is the process of applying energy to the water being treated to evaporate clean water, while leaving behind contaminants in a concentrated brine. Thermal treatment methods considered include mechanical evaporation and wet air oxidation.

Solids and Soils

Physical treatment technologies reduce the mobility or toxicity of contaminants or reduce the volume by changing the physical properties of the materials (by lowering moisture content, increasing density, and/or reducing permeability). Physical treatment methods evaluated include stabilization/fixation, dewatering, and separation.

Thermal treatment technologies involve the application of energy to catalyze reactions that immobilize or detoxify inorganic compounds or destroy organic compounds by oxidation or separation by distillation or volatilization. Process options considered are incineration and desorption.

Chemical treatment promotes reactions that convert contaminants into less hazardous compounds. Chemical treatment process options included in the initial screening are oxidation/reduction, hydrolysis, and chemical extraction.

Biological treatment of solids and soils consists of enhancing the biological degradation or reduction of contaminants by microorganisms. Biological treatment, including land farming, is typically implemented by creating favorable conditions for native microbial activity.

4.3.7.2 In-Situ Treatment

In-situ treatment technologies are process options designed to remediate media in place.

Groundwater and Surface Water

In-situ chemical treatment involves injecting chemicals directly into the impacted region of the aquifer to treat the groundwater or in the impacted surface water. The injected chemical agent interacts with the constituents in the water to neutralize, precipitate, immobilize, fixate, or destroy the contaminants.

In-situ biological treatment of groundwater and surface water (e.g., through injection wells, infiltration trenches, and permeable reactive barriers) consists of enhancing the conditions in the water to reduce contaminants by microbial activity. This is typically achieved by injecting nutrients to preferentially favor the microorganisms that can degrade or reduce the target contaminants.

Solids and Soils

In-situ physical/chemical treatment technologies include stabilization/fixation and aeration. Stabilization/fixation is performed by using special machinery to directly inject stabilizing agents, such as cement, into the soil. Types of equipment and methods used to deliver the stabilization agents into soils include rotary injection augers, jet grouting, and pressure grouting. Aeration of soils is typically achieved by soil vapor extraction.

Thermal treatment technologies involve the application of thermal energy to catalyze reactions that immobilize or detoxify inorganic contaminants or destroy organic compounds by oxidation or separation by distillation or volatilization. Thermal treatments evaluated include vitrification and desorption.

In-situ biological treatment involves technologies where the solids are treated in place. Nutrients are injected into the solids and soils to encourage favorable microbial growth. Biological process options evaluated include enhanced biodegradation and phytoremediation.

4.3.8 Monitored Natural Attenuation

MNA can be used in conjunction with the above-mentioned GRAs to achieve remedial objectives for groundwater. The rationale is that natural processes can contribute to the reduction of COC concentrations in areas where releases and transport have already occurred. In groundwater, MNA can occur through physical (e.g., dilution, dispersion, sorption), geochemical (e.g., sorption, precipitation), and biochemical (biologically mediated reduction) processes.

Selenium occurs as three principal aqueous species in oxygenated water: selenite (SeO_3^{2-}), biselenite ($HSeO_3^-$) and selenate (SeO_4^{2-}) (Hem 1989; Masscheleyn et al. 1990), and the dominant species in solution depends on water chemistry and redox conditions. Geochemical controls that reduce or limit the solubility of selenium in water include sorption to mineral surfaces such as oxyhydroxides of iron, manganese, and aluminum (Hayes et al. 1987; Balistrieri and Chao 1990; Rajan 1979). Clay and carbonate minerals may also provide effective sorption surfaces for selenium (Bar-Yosef and Meek 1987; Cowan et al. 1990). In general, selenate is less strongly sorbed to mineral surfaces than is selenite. Redox potential and pH both affect selenium solubility and sorption reactions. Sorption reactions for selenium are least efficient under oxidizing conditions at circum-neutral pH (Elrashidi et al. 1987).

The degree to which sorption attenuates groundwater transport of selenium, as well as other trace metals, depends on the aqueous speciation of selenium (or other trace metals), sorption site density, affinity of the dissolved chemical for the solid phase (Benjamin and Leckie 1981), solid-surface charge, concentrations of competing ions (e.g., sulfate, phosphate, nitrate, etc.), and ionic strength of the solution (Stumm and Morgan 1981). These factors may vary spatially and with depth in aquifer.

Selenium attenuation can also occur due to biologically mediated reactions in environments with low oxygen (i.e., anoxic, oxygen levels below 0.5 mg/L) (Kirk 2014). Under low-oxygen conditions, microbes reduce the most mobile form of selenium in solution, selenate (SeO_4^{2-}), to less mobile forms thereby limiting selenium transport via groundwater flow. The ratio of selenium to sulfate is also a useful method for evaluating the occurrence of attenuation (Hay et al. 2016).

4.4 Screening of Remedial Technologies and Process Options for Technical Implementability

The remedial technologies and process options identified in Figure 4-1 and described in Section 4.3 were screened based on technical implementability. A wide range of potential remedial technologies and process options were reviewed to evaluate the suitability for addressing residual overburden materials and impacted groundwater and surface water. A given technology or process option was eliminated from further consideration on the basis of technical implementability if site conditions or site characterization data indicated that the technology or

process option is incompatible with the COCs or cannot be implemented effectively because of physical limits or constraints. A summary of the initial screening of remedial technologies and associated process options in terms of technical implementability is presented in Figure 4-2. Process options eliminated from further evaluation are shaded gray.

4.4.1 No Action

The No Action GRA is required by the NCP as a baseline for comparison and is therefore retained for further evaluation. The No Action GRA is not divided into technologies and process options. Because previous work has occurred at Smoky Canyon, this alternative becomes a No Further Action alternative. NTCRAs that have already been implemented would continue. Pilot treatability studies would be terminated.

4.4.2 Institutional Controls

Institutional controls are administrative and legal mechanisms that help to minimize the potential for exposure to contamination and/or protect the integrity of a response action. They may be used alone or in conjunction with other alternatives as part of an overall remedy. Institutional controls are meant to supplement engineering controls during all phases of cleanup and may be a necessary component of the selected remedy. Four types of institutional controls are evaluated (1) government controls, (2) proprietary controls, (3) enforcement and permit tools, and (4) information devices.

Government controls are usually implemented and enforced by a federal, state, or local government or government agency and may include zoning restrictions, land-use controls, forest closure orders, grazing controls, ordinances, building permits, or other provisions that restrict land or resource use. Forest closure orders could be used to prevent access to areas on National Forest System land. Government controls such as zoning restrictions and forest closure orders that restrict land use or prevent access are potentially implementable and are retained for further evaluation. Controlling domestic livestock grazing would allow establishment of vegetation on recently seeded areas and is retained for further consideration.

Proprietary controls are property-use restrictions based on private property law and may include deed restrictions, easements, or covenants. Deed restrictions are rules and regulations that govern one or more parcels of land. They are recorded with the county and are permanent and “run with the land,” so they bind all current and future owners of the parcel(s). In the case of land owned by Simplot, these proprietary controls may be used to prevent future use of alluvial or Wells Formation groundwater with arsenic or selenium concentrations above MCLs as a drinking water source. Deed restrictions are viable for use at the Site and are retained for further evaluation.

Enforcement and permit tools are legal tools such as administrative orders, federal facility agreements, and consent decrees that limit certain activities or require the performance of specific activities such as monitoring or reporting on effectiveness. These legal tools may be issued unilaterally or negotiated and are legally binding and could be enforced. Enforcement and permit tools are viable for use at the Site and are retained for further evaluation.

Information devices provide information or notification that residual or covered contamination may remain at a site. Such tools take a variety of forms and may include signs, deed notices, public information programs, and state registries of contaminated sites. Signs convey information on land use or land-use restrictions; materials used to produce the sign must last for the length of time that the warning will be posted. The Forest Service has posted a notification/warning sign on Smoky Canyon Road. In the future, the Forest Service may elect to post warnings signs to inform the public about the overburden material buried at the Site. Although information devices as an institutional control are not enforceable, signs, and public information programs and are potentially implementable for use at the Site and are retained for further evaluation.

4.4.3 Access Controls

Access controls are physical barriers such as fences and gates to limit access to source areas at a site (e.g., ODAs or seeps or springs). Fences and gates are fixed structures that function as boundaries, barriers, or other means of security. Fencing off a reclaimed/revegetated area can limit the uptake of selenium and other COCs by wildlife and prevent damage to the area while vegetation is becoming established. By fencing off areas with vegetation high in selenium and other COCs or water sources high in selenium and other COCs, the impact to wildlife could be reduced. The type of fence can vary from a three-strand barbed wire to a game-exclusion fence depending on the objective of implementing this access control. However, fences/gates should not be thought of as stand-alone controls, rather they should be implemented in conjunction with source controls. Fences and gates must be adequately maintained. Portions of the Pole Canyon ODA were fenced prior to construction of the NTCRA. Physical barriers such as fences and gates are potentially implementable and are retained for further evaluation.

4.4.4 Containment

Several technologies and process options within the containment GRA are identified and considered for solid media and groundwater and surface water that exceed standards or action levels. This GRA consists of containment measures to prevent or limit exposure to impacted media rather than treatment of the media. Some of the technologies are applicable to both solid and aqueous media water while others are applicable specifically to either solids and soils or groundwater and surface water. These technologies and process options could be used alone or in conjunction with surface control and flow control and routing technologies and process options.

4.4.4.1 Engineered Covers

Engineered covers are commonly used to prevent direct contact with seleniferous materials and to reduce infiltration and erosion, thereby reducing the release of selenium and arsenic that may potentially impact groundwater and surface water. Covers have already been used extensively at the Site for post-mining reclamation. Engineered covers are therefore applicable to overburden solids and soils but may also provide benefits for groundwater and surface water. There are a variety of available engineered cover designs.

Various cover types, as well as encapsulation of seleniferous material, are discussed in the Selenium Management Practices document (Interagency/Phosphate Industry Selenium Working Group [SeWG] 2005). General design requirements for engineered covers include impedance of liquid migration through the solid media, maintenance requirements, sufficient drainage, resistance to damage by animal activity, settling, or subsidence, with a permeability lower than or equal to the underlying natural soils. Simplot identified source areas and available volumes of the primary material types to be evaluated for use in CERCLA cover systems (i.e., soil, tailings, Rex Chert and limestone gravel, and Dinwoody Formation material) that are considered for the FS (Formation 2016b). These cover systems are described below.

Soil Cover

A soil cover can provide a physical barrier between the vegetation root zone and ODA materials, thus reducing the potential for selenium uptake by selenium-accumulating plants along with preventing direct contact and ingestion by potential receptors. Of particular interest in semi-arid environments is the use of a cover designed to store rainwater and release it via evapotranspiration through the vegetative cover. It can also reduce infiltration of precipitation into the underlying overburden materials. The soil cover is potentially implementable and is retained for further evaluation.

Tailings Cover

As described in the Cover System Pilot Study Memorandum (Formation 2014b), Site-specific physical and chemical data for tailings indicate that tailings material is likely to be suitable for use in ODA covers. Two tailings impoundments, Tailings Pond 1 (TP1) and Tailings Pond 2 (TP2) are adjacent to the Site. Several million cubic yards of tailings are available in the impoundments and approximately 500,000 dry tons are generated each year by ongoing mining operations. Tailings material can provide a physical barrier between the vegetation root zone and ODA materials, thus reducing the potential for selenium uptake by selenium-accumulating plants along with preventing direct contact and ingestion by potential receptors.

The physical properties of Smoky Canyon tailings were evaluated in recent geotechnical testing as part of the Dairy Syncline planning process (Golder 2013). Based on the results, a minimum

saturated hydraulic conductivity of 10^{-5} centimeters per second (cm/s) was estimated. This is in the range of hydraulic conductivity of Dinwoody Formation material measured at the Site. The Tailings Revegetation Field-Scale Pilot Study was a 5-year study that was performed near the Smoky Canyon tailings impoundments (Formation 2013c) and investigated plant uptake of selenium and the performance of tailings as a growth medium. This study found that seeded vegetation can establish and grow on tailings material, with or without amendments, and selenium uptake into plants is low. The results show that uptake of selenium by plants growing on tailings would not be an ecological risk issue. Tailings material is potentially implementable for use as a single-layer cover and as a component of a multi-layer cover system and is retained for further evaluation.

Chert/Limestone Cover

Chert and/or limestone layers are used as physical barriers in cover systems. When installed directly above the ROM overburden, chert/limestone provides a capillary break, or an additional thickness of non-seleniferous overburden within the cover profile to prevent vegetation from rooting in overburden materials higher in selenium and other COCs (i.e. center waste shale), and to prevent vegetative uptake and potential risk to foraging animals. Additionally, the coarse texture and corresponding low water-holding capacity result in unfavorable conditions for root advancement through the chert/limestone and into the overburden. Chert may also help prevent small mammals from burrowing into the overburden material. A capillary break layer can provide lateral drainage, which can improve the long-term stability of the cover. Chert and limestone from the Rex Chert Member of the Phosphoria Formation are available from ongoing mining operations and have a generally coarse composition dominated by gravels with some sands and few fines.

Potential use of chert/limestone for cover material was evaluated as part of the EE/CA process for the Pole Canyon NTCRA (Formation 2012a). Due to the coarse textural composition, chert/limestone is unfavorable as a growth medium (i.e., would not support vegetation growth) without additional amendments; if used alone as a surface cover material, chert/limestone would actually result in increased infiltration compared with the existing overburden due to its high saturated hydraulic conductivity. Therefore, use of chert/limestone was considered only as a layer between the growth medium and ROM overburden or as a water conveyance layer in a more complex cover system (i.e. geosynthetic clay liner [GCL], Dinwoody Formation material, or tailings). In this position in the cover system, the thickness of the chert/limestone cover does little to influence the amount of net percolation into the underlying overburden. Therefore, the thickness of chert/limestone should be determined based on its function as a barrier or its water conveyance performance. The rate of generation and availability of chert and/or limestone from active mining operations is a key factor in the scope and timing of implementation. The chert/limestone cover is potentially implementable, is a proven, effective material, and is retained for further evaluation.

Dinwoody Cover

Dinwoody Formation material is well suited for use in cover systems at the Site. It is a locally available material that could be accessed in areas near the ODAs (Simplot 2018). Although there is some variability in the composition and material properties of the Dinwoody Formation at the Site, it is generally comprised of interbedded siltstone, shale, and limestone that grade into a calcareous shale and siltstone with depth. Typically, Dinwoody is a poorly graded, fine-textured material with a low saturated hydraulic conductivity and a high moisture storage capacity. The gradation and texture of Dinwoody provide a growth medium that supports vegetation, and the low saturated hydraulic conductivity of the Dinwoody reduces net infiltration.

The effectiveness of using Dinwoody material for cover systems has been demonstrated on Panel E (Formation 2012a), where it has provided stable reclamation surfaces and resulted in successful growth of vegetation. Dinwoody material was also used as part of the cover system for the 2013 NTCRA on the Pole Canyon ODA. The NTCRA included minor grading of the ODA, placement of a 2-foot-thick chert/limestone cover overlain by a 3-foot-thick Dinwoody cover, installation of storm water runoff controls, and revegetation with non-selenium-accumulating species. A variety of configurations are possible, including a water balance cover (typically a monolithic design constructed of 4 to 10 feet of fine-textured soil [e.g., sandy silt] and vegetated with local grasses) (Albright et al. 2004, 2009). The Dinwoody cover is potentially implementable, is a proven, effective material, and is retained as a cover option.

Geosynthetic Covers

Geosynthetic covers consist of multiple layers and may include a geomembrane (GM) or a GCL. A GCL is a woven fabric-like material that incorporates a bentonite or other clay, which has a very low hydraulic conductivity. A geosynthetic clay laminate liner (GCLL) includes a layer of bentonite clay inserted between two geotextile layers. The top geotextile layer is laminated with a polyethylene geomembrane layer, providing an additional layer of protection against desiccation and ion exchange degradation. If a low permeability cover such as a GM or GCL is used, an overlying natural or geosynthetic drainage layer must be placed just below the soil or rock cover and the closure slope generally needs to be flatter than 3:1 to achieve stability of the cover over the geosynthetic materials. If a GM is selected, it must have high internal shear strength to provide stability on side slopes steeper than 5:1. For side slopes of 3:1, additional anchoring of the geosynthetic is required and angular gravel or rock is required above a geotextile for stability of this layer. The use of a geosynthetic cover is potentially implementable and is retained as a possible cover technology.

4.4.4.2 Barriers

Vertical barriers may be used to control migration of contaminants in groundwater. Low permeability cutoff walls or diversions may be installed below ground to contain, capture, or redirect groundwater flow.

Slurry Walls

Slurry walls are the most common subsurface barriers because they use conventional technology and are an effective means of reducing groundwater flow in unconsolidated earth materials. A slurry wall is constructed by blending a soil mixture with a bentonite slurry and placing the mixture in a vertical trench to form a low permeability barrier wall. In some cases, the trench is excavated under a slurry of cement, bentonite, and water, and this mixture is left in the trench to harden. Slurry walls are not feasible at the Site due to the number of sources and depth of the Wells Formation aquifer and the extent of slurry walls that would be required to control groundwater flow. Slurry walls are not implementable and therefore are not retained.

Sheet Piling

Sheet piling may be used to form a physical groundwater barrier. Sheet piles are made of wood, synthetic materials, pre-cast concrete or steel. Concrete is used primarily where great strength is required. Steel is often the most effective form of sheet pile cutoff. However, interlocks between barrier panels may be difficult to seal. Sheet piling is not feasible at the Site due to the number of sources and the depth of the Wells Formation aquifer and the extent of sheet piling that would be necessary to control groundwater flow. Sheet piling is not implementable and is not retained.

Rock Grouting

Rock grouting or grout curtains are subsurface barriers created in fractured or unconsolidated materials by pressure injection of a low permeability grout mixture. The vibrating beam method, where grout is placed in the void left from the retreat of a previously driven pile, is most often used to place grout to generate a wall in unconsolidated soils. Pressure injection of grout and grout placement using the vibrating beam method are not feasible because of the extent required to control groundwater and the depth of the Wells Formation aquifer. Rock grouting is not implementable and is not retained.

4.4.4.3 Sediment Control Features

Sediment control features may be used to reduce or eliminate loading of sediment in a stream or to minimize the movement of sediments already in the channel. Process options for the sediment control remedial technology include dikes or berms and detention basins. Within the Site, such

sediment controls are applicable only to storm water runoff and would not be appropriate for use in various drainages where containment process options (e.g., rock covers) would be more effective in terms of controlling sediment mobilization.

Dikes/Berms

Dikes and berms consist of grading and reshaping the surface of the land in order to manage surface water infiltration and runoff while controlling erosion. Dikes and berms must be blended with surrounding undisturbed ground to provide a smooth transition in topography. Dikes and berms have been implemented at the Site and are potentially implementable for future actions and are retained for further evaluation.

Detention Basins

Detention basins, also termed sedimentation basins or ponds, detain storm water runoff allowing sediments to settle out of the water. Detention basins have been shown to be moderately to highly effective in settling and removing sediment and moderately effective at minimizing contaminant volume. Detention basins have been applied as BMPs at several of the external ODAs at the Site. Detention basins are implementable and are retained for further evaluation.

4.4.5 Source Control, Flow Control and Routing

Source control, flow control and routing GRAs consist of active measures to effectively manage source materials (e.g., overburden solids and soils) and groundwater and surface water contact (flow volume, velocity, and direction) with those source materials. In particular, these technologies limit the transport of COCs to surface water. Source control, flow control and routing may be used as stand-alone technologies or in conjunction with other technologies.

4.4.5.1 Surface Controls

Surface control process options considered for use at the Site include grading, erosion control and protection, and vegetation. These process options are applicable to overburden solids and soils but may also provide benefits for groundwater and surface water by reducing/eliminating releases of selenium from overburden into groundwater or surface water. Any land surface alterations associated with surface controls must be blended with surrounding undisturbed ground to provide a smooth transition in topography.

Grading

Grading is the general term for techniques used to reshape the surface of the land in order to manage surface water infiltration and runoff while controlling erosion, thereby providing both

source control for overburden solids and soils and flow control for groundwater and surface water. The general equipment and methods used in grading are conventional technologies, readily available and essentially the same for all surfaces. However, specific applications of grading technology will vary by site. Grading is often conducted in conjunction with surface preparation practices and revegetation as part of an integrated site remediation, which includes other actions such as containment. Grading is implementable and is retained for use in conjunction with other technologies.

Erosion Control and Protection

Erosion protection consists of the use of erosion-resistant materials such as riprap, vegetation, and geosynthetic fabrics to reduce or eliminate erosion of solid media by storm water runoff. These materials are often installed after regrading of the surface has been performed. Erosion protection uses conventional equipment and materials. Erosion-control fabrics can promote vegetation by retaining moisture and protecting the seedlings during germination. Maintenance requirements for these erosion protection measures are minimal. Erosion protection is suitable for dry mine waste (i.e., overburden), impacted surface soils, and impacted subsurface soils above the water table. This process option could be used with other technologies or as a stand-alone technology. Erosion control protection is implementable and is retained for further evaluation.

Vegetation

Establishing a vegetative cover is a standard surface reclamation technology for ODAs. In addition to stabilizing surface materials by reducing erosion potential, the vegetation increases evapotranspiration at the surface and reduces water infiltration into overburden and subsequent release of selenium and other COCs. The 2006 Smoky Canyon Mine EE/CA (NewFields 2006a) suggested that infiltration may be decreased by as much as 50% by establishing a well-vegetated cover on poorly vegetated overburden. Although this 50% reduction was not determined from modeling, it was applied to several alternatives to roughly estimate the potential benefits of establishing a good vegetative cover. Planting of native species that have low affinity for selenium uptake may be effective in reducing potential risks to ecological receptors. Vegetation also improves aesthetics. Previous response actions at the Pole Canyon ODA have demonstrated the effectiveness and implementability of revegetation measures in conjunction with containment/covers (NewFields 2006a; Formation 2012a). Vegetation is implementable and is retained for further evaluation in conjunction with engineered cover process options.

4.4.5.2 Slope Stabilization

Slope stabilization technology includes slope reduction and retaining walls to reduce erosion and sediment transport. Slope stabilization process options are often used in combination with other

technologies or process options in containment and flow control and routing GRAs. Slope stabilization is applicable to overburden solids and soils.

Slope Reduction

Slope reduction consists of flattening or reducing the grade of the surface slopes of areas of concern including ODAs. This slows storm water runoff velocity, limits erosion, promotes vegetation, and reduces the potential for slope failure. Slope reduction is implementable and is retained for further evaluation.

Retaining Walls

Retaining walls may be used with grading/slope reduction to stabilize steep soil slopes by reducing the effective slope of an earthen surface. Retaining walls are rigid vertical or near vertical structures of steel beams and sheets, concrete, masonry blocks, wood, rock, or other materials capable of withstanding the structural forces imparted by the soil on the uphill face of the wall. This process option is constructed using conventional techniques. Retaining walls are potentially implementable and are retained for further evaluation for use in ODA cover construction if needed to stabilize slopes.

4.4.5.3 Diversion

Diversion consists of routing or managing flow within open channels or closed conduits, and is applicable to surface water, specifically storm water. Flows could be diverted to open surface water bodies, sedimentation basins, or treatment systems.

Diversion ditches could be used to prevent “clean” surface water from contacting the overburden in a disposal area. Additionally, diversion ditches could be constructed on an ODA to manage runoff in such a manner as to limit infiltration and resultant leaching. This remedial technology limits the release of selenium and other COCs from overburden and migration from the ODA to nearby surface water or groundwater. Diversion ditches are effective if they are adequately designed and maintained. At the Site, diversion ditches would be effective upgradient of certain ODAs to reduce clean surface water run-on from the adjacent slopes by diverting it into existing creeks. They may also be used on long ODA slopes to shuttle water off the overburden.

Stream alterations could be used to limit the “clean” water that comes in contact with overburden. This is accomplished by diverting the natural stream channel away from an ODA or backfilled pit using closed conduits (e.g., culverts and piping), infiltration basins, and/or construction of a new stream channel that mimics the natural stream features in the area. Permits must typically be obtained from both the Idaho Department of Water Resources and the Army Corps of Engineers prior to implementation. Although under CERCLA the need for such permits is waived, the

substantive requirements must still be met. Stream alterations are effective if they are adequately designed and maintained. Stream alteration was used as a component of the NTCRA for the Pole Canyon ODA.

Open Channels

Open channels are engineered canals or ditches constructed for the purpose of collecting and conveying surface water. Constructed conventionally by excavating and shaping the ground surface, open channels are usually lined with vegetation, riprap, or concrete, as necessary and appropriate for the anticipated flows, channel dimensions and gradient, to prevent erosion by surface water. These channels are constructed with engineered grades and side slopes for specifically designed flow volumes and velocities and may also be used to manage groundwater flow after collection. Open channels are potentially implementable and are retained for further evaluation.

Closed Conduits

Closed conduits also provide a means to manage and control surface water. Closed conduits usually consist of culverts or pipes and are typically constructed of high-density polyethylene plastic, polyvinyl chloride plastic, corrugated metal, steel, or concrete depending on the engineering requirements. Often used for conveying flow on steeper grades, where space is limited, or infrastructure encroaches, closed conduits minimize or eliminate erosion of surface soils. Closed conduits must be maintained to ensure proper operation. Similar to open channels, closed conduits can also be used to route groundwater flow after collection. Closed conduits are potentially implementable and are retained as a process option for further evaluation.

4.4.6 Removal and Disposal

Remedial technologies for the removal and disposal GRA for overburden solids and soils and groundwater include excavation of solids and soils, collection of groundwater using extraction wells or trenches, and disposal or consolidation either onsite or offsite.

4.4.6.1 Excavation

Excavation involves physical removal and transport of solid materials from one location to another. This technology could be combined with technologies or process options from other GRAs such as containment, treatment, or disposal. Conventional excavation involves the use of earthmoving equipment (backhoes, trackhoes, scrapers, front-end loaders, and/or bulldozers) to dig, scrape or push materials that require treatment, relocation, or contouring. Conventional excavation could be used for removal of overburden solids or waste rock materials and soils and sediments from ODAs or detention basins, or for contouring an area prior to construction of a

cover system. The removed materials would be further treated, consolidated, placed under a cap or used in the construction of a cover system. Excavation could be easily implemented for excavation and consolidation of solid materials (waste rock) or excavation and reuse of soils as part of the remedial action and is retained as a process option for further evaluation.

4.4.6.2 Collection

Process options for collection of groundwater include extraction wells and interception trenches. Once collected, the groundwater may be either treated or disposed.

Extraction Wells

Extraction wells can typically be used to capture groundwater and control gradients and flow direction. Wells are constructed with conventional drilling equipment and materials. Extraction wells create a local groundwater sink that causes flow toward the well. Once extracted, the groundwater could be routed and managed as necessary. Multiple extraction wells could be installed along preferential pathways and along the West Sage Valley Branch Fault. Extracted groundwater could be treated and discharged or reintroduced.

The RI, however, demonstrated that groundwater flow within the Wells Formation is influenced by preferential flow paths. In fact, placement of a Wells Formation well within zones of high transmissivity and high concentrations of COCs is difficult. Monitoring wells GW-18 and GW-24 are examples. These Wells Formation monitoring wells were placed near the West Sage Valley Branch Fault and downgradient of the Pole Canyon ODA and Panel E, respectively. The Wells Formation at GW-24 is low transmissivity while GW-18 is in a high transmissivity zone. Concentrations of selenium in groundwater samples collected from GW-18 and GW-24 are below the MCL for selenium. Moreover, GW-18 is located less than 700 feet upgradient of Hoopes Spring where the maximum observed selenium concentration is approximately 10 times higher than concentrations observed at GW-18. The presence of preferential flow paths was further demonstrated by the range of observed selenium concentrations from discrete springs sampled at Hoopes Spring during the RI.

In short, use of extraction wells upgradient of Hoopes Spring is unlikely to be effective due to known hydrogeologic complexities. Moreover, Hoopes Spring acts as a regional groundwater discharge feature, which effectively captures the migration of COCs within Wells Formation groundwater in the southern groundwater flow system.

Extraction using pumping wells, similar to the previous Culinary Well and the Industrial Well, could be implemented and is retained as a process option for further evaluation.

Trenches

Interception trenches are excavated ditches or channels used to collect, control, and manage groundwater flow. The trenches are excavated to a depth greater than the groundwater table and are either maintained as open trenches or filled with permeable material such as riprap, drain rock, or drainage pipe. Groundwater flows toward and is intercepted by the trench. The trench could be designed to control the level of the water in the vicinity of the trench. Once in the trench, the water may be managed and routed as necessary. Both closed (gravel-filled or pipe) or open trenches are effective for collection of groundwater in low permeability soils with shallow groundwater tables. Due to the complex geology at the Site, deep Wells Formation groundwater that has been impacted by releases from ODAs flows along preferential pathways and along the West Sage Valley Branch Fault and discharges at Hoopes Spring and South Fork Sage Creek springs. Because most of the groundwater at the Site is in the deep Wells Formation aquifer, collection trenches are not implementable and are not retained as a process option for groundwater collection.

4.4.6.3 Solids Disposal

Disposal process options available for solid media include onsite consolidation/onsite disposal or offsite disposal at a disposal facility.

Onsite Consolidation/Onsite Disposal

Consolidating overburden can limit the water in flow, the oxygen in flux, and the uptake by vegetation thus limiting the impact to surface water, groundwater, and wildlife. By consolidating material into one disposal area, there could be an overall reduction in surface area available for infiltration of precipitation and leaching of contaminants, while also providing an environment within the disposal area that is more conducive to lower oxidation rates. Onsite consolidation of small volumes of nonhazardous treatment residuals from treatment systems (e.g., sludge from a fluidized bed bioreactor system or spent media from a passive treatment system) in backfilled pits could minimize leaching of selenium and other COCs from external ODAs. Onsite consolidation of larger volumes of overburden material by backfilling pits and reclaiming slopes would be beneficial to reduce the overall footprint of waste materials. Onsite consolidation/onsite disposal is potentially implementable, as long as the disposal setting is suitable to prevent remobilization of COCs into the environment and is retained for further evaluation.

Offsite Disposal

Excavated solid media may be disposed of offsite. Offsite disposal requires excavating the impacted solid media and transporting the media to an appropriate disposal facility. Although not generally required for mine wastes, pretreatment of mine wastes that exceed Resource

Conservation and Recovery Act (RCRA) toxicity criteria, based on the toxicity characteristic leaching procedure (TCLP) test (EPA Method 1311) would be required prior to disposal in a hazardous waste landfill. Offsite disposal would reduce the volume of waste material and is considered to be a suitable process option for all solid media. Offsite disposal is potentially implementable and is retained for further evaluation.

4.4.6.4 Groundwater/Surface Water Disposal

Disposal options for groundwater or surface water include injection or conveyance and discharge to an appropriate treatment or other storage/disposal facility.

Injection

Injection wells may be used for disposal of treated groundwater or surface water by injecting water into wells drilled into the subsurface. Groundwater at the Site occurs in alluvium and in Wells Formation bedrock. Because the valley-fill alluvial groundwater flow system discharges to surface water in Sage Creek, injection of groundwater into this system would not result in disposal and would not be feasible. Similarly, because the Wells Formation aquifer discharges at the springs complex, injected groundwater would be transported to this area, and therefore, would not be disposed. Injection of groundwater would not be feasible. Neither of these hydrogeologic units provides an appropriate situation where large quantities of water could be injected for disposal. Aqueous injection is therefore not retained for further evaluation.

Discharge to Treatment or Other Storage/Disposal Facility

Impacted groundwater or surface water may also be transported to a publicly owned treatment works or a dedicated treatment or other storage/disposal facility at the Site. There are no publicly owned treatment works in the vicinity of the Site, therefore, this option is not implementable and is not retained. Discharge to an onsite treatment or other storage/disposal facility is potentially implementable in conjunction with treatment technologies and is retained for further evaluation.

4.4.7 Treatment

4.4.7.1 Ex-Situ Treatment

This section provides more detailed information about the ex-situ treatment options evaluated, along with a preliminary screening of each technology.

Groundwater and Surface Water

Separation

Gravity – Gravity separation involves settling of suspended solids in ponds, basins, or tanks, with or without aid of baffles or other devices. Gravity settling typically results in sludge with a solids content of 30% to 40% by weight. The technology would not remove dissolved selenium and is not considered as a viable stand-alone treatment. However, gravity separation is potentially implementable in conjunction with other technologies that generate suspended solids and is retained for further evaluation.

Mechanical – Mechanical separation is a process to remove solids from liquids. Mechanical separation is achieved using devices such as belt presses, filter presses, and vacuum filtration units. These devices can attain up to about 70% solids concentration depending on the nature of the solids to be removed. Mechanical separation would not address the dissolved selenium in water at the Site but would potentially be implementable for dewatering waste streams from other treatment technologies and is retained for further evaluation.

Media Filtration – Media filtration is a separation process that uses granular material (typically anthracite coal and/or sand) through which influent water flows. Suspended solids are trapped on top and within the filter bed, while effluent is collected in an underdrain. As suspended particles collect in the filter media, they block the drain pores, reducing the filter effectiveness. The collected solids are rinsed out periodically by reversing the direction of the flow through the media (backwashing). Like the other physical separation processes, media filtration would not be an effective stand-alone process, but is potentially implementable and is retained for consideration in conjunction with other technologies.

Demineralization

Reverse Osmosis – Reverse osmosis is a physical treatment process in which pressurized water passes through a semipermeable membrane. The applied pressure to the waste stream is greater than the osmotic pressure of the feed water. As water passes through the membrane, dissolved constituents in the water are concentrated on the feed side of the membrane to form the waste brine and a dilute product water on the permeate side of the membrane. The waste brine may be as much as 15% to 25% of the total feed water flow and requires further handling and treatment. A treatability pilot study was conducted at Smoky Canyon Mine to evaluate the effectiveness of reverse osmosis to remove dissolved selenium and other constituents from Site waters (Formation 2011f). The selenium concentration in the influent water for the pilot study was 0.03 to 0.05 mg/L.

Selenium in the "concentrate," produced by the reverse osmosis unit, ranged from 0.14 to 0.20 mg/L. Selenium concentration in the "permeate" (effluent) from the reverse osmosis unit was effectively non-detect. The unit was capable of treating approximately 25 gallons per minute (gpm), with the concentrate comprising 5 gpm and the clean permeate the remaining 20 gpm. The results of the study showed the system was highly effective at separating and concentrating the selenium. Reverse osmosis is considered a potentially implementable technology which would need to be combined with a technology that removes selenium from the aqueous concentrate stream and is retained for further evaluation.

Ultrafiltration – Ultrafiltration is a membrane-filtration technology similar to reverse osmosis; however, the pore size in the membrane is slightly larger than the pore size in the reverse osmosis membrane allowing monovalent ions (e.g., sodium, chloride, etc.) to pass through while rejecting multivalent ions (e.g., selenium, calcium, sulfate, etc.). The proportion of water that could be treated by ultrafiltration will vary depending on its chemical composition. Ultrafiltration is considered a potentially implementable treatment technology in conjunction with or as a substitute for reverse osmosis and is retained for further consideration.

Ion Exchange – Ion exchange is a treatment method in which cation or anion exchange resins are used to remove ions from water or wastewater. Ions held by electrostatic forces to charged function groups on the surface of the ion exchange resin are replaced by ions of similar charge in the water. Ion exchange resins are selected to preferentially remove specific ions from the feed water and replace them with highly soluble, nontoxic ions. Due to regeneration and rinsing requirements, the ion exchange process would result in waste materials that would require further handling and treatment. Ion exchange is potentially implementable for selenium removal in conjunction with other processes and is retained for further evaluation.

Electrodialysis – Electrodialysis is a membrane process that employs an electric field as the driving force for separating a liquid influent into a concentrated stream and a depleted ("clean") stream. Cation exchange membranes permit only negatively charged ions to pass, while anion exchange membranes permit only positively charged ions to pass. Electrodialysis is typically used for low flow rate and high contaminant concentration wastewater treatment applications. While electrodialysis is effective in removing organic contaminants, it is not implementable for the removal of inorganic contaminants; therefore, it is not considered an appropriate treatment technology option and is not retained.

Adsorption

Activated Carbon – Carbon adsorption is a proven technology for the removal of organic constituents in water treatment systems. In the carbon adsorption process, water is contacted with the activated carbon in a series of packed bed columns. Although carbon adsorption is an effective method of removing organic constituents, it is only moderately effective for removal of inorganic constituents. Overall performance typically is related to water chemistry. While carbon adsorption may not be a stand-alone technology for selenium removal, the process is potentially implementable in conjunction with other technologies and is retained for further consideration.

Metal Oxide – Metal oxides such as zero-valent iron or activated alumina are capable of selective metal adsorption. As water flows through a bed of these materials, metal/metalloid ions (e.g., arsenic) are adsorbed by the surface of the iron or alumina particles in the bed. The process is pH dependent and results in a solid residue that may require further treatment and disposal. While metal oxide adsorption may not be a stand-alone technology, the process is potentially implementable in conjunction with other technologies and is retained for further consideration.

Chemical

Solvent Extraction – Solvent extraction is the separation of constituents from a liquid by contact with another, immiscible, liquid. Solvent extraction is effective on organic constituents but is not an effective treatment method for selenium or other inorganic constituents. Therefore, solvent extraction is not technically implementable and is eliminated from further screening.

Chemical Precipitation – Chemical precipitation is a treatment method in which dissolved ions/salts are precipitated in the form of insoluble salts. Precipitation is caused by addition of chemicals to reach chemical saturation and/or vary the pH. The insoluble salts may be removed from the water by sedimentation, coagulation, and/or flocculation. Precipitation is considered potentially implementable for removal of selenium in conjunction with other treatment technologies and is retained for further evaluation.

Oxidation/Reduction – Chemical oxidation and reduction use agents such as oxidation, chlorination, hydrogen peroxide, and ultraviolet light to react with contaminants and oxidize them. Oxidizing agents are non-specific and will react with any reducing agents present in the water to be treated. In some cases, the reaction products have the potential to be more toxic than the original contaminants. Care must be taken when selecting the oxidizing agents to be used. Oxidation/reduction reactions have been demonstrated as an effective stand-alone process for treatment of organics and some inorganic compounds

such as cyanides. Oxidation/reduction may improve the separation characteristics for removal of selenium if used in conjunction with other treatment technologies and is retained for further evaluation.

Biological

Biodegradation – Biological treatment involves the degradation or reduction of contaminants by microorganisms. Groundwater or surface water could be extracted or pumped to a process location (e.g., wetlands, anaerobic bioreactor, or fluidized bed bioreactor) for treatment. Metals and other inorganic contaminants could be removed from the water using anaerobic bacteria that decrease the solubility via biological processes and then precipitated or absorbed by the media in the wetlands or bioreactor.

Two pilot scale biological treatment systems have been evaluated at the Site. The first system was a semi-passive, buried, anaerobic, bioreactor used to treat a low flow, high concentration seep (DS-7), which discharges to the surface at the eastern toe of the Panel D external ODA. Overburden material comprising this ODA was placed directly overlying a small stream channel during mining of Panel D (Formation 2014c). The ODA was covered with a partial topsoil and vegetative cover system in 2002. Seep DS-7 is likely the surface expression of water that infiltrates through the ODA, reaches the lower permeability material present at the ground surface beneath the ODA, and flows along the small channel. The seep is captured by detention basin DP-7 where the water either evaporates or infiltrates downward into underlying Wells Formation bedrock. The initial bioreactor vessel was amended with cheese whey, compost, and zero-valent iron to establish and maintain the appropriate environmental conditions for the targeted microorganisms. The pilot system operated for approximately 7 months and achieved a selenium removal efficiency between 72% and 97% (Moller 2002).

This pilot unit was refitted and used for about 2 years, from July 2013 to November 2015, for a semi-passive treatment pilot study. Overall, the treatment system achieved 56% removal of total selenium in seep water (Formation 2017b). The semi-passive biological treatment system is relatively easy to implement and could be installed, operated, and maintained using common materials and local feed source(s), but may need additional supplements to promote bacterial activity. Access to the pilot treatment system to adjust operational parameters to maintain treatment operation was difficult and potentially unsafe during the winter months because of the steep, snow-covered unimproved road leading to the seep and treatment system. Although the pilot treatment system was supposed to be semi-passive and required little or no maintenance, the system was more difficult to operate during the winter due to freezing within the bioreactors and required significant maintenance during spring restart. Although this semi-passive system has moderate

effectiveness for removing selenium and is difficult to implement in remote locations during the wintertime, it is retained for further evaluation.

The second biological treatment pilot study is a larger scale, active water treatment plant located between Hoopes Spring and South Fork Sage Creek springs. The plant consists of an anaerobic fluidized bed bioreactor which contains media that hosts a film of bacteria that specifically target selenium for their biological metabolism. Start-up and troubleshooting for the first phase of the pilot study began in late 2014 and the system treated 200 gpm to 250 gpm of comingled flow from Hoopes Spring and South Fork Sage Creek Springs through early 2016 (Formation 2014d, 2017a). The Phase 1 pilot study system operated from March 2016 to March 2017. An ultrafiltration/reverse osmosis system and a second fluidized bed bioreactor unit was added for Phase 2 in order to treat flows of 1,000 gpm to 2,000 gpm (Formation 2017a). The Phase 2 pilot study system began operation in February 2018 and is ongoing. Initial data indicate that the active fluidized bed bioreactor is capable of achieving 80% to 90% removal.

Biological treatment of water at the Site is potentially implementable for removing selenium and other COCs from groundwater and surface water and is retained for further consideration.

Thermal

Mechanical Evaporation – Mechanical evaporation is a process in which water is heated to the boiling point. The water vapor is condensed to form condensate (distilled water), which is the product. The contaminants are concentrated in the water brine byproduct. Because of the large water flow rates at the Site, mechanical evaporation would not be implementable and is not retained for further consideration.

Wet Air Oxidation – Wet air oxidation is a combustion process that occurs in the liquid phase, by adding air at high pressure and elevated temperatures. The products of the reaction are water, nitrogen compounds, carbon dioxide, and an oxidized liquid stream. While the process is appropriate for destroying organic compounds, it is not implementable for inorganics; therefore, wet air oxidation is not a viable process option for the Site and is not retained.

Solids and Soils

Physical

Stabilization/Fixation – Stabilization/fixation is a technology in which inorganic or organic agents are added to impacted soil to reduce the solubility or mobility of contaminants. Ex-situ stabilization generally involves excavation of the solids, mechanical mixing of the solids with stabilizing agents, curing of the mass for optimal leach resistance and geotechnical properties, followed by onsite or offsite disposal of the stabilized mass. A variety of stabilization agents are available, including cement, fly ash, silica, bentonite, and various polymers. The types and combinations of stabilization agents that are effective for a particular waste depend on the chemical and physical characteristics of the solid. Stabilization/fixation may be applicable to smaller volumes of overburden used in the cover process to aid in immobilizing contaminants in the upper portions of the overburden. Stabilization/fixation is potentially implementable and is retained for further evaluation.

Dewatering – Dewatering is most effective for separating liquid and solid media for further treatment or disposal. Dewatering is not applicable for large volumes of overburden material; therefore, this process option is not retained.

Separation – Physical separation is a process whereby soils are slurried and passed through a gravity separation process to extract inorganic constituents. This process is most effective where there is a significant difference in particle size, and the contaminants are present in a narrow range of sizes. It is also effective where free inorganic constituents are present and could be selectively removed. These conditions are not present at the Site. Physical separation is not implementable and is not retained.

Thermal

Incineration – Incineration is a process that effectively destroys organic compounds by applying sufficient energy to convert these compounds into nontoxic constituents (e.g., water and carbon dioxide). Incineration is not applicable for inorganic constituents such as selenium in solids and soils; therefore, this technology is not retained.

Desorption – Desorption is a process by which volatile compounds are separated or recovered from a solid matrix. These separation process options are effective for organic constituents but are not effective for inorganic constituents. Desorption is not appropriate for use at the Site and is not retained.

Chemical

Oxidation/Reduction – Similar to the ex-situ treatment of water, oxidizing agents could be applied to solids and soils to react with contaminants reducing them to a less toxic or mobile form. The ex-situ version of this process is achieved by excavating the solids, and slurrying them in a reactor with the oxidizing agent. These reactions could be effective in detoxifying hazardous sludge containing both organics and inorganics. Common oxidizing agents used for sludge treatment include hydrogen peroxide, chlorine, and ozone. This treatment would not be applicable for treating contaminants as a stand-alone technology but could be used in conjunction with other treatment options to reduce the toxicity of process solids. Oxidation/reduction is potentially implementable and is retained for further evaluation.

Hydrolysis – Hydrolysis is a process in which contaminants react with hydrolyzing agents such as mineral acids or alkaline solutions, resulting in the decomposition of the chemical compounds. It is widely used for treating organic wastes but is not feasible for removing selenium or other inorganic chemicals. Hydrolysis cannot be implemented technically and is not retained.

Extraction – Extraction is generally a multistage, counter current, intense scrubbing circuit in which contaminated soil or sludge is excavated/dredged, screened, attrition scrubbed, washed with a surfactant, and separated. The application of extraction has been demonstrated for soils contaminated with petroleum hydrocarbons and/or wood treating chemicals. Extraction is not a proven method for treatment of inorganic constituents and further research may be required for those applications. Extraction is considered potentially implementable with additional research and is retained for further evaluation.

Biological

Enhanced Biodegradation – Biological treatment of solids and soils consists of enhancing the biological degradation of constituents by microorganisms. Ex-situ biological treatment is typically implemented by slurrying solids with the nutrient additives needed to create favorable conditions for the desired microbial activity. Biological treatment of solids has been proven to be most effective for the treatment of hydrocarbons and other organic constituents. The technology is not implementable for the removal, or fixation of inorganic constituents in solids, and is not an appropriate treatment option for solids at Smoky Canyon Mine. Therefore, enhanced biodegradation is not retained.

4.4.7.2 In-Situ Treatment

This section provides more detailed information about the in-situ treatment options being evaluated, and the preliminary screening of each technology for implementability.

Groundwater and Surface Water

Chemical

Chemical Injection – Chemical agents are directly injected into the impacted region of the aquifer to treat the groundwater. The injected chemical agent interacts with the constituents in the groundwater plume to neutralize, precipitate, immobilize, fixate, or destroy the contaminants. General limitations of this technology include the possibility of displacing chemicals to adjacent areas due to the added volume of the chemical solution, and the production of hazardous compounds by reaction of the injected agents with constituents other than the treatment target. Because of the Site conditions for groundwater (e.g., deep aquifer and fractured flow), and the properties of selenium and arsenic, chemical injection is not a viable technology for the Site and is eliminated from further consideration.

Biological

Biodegradation – In-situ biological treatment of groundwater and surface water uses similar scientific principles as ex-situ biological treatment and is primarily achieved by enhancing conditions within the contaminated plume to favor native microorganisms that can metabolize the target contaminants. In most situations in-situ biodegradation is most successful where the geochemical environment and hydraulic conditions allow for control of the key growth variables (e.g., temperature, pH, and nutrients).

Permeable reactive barrier (PRB) technology is an in-situ permeable system that uses reactive media designed to passively treat intercepted contaminated surface water or groundwater. The type of reactive material selected for the PRB depends on local hydrogeologic conditions, and types of contaminants. The reactive media is placed in a trench across the water-bearing zone to be treated. The trench is aligned perpendicular to flow such as to intercept and treat contaminated water. Chemical reactions between the reactive media and contaminated water flowing through the media results in transformation or immobilization of the contaminants.

Unlike conventional pump-and-treat systems, PRBs do not require treatment equipment reliant on access to power and other infrastructure. The technology is capable of successfully treating many inorganic contaminants. To treat selenium, PRBs rely on reactive media that use chemical and microbial processes to chemically reduce and

transform selenium from selenate (SeO_4^{-2}) to selenite (SeO_3^{-2}) and ultimately to elemental selenium (Se0). Elemental selenium (Se0) precipitates out of solution and is not bioavailable as an insoluble element. Reactive material suitable to treat selenium include inert sand, wood chips, and alfalfa hay. Various factors influence the reduction speed of microbial processes, including pH, temperature, and salinity.

A subsurface semi-passive remedial technology (PRB) is currently being tested by Monsanto at the toe of the Horseshoe ODA at the South Rasmussen Mine. The current installation consists of an excavated trench that is backfilled with structural backfill material, a short-term carbon source, and long-term carbon source. The alluvial flow system in the area ranges between near surface to 20 bgs. Maximum trench depth is 20 feet. Silica sand is used as the structural backfill material, alfalfa is used as the short-term carbon source, and wood chips are used as the long-term carbon source. The three elements are mixed according to the design ratio (1:1:1) by the loader and are then deposited into the trench. The design also includes installation of some conduit pipes that would allow for supplemental carbon sources to be added to the system, if needed.

In-situ biological treatment is applicable to inorganic constituents in groundwater and surface water and is retained for further evaluation.

<u>Solids and Soils</u>

Physical

Stabilization/Fixation – In-situ stabilization/fixation is performed by using special machinery to directly inject stabilizing agents, such as cement, into the soil. Types of equipment and methods used to deliver the stabilization agents into soils include rotary injection augers, jet grouting, and pressure grouting. In-situ stabilization and fixation have similar advantages and disadvantages to ex-situ treatments. Although stabilization/fixation may not be implementable for large volumes of overburden material, it may be applicable for immobilizing small volumes of material as part of the cover process and is retained for further consideration.

Aeration – Aeration of soils is typically achieved using soil vapor extraction systems. These systems apply a vacuum to subsurface wells to enhance the volatilization process for organic compounds. This treatment technology is not applicable to the inorganic contaminants at the Site and is therefore not retained.

Thermal

Vitrification – Vitrification is a thermal treatment process that immobilizes inorganic compounds and destroys organic compounds by electrically heating and fusing the soil into a stable, glass-like block. Vitrification is potentially implementable and is retained for further consideration.

Desorption – Thermal desorption is similar to aeration, with the addition of a heat source to aid in the volatilization process. As previously discussed, this type of technology is not effective for the treatment of selenium or other inorganic constituents, and therefore, is not appropriate for use at the Site and is not retained.

Biological

Enhanced Biodegradation – In-situ biological treatment of solids uses the same principles as ex-situ biological treatment, except that the solids are not removed and are instead treated in place. It consists of enhancing the biological degradation or reduction of constituents by microorganisms. This process has not been demonstrated to be effective as a treatment for selenium or other inorganic constituents in soils; therefore, this technology is not appropriate for the Site and is not retained.

Phytoremediation – Phytoremediation involves the use of vegetation for the in-situ treatment of contaminated soils and sediments. Plants can directly uptake some organic and inorganic constituents and accumulate them in the plant tissue. Due to the presence of grazing livestock and wildlife in the vicinity of the Site, phytoremediation would not be an appropriate technology and is not retained.

4.4.8 Monitored Natural Attenuation

Groundwater flow causes physical mixing, dilution, and dispersion of contaminants in groundwater. Those physical processes result in decreasing contaminant concentrations with distance along a flow pathway. Sorption and biologically mediated MNA processes are dependent on geochemical conditions in the Wells Formation aquifer and alluvial flow system at the Site. Under mildly reducing conditions, selenite (SeO_3^{2-}) is the dominant form of selenium in water. When conditions are oxidizing, selenate (SeO_4^{2-}) is the dominant form of selenium. In general, selenate is less strongly sorbed to mineral surfaces than selenite.

Hay et al. (2016) evaluated the release and subsequent transport of selenium from overburden at multiple phosphate mines in southeastern Idaho, with a particular emphasis on understanding conditions leading to selenium attenuation. They compared the results of saturated and unsaturated column tests with groundwater quality data and demonstrated that the ratio of

aqueous selenium to aqueous sulfate can be a useful metric for understanding selenium release and attenuation. Hay et al. (2016) hypothesized that selenium released in the oxic upper portions of overburden disposed in backfilled pits and large external overburden piles can be subsequently attenuated via reductive precipitation at depth in unsaturated, low oxygen portions of the waste shale. Hay et al. reported that selenium attenuation was not observed in overburden disposed at the Smoky Canyon Mine, and they attributed the lack of selenium attenuation to relatively high oxygen concentrations measured in pore gas samples collected from Panel A and Panel D backfilled pits, where the oxygen content of pore gas remained near atmospheric levels at depths of more than 300 feet below the surface. Based on this study, the selenium species released from ODAs at Smoky Canyon is expected to be predominantly the more oxidized, selenate form.

Attenuation of cadmium and selenium transport by groundwater flow was evaluated as part of the groundwater impact analysis conducted for the Panels F and G EIS (Buck and Mayo 2005; NewFields 2006b). The empirical data presented in these studies demonstrate that both cadmium and selenium experience attenuation during groundwater transport, with cadmium being more highly attenuated than selenium. The potential for attenuation of other mobile constituents of shale overburden, including selenium, was also evaluated in support of similar impact analyses conducted for Monsanto's Blackfoot Bridge Mine (Whetstone 2010) and Agrium's Dry Valley Mine (Enviromin 2006). Each of these studies also found that selenium may be attenuated during groundwater transport within the Wells Formation aquifer by sorption to mineral solids present in the Wells Formation limestone.

The fate and transport of selenium in groundwater at the Site was evaluated during the Site Investigation (NewFields 2005), the RI (Formation 2014c), and during preparation of the Panels F and G EIS (NewFields 2006b). Selenium is typically present in groundwater as selenate, with minor selenite present at some locations including ODA seeps. Site-specific batch-sorption tests (NewFields 2006b) indicated that some selenium was removed from D-Panel seep water when that water was in contact with Wells Formation. The selenium in the seep water was predominantly selenate with lesser selenite (approximately 15% of selenium in solution). Therefore, although the geochemical characteristics of groundwater at the Site are typically oxidizing, and the dominant selenium species present is the relatively mobile form, selenate, attenuation of selenium transport may take place within the Wells Formation. However, based on the observed distribution of selenium in groundwater across the Site, it appears that the geochemical attenuation mechanism demonstrated by the batch-sorption tests does not limit the extent of selenium transport from source areas, and natural attenuation may offer only limited reductions in selenium concentrations in groundwater downgradient of those sources. MNA is retained in conjunction with other GRAs for further evaluation.

4.5 Screening of Remedial Technologies and Process Options for Effectiveness, Implementability, and Relative Cost

Each of the technically implementable remedial technologies and process options retained from the initial screening process presented in Section 4.4 were further evaluated to determine whether they should be eliminated from consideration or retained for additional screening by media. Technologies or process options were qualitatively evaluated for effectiveness, implementability, and relative cost. The criteria used for this evaluation are as follows:

Effectiveness

Effectiveness of a remedial technology or process option is evaluated on the potential effectiveness in handling the estimated volume of overburden solids and soil and groundwater and surface water and on meeting the objectives identified in the RAOs. Potential impacts to human health and the environment during construction and implementation are considered. The evaluation also considers whether the remedial technology or process option is proven effective for the conditions at the Site.

Implementability

Technically implementable remedial technologies and process options retained from the initial screening are evaluated for technical and administrative feasibility. Remedial technologies and process options that were clearly ineffective and were therefore not applicable or not feasible were eliminated during the initial screening. In this evaluation, implementability focuses on the ability to obtain permits for offsite remedial actions, administrative and institutional feasibility, the availability and capacity of treatment and disposal services, and the availability of necessary equipment and workers to implement the technology.

Relative Cost

Cost has a limited role in the screening of remedial technologies and process options. Relative capital and O&M costs are used rather than detailed cost estimates. The cost analysis is evaluated based on engineering judgment and is ranked relative to other process options (i.e., low, moderate, high cost) in the same remedial technology type. Because remedial alternatives and associated quantities are not defined during this screening evaluation, relative cost is provided qualitatively rather than quantitatively. The greatest differences in costs are generally associated with different technology types. Cost differences of different process options within a technology type are usually less significant.

Each of the remedial technologies and process options retained from the initial screening were evaluated against the three criteria to determine whether they should be eliminated from further consideration in the FS or retained for additional media-specific screening. A summary of the

results of the evaluation process are shown in Figure 4-3. Remedial technologies or process options with low effectiveness, low implementability, and/or relative high cost are eliminated from further consideration and are not used to develop remedial alternatives. These process options are shaded gray. The specific location where implementation of a retained process option is applicable is also considered during the evaluation and is briefly described. The screening is described in the following subsections.

4.5.1 No Further Action

The No Action alternative is required for consideration by the NCP and is retained. Because previous work has occurred at Smoky Canyon Mine, this alternative is No Further Action.

4.5.2 Institutional Controls

Institutional controls are administrative and legal mechanisms that help to minimize the potential for exposure to contamination and/or protect the integrity of a response action. They may be used alone or in conjunction with other alternatives as part of an overall remedy and are meant to supplement engineering controls during all phases of cleanup and may be a necessary component of the selected remedy.

The land where mining activities have occurred at the Site (and where the source areas are located) is federal land managed by the Caribou-Targhee National Forest. As such, land-use controls such as Forest Service closure orders may be used by the Forest Service to prevent access to the Site or prevent activities that could compromise the integrity of remedial actions. The Forest Service administers several grazing allotments that encompass portions of the Site. Land managers use grazing management plans as tools to protect water quality, forage, and beneficial use. Grazing controls are often included as a BMP temporarily during implementation of the final remedy. Controlling domestic livestock grazing would allow establishment of vegetation on recently seeded areas. Land-use controls and grazing controls are easily implementable, would be effective at a relatively low cost, and are retained for further screening by media.

Simplot owns the land in Sage Valley and therefore could implement deed restrictions to prevent future activities that would present a risk. Deed restrictions are easily implementable, would be effective at a relatively low cost, and are retained for screening by media.

Enforcement and permit tools such as administrative orders, federal facility agreements, and consent decrees could be effective to limit certain activities or require the performance of specific activities such as monitoring or reporting on effectiveness. Administrative orders and consent decrees are legally binding and could be enforced at a relatively low cost. These enforcement options are retained for screening by media.

Public information programs would be effective to restrict activities that could compromise remedial actions. For example, during the period that cover systems vegetation is maturing, it would be appropriate to inform the public that access is restricted until certain components of the remedy are complete. Signs could be an effective method of providing information. In the future, the Forest Service may elect to post warnings signs to inform the public about the residual contamination present at the Site. Public information programs and warning signs are easily implementable institutional controls and would be moderately effective at a relatively low cost and are retained.

These process options are all retained for further screening by media.

4.5.3 Access Controls

Access controls include physical barriers such as fences and gates to limit access to source areas at the Site (e.g., ODAs or seeps or springs).

These controls would be appropriate for preventing access during implementation of remedial actions and until they are effective. For example, fences could be used to restrict access to seeps and detention basins with selenium and arsenic concentrations above levels of concern and would be effective while control of the sources is being implemented and until source control becomes effective (which will reduce concentrations in the seeps and detention basins).

Physical barrier process options are all retained for further screening by media.

4.5.4 Containment

Various cover types, as well as encapsulation of seleniferous material, are discussed in the Selenium Management Practices document (SeWG 2005). Simplot identified source areas and available volumes of the primary material types to be evaluated for use in CERCLA cover systems that are considered for the FS (Formation 2016b).

Dinwoody covers have already been used extensively at the Site for post-mining reclamation. They are effective in preventing direct contact to overburden materials and in reducing infiltration of water (and thereby reducing the subsequent release of selenium and transport to soils, groundwater and surface water). The Pole Canyon ODA 2013 NTCRA entailed installation of a 3-foot thick Dinwoody cover over a 2-foot thick layer of chert/limestone. This cover was selected for the NTCRA by an EE/CA evaluation which showed that it would be effective in protecting human health and the environment. In addition to being used as a thick barrier layer to prevent vegetation from rooting in overburden materials, chert/limestone could be used as a water conveyance layer in a more complex cover system (i.e. geosynthetic clay liner [GCL], Dinwoody or tailings).

Another possible configuration is a monolithic Dinwoody storage layer that can act as a "water balance cover". Water balance covers tested in field demonstrations in semi-arid climates (e.g., Montana and Utah) are hydraulically equivalent to the geosynthetic cover (Albright et al. 2004). The monolithic soil storage layer is effective in storing and releasing snowmelt and rainwater and does not rely on the physical characteristics of a single design element (i.e., the low hydraulic conductivity barrier). Although the water balance cover is thicker than a soil or geosynthetic cover, soil placement methods are implementable and less labor intensive than construction of a hydraulic barrier layer or placement of a geomembrane, resulting in a lower relative cost.

Dinwoody and chert/limestone covers are proven, effective materials, and are retained for screening by media.

Simplot also identified tailings as a potential component of an ODA cover system because of its low hydraulic conductivity and subsequent effectiveness in reducing infiltration into underlying overburden materials (Formation 2014b). Because the material could be highly erodible on an ODA slope it is not implementable as a surface material but could be used as a subsurface layer (for example beneath a chert/limestone layer that would provide physical protection and stability). A large quantity is available in the tailings impoundments and more is generated each year by active mining. Tailings material is retained for use as a subsurface layer in cover systems on ODAs.

Soil covers can provide a physical barrier between the vegetation root zone and ODA materials, thus reducing the potential for selenium uptake by selenium-accumulating plants along with preventing direct contact and ingestion by potential receptors. However, Dinwoody is present at the Site, is proven implementable, and can support vegetation in a similar manner to soil. Sufficient quantities of soil for ODA covers would be more difficult to obtain and have a higher cost because of longer transportation distances. Because it is less effective, less implementable, and comes at a higher cost than Dinwoody material, a soil cover is screened out from further consideration in the FS.

Geosynthetic covers consist of multiple layers and may include a GM or GCL. Other materials such as Dinwoody and chert/limestone would also be used in a GM/GCL cover to provide growth media for vegetation and stability/drainage. The GCL technology has been implemented successfully in the Southeast Idaho Phosphate Mining Resource Area: notably at South Maybe Canyon Mine (a CERCLA action on a cross-valley fill ODA) (USFS 2012) and at the Blackfoot Bridge Mine (as part of active mining) (BLM 2011). Therefore, this option is retained for screening by media.

Sediment control features such as dikes and berms and detention basins already in place at the Site are effective in preventing storm water runoff from mining areas from reaching local creeks. These features would be maintained as needed. Additional features may be constructed to

support installation and operation of new covers on Panel A and Panel D, and therefore, these process options are retained.

With the exception of soil covers, all engineered cover process options and sediment control features are retained for further screening by media.

4.5.5 Source Control, Flow Control and Routing

Surface control process options considered for use at the Site include grading, erosion control and protection, and vegetation. Grading could be used during cover installation to provide a surface that promotes runoff and thus reduces infiltration. Grading will be needed for covers at Panel A and Panel D to eliminate areas where pooling of water currently occurs. Erosion protection consists of the use of erosion-resistant materials such as riprap, vegetation, and geosynthetic fabrics to reduce or eliminate erosion of solid media by storm water runoff. These materials are usually installed after regrading of the surface has been performed and have been used at the Site. These process options will be used as necessary in the design of cover systems. Establishing a vegetative cover is a standard surface reclamation technology for covers on ODAs and has been implemented successfully at the Site. Vegetation will be used at the surface of any cover system installed on ODAs.

Slope stabilization technology includes slope reduction (by grading) and retaining walls to reduce erosion and sediment transport. Both process options were used in the Pole Canyon ODA 2013 NTCRA and the option could be used in cover installation at other ODAs (to be determined during remedial design).

Diversion consists of routing or managing flow within open channels or closed conduits. This process option was used in the 2006 NTCRA at the Pole Canyon ODA to convey the flow in Pole Canyon Creek around the ODA. For future work, this process option may be used as part of the design of cover systems on the Panel A and Panel D ODAs to manage storm water.

Source control, flow control and routing process options are all retained for further screening by media.

4.5.6 Removal and Disposal

Remedial technologies for the removal and disposal GRA for overburden solids and soils include excavation of solids and soils, and disposal or consolidation either onsite or offsite. Technologies for removal and disposal of contaminated groundwater are limited to extraction wells and discharge to an onsite treatment or other storage/disposal facility.

Complete source removal is not implementable or effective for pit backfill and external ODAs. The material volume is large (millions to tens of millions of cubic yards) and no suitable location exists for disposal. Also, the resultant disposal area would have similar environmental conditions and issues as for the current pit backfill and ODAs. Similarly, offsite disposal of large volumes of material would not be more effective than source control actions and would entail orders of magnitude higher cost.

However, source removal could be effective for small volumes of materials. For example, once source controls (i.e., ODA covers) are implemented and are effective, residual sediment remaining in seep areas or storm water/seep detention ponds could be removed and consolidated onsite. This could be an effective method to manage residual risk after source controls are complete. Similarly, residual solid materials generated by water treatment, could be consolidated onsite if their chemical properties were suitable. If the residual materials were characterized as hazardous waste, then the materials would require offsite disposal in a hazardous waste landfill.

Extraction wells could be used to capture groundwater and control gradients and flow direction. Multiple extraction wells could be installed along preferential pathways and along the West Sage Valley Branch Fault. Extracted groundwater could be treated and discharged or reintroduced. The RI, however, demonstrated that groundwater flow within the Wells Formation is influenced by preferential flow paths. In fact, placement of a Wells Formation well within zones of high transmissivity and high concentrations of COCs is difficult. Monitoring wells GW-18 and GW-24 are examples. These Wells Formation monitoring wells were placed near the West Sage Valley Branch Fault and downgradient of the Pole Canyon ODA and Panel E, respectively. The Wells Formation at GW-24 is low transmissivity while GW-18 is in a high transmissivity zone. Concentrations of selenium in groundwater samples collected from GW-18 and GW-24 are below the MCL for selenium. Moreover, GW-18 is located less than 700 feet upgradient of Hoopes Spring where the maximum observed selenium concentration is approximately 10 times observations at GW-18. The presence of preferential flow paths was further demonstrated by the range of observed selenium concentrations from discrete springs sampled at Hoopes Springs during the RI.

In short, use of extraction wells upgradient of Hoopes Springs is unlikely to be effective due to known hydrogeologic complexities. Moreover, Hoopes Springs acts as a regional groundwater discharge feature, which effectively captures the migration of COCs within Wells Formation groundwater in the southern groundwater flow system. Extraction from pumping wells similar to the Industrial Well would be moderately effective and fairly easy to implement but would have a relatively high cost. Extraction wells are retained as a technology for screening by media.

Another retained process option for this remedial technology is routing groundwater that discharges at the springs complex to a water treatment facility. This is being implemented in the water treatment pilot study and additional conveyance systems may be installed to maintain the

required influent flow and quality to any treatment system. Groundwater or surface water could also be routed to a storage/disposal facility.

Removal and disposal technologies/process options retained for further screening by media include excavation of solids and soils and disposal or consolidation onsite or disposal offsite, and extraction or routing of groundwater and surface water and disposal through surface discharge (e.g., retention ponds) or subsurface injection (e.g., reinjection well or infiltration basin).

4.5.7 Treatment

Groundwater and Surface Water

The principal treatment technology for removing selenium is biological treatment. Two pilot scale biological treatment systems have been evaluated at the Site. The first system was a semi-passive, buried, anaerobic, bioreactor used to treat a low flow, high concentration toe seep (seep DS-7) from one of the ODAs. The initial pilot system operated for approximately 7 months and achieved a selenium removal efficiency between 72% and 97% (Moller 2002). This pilot unit was refitted in 2013 and used for about 2 years. Overall, the treatment system achieved a selenium removal efficiency of 56% (Formation 2017b). The system was supposed to be semi-passive with little maintenance required; however, it was more difficult to operate during the winter due to freezing within the bioreactors and required significant maintenance during spring restart. Although this semi-passive system has moderate effectiveness for removing selenium and is difficult to implement in remote locations during the wintertime, it is retained for screening by media because it is implementable for a low to moderate cost.

The second biological treatment pilot study is a larger scale, active water treatment plant, located between Hoopes Spring and South Fork Sage Creek springs. The plant consists of an anaerobic fluidized bed bioreactor which contains media that hosts a film of bacteria that specifically target selenium for their biological metabolism. Phase 1 of the pilot study operated from March 2016 to March 2017. A second fluidized bed bioreactor unit was added in conjunction with an ultrafiltration/reverse osmosis system for Phase 2 in order to treat higher flows (Formation 2017a). The Phase 2 pilot study system began operating in February 2018 and is ongoing. Initial data indicate that the active fluidized bed bioreactor is capable of achieving 80% to 90% removal.

Other process options may be required to support the biological treatment system, as determined by design and operations testing. These include gravity separation (settling of suspended solids in ponds, basins, or tanks), mechanical separation (such as belt presses, filter presses, and vacuum filtration units), media filtration (typically using sand), ultrafiltration/reverse osmosis (separation of contaminants by semipermeable membrane), chemical precipitation (precipitation of dissolved ions/salts in the form of insoluble salts), and/or chemical oxidation or reduction to improve selenium removal efficiency. While these options are retained in the FS process, they

are not stand-alone technologies, rather options to improve the selenium removal by the biological system.

Several process options evaluated for effectiveness, implementability, and relative cost were not retained for development of remedial alternatives in the FS including ion exchange, and adsorption using activated carbon or metal oxides.

Ion exchange was initially retained as a potentially implementable treatment technology. However, the process has not been tested in conditions similar to those found at the springs complex and due to uncertain effectiveness and relatively high cost, ion exchange is screened out of further consideration.

Carbon adsorption is implementable and is an effective method of removing organic constituents; however, it is only moderately effective for removal of low concentrations of arsenic and is ineffective for the removal of selenium. Overall performance typically is related to water chemistry. While carbon adsorption may be potentially implementable, it has low to moderate effectiveness for inorganic contaminants and a relatively high cost. Therefore, carbon adsorption is not retained.

Metal oxides are capable of selective metal adsorption. A pilot scale study was performed at the Site to test the effectiveness of a zero-valent iron, metal oxide adsorption system (Formation 2012d). Zero-valent iron was selected over the more common activated alumina due to the potential for the iron media to more effectively remove selenium than the alumina. Selenium concentrations in the pilot influent ranged from 0.035 to 0.050 mg/L. The 24-gpm system only achieved an average selenium reduction of 40% to 50% (not sufficient to meet surface water quality criteria). This study demonstrated that the technology would not be effective at consistently reducing selenium concentrations to levels that would meet Site PRGs and is therefore not retained.

Biodegradation is retained for further screening by media as a primary process option for treatment of groundwater and surface water.

Solids and Soils

In-situ or ex-situ stabilization/fixation involves injecting stabilizing agents, such as cement, into the soil or excavation and mechanical mixing of solids with stabilizing agents. While this process may not be implementable for large volumes of overburden material, it may be applicable for smaller volumes. Stabilization/fixation is implementable and could be effective for immobilizing small volumes of material as part of the cover process and is retained for screening by media in conjunction with cover process options.

Extraction is implementable and is effective for removal of organic constituents from solids and soils but is not a proven treatment method for inorganic constituent removal. Further research may be required, which would increase the relative cost of this technology. Using extraction on large volumes of overburden material would also result in higher relative costs. Extraction is not an appropriate process option and is not retained.

Physical stabilization/fixation is retained as a process option for treatment of solids and soils for screening by media.

Vitrification is a thermal treatment process that immobilizes inorganic compounds in solids and soils. Although thermal vitrification could be effective, due to the large volumes of overburden present at the Site the process would have low implementability and relatively high costs; therefore, vitrification is not retained.

4.5.8 Monitored Natural Attenuation

MNA is a natural physical, chemical, and/or biological treatment process that may be used in conjunction with the above-mentioned technologies and process options to achieve remedial objectives for groundwater and is retained for further evaluation.

4.6 Remedial Technologies/Process Options Retained for Further Evaluation

Based on the results of the two-step screening process described in Sections 4.4 and 4.5, the remedial technologies and process options within each GRA that are retained for further evaluation by media are summarized in Table 4-3. Evaluation and selection of representative technologies and process options for solids and soils, groundwater, and surface water is presented in Section 5.

5.0 EVALUATION AND SELECTION OF REPRESENTATIVE TECHNOLOGIES

This section evaluates the remedial technology/process options retained after the initial screening in Section 4 for the Site media of concern for effectiveness, implementability, and relative cost. The goal of this final evaluation step is to further reduce the number of retained process options and to select representative technologies that ultimately will be used to develop remedial alternatives for the Site. Technologies/process options retained after this final screening step will be combined and assembled into a range of remedial alternatives in FSTM#2: Development, Screening, and Detailed Analysis of Alternatives.

The screening criteria used for this evaluation are as follows:

Effectiveness – Process options are evaluated on potential effectiveness in handling the estimated area or volume of solids and soils, groundwater, or surface water and on meeting the objectives identified in the RAOs. Process options are also evaluated relative to each other within the same technology type to reduce the number of process options for each technology.

Implementability – Technically implementable process options are evaluated for technical and administrative feasibility to eliminate those that are clearly ineffective, unworkable or not applicable to Site-specific conditions.

Relative Cost – Relative costs based on engineering judgment are ranked (i.e., low, moderate, high) for both capital and O&M. Costs for each process option are evaluated relative to other process options in the same technology type.

A summary of the detailed technology screening performed for Site media of concern in the FS (solids and soils, groundwater and surface water) is provided in Table 5-1 through Table 5-3.

5.1 Solids and Soils

Retained technologies and process options for solids and soils were further screened against the effectiveness, implementability, and cost criteria. The rationale for retaining or eliminating each technology/process option is presented below and summarized in Table 5-1.

5.1.1 No Action

No Further Action – The No Further Action option would entail no additional work at the Site. NTCRAs that have already been implemented would continue to be operated and maintained per existing Agreements. Pilot treatability studies would be terminated. As discussed in the RI/FS

guidance (USEPA 1988), the No Action alternative is required by the NCP as a baseline for comparison with other remedial alternatives.

Effectiveness: Moderate. The 2013 NTCRA performed at the Pole Canyon ODA has covered 130 acres of overburden, preventing direct contact and erosion. This action has lowered the Site-wide average selenium concentration in surface soils. However, there would be no additional actions to limit exposures of human or ecological receptors to selenium or arsenic in overburden materials in ODAs.

Implementability: High. The No Further Action option is easily implementable because it requires no additional work at the Site. O&M activities for the Pole Canyon ODA NTCRAs would continue.

Cost: No additional capital costs. No O&M costs (the costs for the Pole Canyon NTCRAs are included in the baseline alternative, i.e., zero for the detailed analysis).

Site-Specific Considerations: No further actions would be taken.

Applicability Within the Site: The No Further Action alternative is required by the NCP.

Decision Rationale: The No Further Action alternative is required by the NCP as a baseline against which other options are compared and is retained for the development of remedial alternatives.

5.1.2 Institutional Controls/Access Controls

Options that are applicable to solids and soils are institutional controls (land-use controls/grazing controls, administrative orders/consent decrees, and information programs) and access controls (fences/gates). Evaluation of each of these process options for effectiveness, implementability, and cost is provided below.

Land-Use Controls/Grazing Controls – Land-use controls are legal and administrative actions to limit the potential exposure to selenium and other COCs under both current and future land-use scenarios. Because ODAs are located on public land managed by the Caribou-Targhee National Forest, land-use controls such as closure orders could be used by the Forest Service to prevent access to the Site or prevent activities that could compromise the integrity of remedial actions. Grazing controls could include guidelines for the duration of grazing, the type of livestock allowed to graze on the area, timing of grazing, or closure of grazing allotments to allow for covered areas to be revegetated.

Effectiveness: High. Land-use controls could be used to limit access and prevent direct human and/or wildlife exposure to elevated selenium and arsenic concentrations in soil, associated vegetation, and overburden material on the Site while the cover vegetation matures.

Implementability: High. These types of institutional controls are easy to implement because overburden areas at the Smoky Canyon Mine are on public lands that are managed by the Forest Service.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Land-use controls and grazing controls are effective in limiting access and preventing activities that could compromise the integrity of remedial actions.

Applicability Within the Site: Land-use controls and grazing controls are applicable for areas of the Site on public lands.

Decision Rationale: Land-use controls and grazing controls are effective in limiting access and preventing exposure to selenium and arsenic in overburden materials. Land-use controls and grazing controls are a typical component of an overall Site remedy and are retained for the development of alternatives.

Administrative Orders/Consent Decrees – Administrative orders and consent decrees could be implemented to limit certain activities or require the performance of specific activities such as monitoring or reporting on effectiveness of remedial actions.

Effectiveness: High. Administrative orders and consent decrees are legally binding and could be enforced at a relatively low cost. They are effective in requiring the performance of monitoring or reporting on the effectiveness of a remedy.

Implementability: High. Enforcement tools such as administrative orders and consent decrees could be issued unilaterally or negotiated by the Agencies participating in the RI/FS process at the mine and are easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Administrative orders and consent decrees are effective in requiring the performance of monitoring or reporting on the effectiveness of a remedy.

Applicability Within the Site: Administrative orders and consent decrees are applicable for evaluation of the effectiveness of a remedy such as a cover system.

Decision Rationale: Administrative orders and consent decrees are effective in requiring effectiveness monitoring and reporting and are retained for the development of remedial alternatives.

Information Programs – Information programs could be used to convey information on land use or land-use restrictions as a result of remedial actions and to notify the public that covered contamination remains at the Site. For example, during the period that cover systems vegetation is maturing, it would be appropriate to inform the public that access is restricted until certain components of the remedy are complete.

Effectiveness: High. Information programs are effective in reducing the likelihood of public exposure to selenium and arsenic in overburden solids and soils.

Implementability: High. Information programs are easy to develop and implement for public awareness.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Information programs are effective in restricting activities that could compromise remedial actions and in notifying the public that covered contamination remains at the Site.

Applicability Within the Site: Information programs are applicable for areas of the Site on public lands.

Decision Rationale: Institutional controls such as information programs are a typical component of an overall Site remedy. Information programs are effective and are retained for use with other remedial technologies.

Fences/Gates – Fences and gates are physical barriers that could be used to limit access and prevent direct exposure to contaminants in source areas on the Site.

Effectiveness: Moderate. Fencing is effective at limiting access to elevated concentrations of selenium and arsenic in soil and vegetation on ODAs at the Site.

Implementability: High. The materials and equipment are readily available and building a fence to restrict access to contaminated soils and vegetation would be easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Fencing is effective in preventing large animal exposure to selenium in soil and vegetation on ODAs but would not prevent access to smaller animals or birds.

Applicability Within the Site: Fencing is potentially applicable to relatively small areas that have unacceptable risks (for example soil at seeps or ponds).

Decision Rationale: Fencing is effective at limiting large animal access and preventing direct exposure to selenium and arsenic in soils and overburden material on the Site. Fencing is retained for use with other remedial technologies.

5.1.3 Containment/Engineered Covers

Containment options that are applicable to solids and soils include various types of engineered cover systems constructed to provide a stable, physical barrier to prevent direct contact with overburden. Evaluation of this type of cover system for effectiveness, implementability, and cost is provided below.

Chert/Limestone Cover – Chert/Limestone could be used as a physical barrier layer, a conveyance layer, or a capillary break layer of a multi-layer cover system to provide an additional thickness of non-seleniferous material overlying the overburden within the cover profile. Chert/Limestone is effective in preventing direct contact with overburden material and reducing levels of selenium in vegetation growing on the cover.

Effectiveness: High. Chert/Limestone is proven effective in preventing vegetation from rooting.

Implementability: High. Chert/Limestone covers are implementable and are composed of proven, effective materials that have already been used extensively at the Site for post-mining reclamation and in the 2013 Pole Canyon NTCRA.

Cost: Moderate capital costs. Low O&M costs.

Site-Specific Considerations: Chert/Limestone is readily available in the Rex Chert Member at the Site and is proven effective in preventing vegetation from rooting.

Applicability Within the Site: Chert/Limestone is applicable as a capillary break layer and/or a barrier layer for vegetation uptake of COCs in different cover types.

Decision Rationale: Chert/Limestone is effective as a barrier layer or a water conveyance layer and is typically combined with other materials for an effective system and is retained for the development of remedial alternatives.

Dinwoody Cover – Dinwoody material could be used as a single layer or as a component in combination with other materials in a multi-layer system (i.e., Enhanced Dinwoody Cover currently in use at Panel F) in a physical barrier cover system to prevent direct contact with overburden and provide a growth medium for vegetation.

Effectiveness: High. Dinwoody Formation material is proven effective in preventing direct contact with overburden material.

Implementability: High. The Dinwoody cover is implementable and is composed of proven, effective materials that have already been used extensively at the Site for post-mining reclamation and in the 2013 Pole Canyon NTCRA.

Cost: Moderate capital costs. Low O&M costs.

Site-Specific Considerations: Dinwoody Formation material is available at the Site and is proven effective in preventing contact with overburden material.

Applicability Within the Site: Dinwoody material is applicable as a soil layer with a low saturated hydraulic conductivity and a high moisture storage capacity that would support vegetation growth as part of a barrier cover system.

Decision Rationale: Dinwoody material is effective in preventing direct contact with overburden, is present at the Site, and can support vegetation growth. Dinwoody material could be combined with other cover layers and is retained for the development of remedial alternatives.

5.1.4 Source Control and Routing

Source control and routing process options are applicable for solids and soils but may also provide benefits for groundwater and surface water by reducing or eliminating releases of selenium from soils and overburden into groundwater or surface water. Source control and routing include surface controls (grading, erosion control, and vegetation) and slope stabilization (slope reduction and retaining walls). Evaluation of each of these options for effectiveness, implementability, and cost is provided below.

Surface Controls (Grading and Erosion Control) – Land surface alterations associated with surface controls are blended with surrounding undisturbed ground to provide a smooth transition

in topography. Soil grading could be used to manage surface water infiltration and runoff. Erosion protection consists of the use of erosion-resistant materials such as riprap, vegetation, and geosynthetic fabrics to reduce or eliminate erosion of solids and soils by storm water runoff. Erosion control fabric could also be used to protect seedlings during germination.

Effectiveness: Moderate. Grading and erosion control are not effective in preventing access to contaminated solids and soils associated with overburden materials, but they are effective in reducing releases of selenium and arsenic from overburden into groundwater and surface water.

Implementability: High. Grading and erosion control are implementable using conventional construction techniques and could be used during ODA cover construction.

Cost: Low to moderate capital costs (depends on scale of action). Low O&M costs.

Site-Specific Considerations: Grading could be implemented to increase or direct water runoff and as part of installation of a cover. Erosion control is effective in reducing the migration of solids from covered or uncovered areas.

Applicability Within the Site: Grading is applicable for eliminating areas where pooling of water occurs and to manage surface water infiltration. Erosion control is applicable for use during and after cover construction to reduce transport of solids by storm water runoff.

Decision Rationale: Grading and erosion controls are retained for use in cover construction due to their benefit during construction and on covered/uncovered areas in reducing transport of solids in storm water.

Surface Controls (Vegetation) – Establishing a vegetative cover is a standard surface reclamation technology that could be used for ODAs and is a component of an overall Site remedy.

Effectiveness: Moderate. In addition to stabilizing surface materials by reducing erosion potential, vegetation is effective in increasing evapotranspiration at the surface and reducing water infiltration into overburden and subsequent release of selenium and arsenic. Planting of native species that have low affinity for selenium uptake may be effective in reducing potential risks to ecological receptors. Vegetation also improves aesthetics. Previous response actions at the Pole Canyon ODA have demonstrated the effectiveness of revegetation measures in conjunction with containment/covers.

Implementability: High. Vegetation is implementable in conjunction with surface controls such as grading and erosion control and with containment options.

Cost: Moderate capital costs. Low O&M costs.

Site-Specific Considerations: Vegetation is effective in stabilizing surface materials, reducing erosion potential, and increasing evapotranspiration. Species management (i.e., planting native species and eliminating selenium-accumulating species) could also reduce selenium uptake.

Applicability Within the Site: Vegetation is applicable for use on covered and uncovered ODAs at the Site.

Decision Rationale: Vegetation is an effective element of cover systems and could be used to stabilize surfaces and reduce selenium uptake on covered and uncovered areas and is retained for use with other technologies.

Slope Stabilization (Slope Reduction and Retaining Walls) – Slope stabilization techniques such as slope reduction and retaining walls could be used to reduce erosion and sediment transport. Reducing the grade of slopes slows storm water runoff which limits erosion, promotes vegetation growth, and reduces the potential for slope failure. Retaining walls could be used to stabilize steep slopes by reducing the effective slope of an earthen surface such as an ODA.

Effectiveness: Moderate. Slope reduction and retaining walls are moderately effective in stabilizing slopes. Both process options were used as part of the 2013 NTCRA at the Pole Canyon ODA and could be used in cover installation at other ODAs (to be determined during remedial design).

Implementability: High. Slope stabilization is implementable using conventional construction techniques and could be used during ODA cover construction.

Cost: Low to moderate capital costs. Low O&M costs.

Site-Specific Considerations: Slope stabilization was used in the 2013 Pole Canyon NTCRA and is readily implementable using conventional construction techniques.

Applicability Within the Site: Slope reduction and retaining walls are applicable for stabilization of slopes during construction of cover systems on ODAs.

Decision Rationale: Slope stabilization is retained for use in conjunction with cover construction in the development of remedial alternatives for the Site.

5.1.5 Removal and Disposal

Removal and disposal technologies/process options applicable to solids and soils include excavation and disposal (onsite consolidation/disposal or offsite disposal). Evaluation of each of these options for effectiveness, implementability, and cost is provided below.

Excavation – Conventional excavation could be used for removal of overburden solids/waste rock materials and soils/sediments from ODAs or detention basins, or for contouring an area prior to construction of a cover system. The removed materials could be further treated, consolidated, placed under a cap, or used in the construction of a cover system.

Effectiveness: High. Excavation is effective for removing small volumes of materials such as sediment in seep areas or ponds and treatment residuals.

Implementability: High. Conventional excavation could be easily implemented for excavation and consolidation of solid materials or excavation and reuse of soils as part of the remedial action.

Cost: Low to high capital costs. Low to moderate O&M costs associated with re-establishment of vegetation and prevention of erosion.

Site-Specific Considerations: Conventional excavation of overburden solids/soils is not effective or implementable for pit backfill or overburden material in external ODAs. Excavation is effective and implementable for small volumes of materials such as sediment in seep areas or ponds and in-situ treatment residuals.

Applicability Within the Site: Excavation may be applicable for small volumes of materials.

Decision Rationale: Excavation is not applicable for overburden solids and soils and is not retained. Excavation is retained for small volumes of sediment and/or in-situ treatment residuals.

Onsite Consolidation/Disposal – Onsite consolidation of overburden material by backfilling pits and reclaiming slopes could be beneficial to reduce the overall footprint of waste materials. Onsite consolidation of small volumes of nonhazardous treatment residuals from the treatment systems (e.g., sludge from the fluidized bed bioreactor system or spent media from a passive treatment system) in backfilled pits could minimize leaching of selenium and arsenic from external ODAs.

Effectiveness: High. Complete source removal/disposal is not effective for pit backfill and external ODAs due to the large material volume (millions to tens of millions of cubic yards) and the fact that the resultant disposal area would have similar or worse environmental conditions as the current pit backfill and ODAs. Residual sediment remaining in seep

areas or in storm water/seep detention ponds could be removed and consolidated onsite. Similarly, residual solid materials generated by water treatment, could be consolidated onsite if their chemical properties are suitable. Disposal areas would likely be covered.

Implementability: High. Complete source removal/disposal is not implementable for pit backfill and external ODAs because of the large material volume and the lack of a suitable location for disposal. Onsite consolidation/disposal is implementable for small volumes of material such as seep or pond sediment and/or treatment residuals.

Cost: Low capital costs (small volumes of material). Low O&M costs.

Site-Specific Considerations: Onsite consolidation/disposal of overburden solids and soils is readily implementable and effective using conventional construction techniques. Onsite consolidation/disposal is effective for small volumes of materials such as sediment in seep areas or ponds and treatment residuals. Onsite consolidation/disposal is potentially implementable, as long as the disposal setting is suitable to prevent remobilization of selenium and arsenic into the environment.

Applicability Within the Site: Onsite consolidation/disposal is not applicable because existing mine pits have already been backfilled and overburden material has already been consolidated into ODAs. However, onsite consolidation/disposal may be applicable for small volumes of materials such as from sedimentation basins or seep areas.

Decision Rationale: Onsite consolidation/disposal is not applicable for the large material volumes of overburden solids and soils and is not retained. Onsite consolidation/disposal is retained for small volumes of material such as seep or pond sediment and/or treatment residuals.

Offsite Disposal – Excavated solid media could be disposed of offsite. Offsite disposal requires excavating the impacted solid media and transporting it to an appropriate disposal facility. Impacted materials (soils/solids or water treatment residuals that exceed RCRA toxicity criteria would require disposal in a hazardous waste landfill).

Effectiveness: High. Offsite disposal would reduce the volume of waste material and is considered to be a suitable process option for all solid media.

Implementability: Low to High. Offsite disposal is not implementable for large volumes of overburden solids/soils at the Site. However, offsite disposal is implementable for small volumes of materials (such as residuals from water treatment systems).

Cost: High capital costs. No O&M costs.

Site-Specific Considerations: Offsite disposal is not implementable for the large volumes of overburden solids/soils at the Site. However, offsite disposal is effective and implementable for small volumes of materials such as treatment residuals.

Applicability Within the Site: Offsite disposal is not applicable because the overburden at the Site has already been consolidated into ODAs onsite. However, offsite disposal may be applicable for small volumes of material.

Decision Rationale: Offsite disposal is not applicable for overburden solids/soils and is not retained. Offsite disposal is retained for small volumes of materials such as treatment residuals.

5.1.6 Ex-Situ Treatment

Ex-situ treatment options applicable to solids and soils are limited to stabilization/fixation. Evaluation for effectiveness, implementability, and cost is provided below.

Stabilization/Fixation – Ex-situ stabilization generally involves excavation of the solids, mechanical mixing of the solids with stabilizing agents, curing of the mass for optimal reduction in leachability, followed by onsite or offsite disposal. A variety of stabilization agents are available and could be used, including cement, fly ash, silica, bentonite, and various polymers.

Effectiveness: Low. Although stabilization/fixation has been shown to be effective for reducing the leachability of heavy metals, the process is not effective for immobilizing the relatively low concentrations of selenium and arsenic in overburden solids and soils.

Implementability: Low. The implementability of stabilization/fixation is low due to the large volume of overburden solids and soils at the Site. The process is better suited to coarse sands and gravels than to the fine silts and clays that characterize waste shales in the overburden material.

Cost: Very high capital costs. Low O&M costs.

Site-Specific Considerations: Ex-situ stabilization/fixation is not effective or implementable for immobilizing contaminants in overburden solids and soils.

Applicability Within the Site: Ex-situ stabilization/fixation is not applicable for treatment of the large volumes of overburden solids and soils at the Site.

Decision Rationale: Ex-situ stabilization/fixation is not retained because it is not effective or implementable for conditions found at the Site.

5.1.7 In-Situ Treatment

In-situ treatment technologies/process options applicable to solids and soils is limited to stabilization/fixation. Evaluation for effectiveness, implementability, and cost is provided below.

Stabilization/Fixation – In-situ stabilization/fixation is performed by directly injecting stabilizing agents such as cement, fly ash, silica, bentonite, or various polymers into the soil using rotary injection augers, jet grouting, and/or pressure grouting techniques.

Effectiveness: Low. Although stabilization/fixation has been shown to be effective for reducing the leachability of heavy metals, the process is not effective for immobilizing the relatively low concentrations of selenium and arsenic in overburden.

Implementability: Low. As with ex-situ treatment, the implementability of in-situ stabilization/fixation is low due to the large volume and fine grain size of the overburden solids at the Site.

Cost: High capital costs. Low O&M costs.

Site-Specific Considerations: In-situ stabilization/fixation is not effective or implementable for immobilizing contaminants in overburden solids.

Applicability Within the Site: In-situ stabilization/fixation is not applicable for treatment of the large volumes of overburden solids at the Site.

Decision Rationale: In-situ stabilization/fixation is not retained because it is not effective or implementable for conditions found at the Site.

5.2 Groundwater

Retained technologies and process options for groundwater are further screened against the effectiveness, implementability, and cost criteria (Table 5-2).

5.2.1 No Action

No Further Action – The No Further Action alternative would entail no additional work at the Site. NTCRAs that have already been implemented would continue. Pilot treatability studies would be terminated. As discussed in the RI/FS guidance (USEPA 1988), the No Action alternative is required by the NCP as a baseline for comparison with other remedial technologies.

Effectiveness: Moderate. The 2006 and 2013 NTCRAs have resulted in a significant reduction in releases of selenium to groundwater from the Pole Canyon ODA. This is expected to improve groundwater quality over time. However, there would be no additional actions to reduce infiltration into overburden in ODAs at the Site.

Implementability: High. The No Further Action alternative is easily implementable because it requires no additional work at the Site. O&M activities for the Pole Canyon ODA NTCRAs would continue.

Cost: No additional capital costs. No O&M costs (the costs for the Pole Canyon NTCRAs are included in the baseline alternative, i.e., zero for the detailed analysis).

Site-Specific Considerations: No further actions would be taken.

Applicability Within the Site: The No Further Action alternative is required by the NCP.

Decision Rationale: The No Further Action alternative is required by the NCP as a baseline against which other options are compared and is retained for the development of remedial alternatives.

5.2.2 Institutional Controls

Several institutional controls (administrative orders/consent decrees and deed restrictions) are applicable for groundwater. Evaluation of each of these process options for effectiveness, implementability, and cost is provided below.

Administrative Orders/Consent Decrees – Administrative orders/consent decrees are enforcement tools that could require monitoring and reporting of the performance and effectiveness of a remedy. Institutional controls are typically a component of an overall Site remedy.

Effectiveness: High. Administrative orders and consent decrees are legally binding. Enforcement tools could be effective in requiring groundwater monitoring to evaluate the effectiveness of containment/source control remedies at the Site.

Implementability: High. Enforcement tools such as administrative orders and consent decrees could be issued unilaterally or negotiated by the Agencies participating in the RI/FS process at the mine and are easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Enforcement tools could be effective in requiring groundwater monitoring to evaluate the effectiveness of containment/source control remedies at the Site.

Applicability Within the Site: Administrative orders and consent decrees are applicable for compliance monitoring at the Site.

Decision Rationale: Administrative orders/consent decrees are effective in requiring effectiveness monitoring and reporting and are retained for the development of remedial alternatives.

Deed Restrictions – Deed restrictions could be used to prevent the use of groundwater with arsenic or selenium concentrations above their respective MCLs as a domestic water supply. Proprietary controls such as deed restrictions are typically a component of an overall Site remedy.

Effectiveness: Moderate. Deed restrictions are effective in preventing groundwater extraction and use as a drinking source on private land. They do not address the sources of selenium to groundwater but would be effective as part of an overall remedy while remedial components are taking effect and arsenic and selenium concentrations remain above MCLs in groundwater.

Implementability: High. Because Simplot owns the land in Sage Valley, implementation of deed restrictions to prevent the use of groundwater as domestic water supply would be straight forward.

Cost: Low capital costs. Low O&M costs. Deed restrictions could be implementable for a relatively low cost.

Site-Specific Considerations: Deed restrictions could be implemented to prevent the use of groundwater with arsenic or selenium concentrations above MCLs as a domestic water supply.

Applicability Within the Site: Deed restrictions are applicable on Simplot-owned land in Sage Valley.

Decision Rationale: Deed restrictions could be effective in protecting people until the remedy becomes effective and are retained for the development of remedial alternatives.

5.2.3 Containment/Engineered Covers

Containment options that are applicable to groundwater include various types of engineered cover systems (tailings cover, chert/limestone cover, Dinwoody cover, and geosynthetic cover) to reduce infiltration into overburden and subsequent release and transport of selenium to groundwater. Evaluation of each of the material options for cover systems for effectiveness, implementability, and cost is provided below. Ultimately the retained materials will be assembled into appropriate combinations to provide distinct cover types for remedial alternatives in the detailed analysis.

Tailings Cover – Tailings material, which is readily available at the Site, has relatively low hydraulic conductivity and could be used in a cover to reduce infiltration into ODAs.

Effectiveness: Moderate. Tailings material has the potential to be effective for use in cover systems due to its low hydraulic conductivity which could reduce infiltration into underlying overburden materials. As shown in the Tailings Revegetation Field-Scale Pilot Study (Formation 2013c), vegetation can establish and grow on tailings material, with or without amendments, and selenium uptake into plants is relatively low.

Implementability: Low. Tailings material is potentially implementable for use in ODA cover systems. Because the material could be highly erodible on an ODA slope, tailings would not be suitable as a surface material. Potential difficulties in placing the material on ODA slopes would also make use of tailings as a subsurface layer in a cover system problematic.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Tailings material is readily available at the Area B tailings impoundments.

Applicability Within the Site: Tailings material is potentially applicable for use as a layer in multi-layer cover systems to reduce infiltration into ODAs.

Decision Rationale: Because tailings material could be highly erodible on an ODA slope, it is not suitable as a surface material but could be used as a subsurface layer (though it would be difficult to place on a slope during cover construction). It could also be difficult to construct as a subsurface layer in a cover system. Erodibility on slopes and performance make tailings less desirable than other materials that are available at the Site. Therefore, a tailings cover is eliminated from further consideration in the development of remedial alternatives.

Chert/Limestone Cover – Chert/Limestone could be used as a physical barrier layer, a water conveyance layer, or a capillary break layer of a multi-layer cover system to provide an additional thickness of non-seleniferous material above the overburden within the cover profile.

Effectiveness: High. Chert/Limestone is proven effective in multi-layer cover systems. It does little to reduce infiltration but can provide an important function, such as protecting other layers or conveying water within the cover.

Implementability: High. Chert/Limestone covers are implementable and are composed of proven, effective materials that have already been used extensively at the Site for post-mining reclamation and in the 2013 Pole Canyon NTCRA.

Cost: Moderate capital costs. Low O&M costs.

Site-Specific Considerations: Chert/Limestone is readily available in the Rex Chert Member at the Site and is proven effective in preventing vegetation from rooting.

Applicability Within the Site: Chert/Limestone is applicable for use in cover systems as a capillary break layer and/or a barrier layer in different cover types.

Decision Rationale: Chert/Limestone is effective as a barrier layer or a water conveyance layer and is typically combined with other materials for an effective system and is retained for the development of remedial alternatives.

Dinwoody Cover – Dinwoody material could be used in an ODA cover system and is effective in reducing infiltration. One option is a water balance cover that relies on temporary storage of snowmelt and rainwater in soil near the surface coupled with removal of stored water by evaporation and transpiration. Water balance (or “ET covers”) consist of a monolithic layer of Dinwoody material or other soil. Other configurations may be more effective.

Effectiveness: High. Dinwoody Formation material is proven effective in reducing infiltration of water (and thereby reducing the subsequent release of selenium to groundwater). Cover configurations (i.e., thickness and combination with Chert/Limestone or other constituents) will be evaluated in the initial FSTM#2 screening step to identify cover systems to be evaluated in the detailed analysis.

Implementability: High. The Dinwoody cover is implementable and is composed of proven, effective materials that have already been used extensively at the Site for post-mining reclamation and in the 2013 Pole Canyon NTCRA.

Cost: Moderate capital costs. Low O&M costs.

Site-Specific Considerations: Dinwoody Formation material is available at the Site and is proven effective in reducing infiltration and the mobility of selenium. The volume and suitability of the Dinwoody on Site still needs to be evaluated.

Applicability Within the Site: Dinwoody material is applicable as a soil layer with a low saturated hydraulic conductivity to reduce infiltration and a high moisture storage capacity that would support vegetation growth as part of a multi-layer cover system.

Decision Rationale: Dinwoody material is effective in reducing infiltration to overburden and is present at the Site. Dinwoody material could be combined with other cover layers and is retained for the development of remedial alternatives.

Geosynthetic Cover – Geosynthetic covers (i.e., with a GM liner, a GCL, or equivalent) consist of multiple layers that could be used to reduce infiltration into the overburden material. A low permeability geosynthetic cover would require an overlying natural or geosynthetic drainage layer and a relatively flat closure slope for stability.

Effectiveness: High. Geosynthetic covers are effective in reducing infiltration into the overburden material and could be part of an overall Site remedy. The GCL technology has been implemented in southeast Idaho, notably at South Maybe Canyon Mine (a CERCLA action on a cross-valley fill ODA) (USFS 2012) and at the Blackfoot Bridge Mine (as part of active mining) (BLM 2011).

Implementability: Moderate. Geosynthetic covers are implementable using conventional construction techniques. The closure slope generally needs to be flatter than 3:1 to achieve stability of the cover over the geosynthetic materials. For side slopes of 3:1, additional anchoring of the geosynthetic is required and angular gravel or rock is required above a geotextile for stability of this layer.

Cost: High capital costs. High O&M costs.

Site-Specific Considerations: Geosynthetic covers are effective in limiting infiltration and reducing the mobility of selenium but are more difficult to implement than other types of covers because of problems related to tearing the membrane.

Applicability Within the Site: Geosynthetic covers are applicable as a low permeability layer of a multi-layer cover system.

Decision Rationale: Geosynthetic cover layers are effective in reducing infiltration into the ODAs but have lower implementability and higher capital and O&M costs relative to other

types of cover layers. Geosynthetic covers are retained for the development of alternatives.

5.2.4 Source Control and Routing

Source control and routing process options for groundwater are limited to diversion (open/closed channels). This option is evaluated for effectiveness, implementability, and cost.

Diversion (Open/Closed Channels) – Diversion channels could be used to route groundwater that discharges at the springs complex to a treatment facility and are likely to be a critical component of an overall Site remedy.

Effectiveness: High. Diversion channels are effective in routing groundwater to a treatment facility at the Site.

Implementability: High. This process is being implemented in the Hoopes Water Treatment Plant (WTP) Pilot Study and additional conveyance systems may be installed to maintain the required influent flow and quality to any treatment system that is part of the final remedy.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Open or closed channels are effective means of conveying groundwater that discharges to the surface at springs to a treatment facility at the Site.

Applicability Within the Site: Diversion channels are applicable for conveying groundwater to a treatment facility.

Decision Rationale: Diversion channels are effective in conveying groundwater and may be used as part of an overall Site remedy and are retained.

5.2.5 Removal and Disposal

Removal and disposal process options applicable to groundwater are limited to extraction wells for removal and groundwater disposal to a treatment system. Evaluation of these options for effectiveness, implementability, and cost is provided below.

Groundwater Removal (Extraction Wells) – Extraction wells could be used to capture groundwater and control gradients and flow direction. Multiple extraction wells could be installed along preferential pathways and along the West Sage Valley Branch Fault. Extracted groundwater could be routed to an onsite treatment facility.

Effectiveness: Low. The effectiveness of groundwater extraction wells is low because groundwater flow within the Wells Formation is influenced by preferential flow paths and placement of a Wells Formation well within zones of high transmissivity and high concentrations of COCs would be difficult, as demonstrated during well installation for the RI (Formation 2014c).

Implementability: High. Drilling and installation of groundwater extraction wells is easy to implement.

Cost: High capital costs. Low O&M costs.

Site-Specific Considerations: Use of extraction wells upgradient of Hoopes Springs is unlikely to be effective due to known hydrogeologic complexities. Groundwater reports to the surface at Hoopes Spring and South Fork Sage Creek springs and could be collected for treatment there if necessary.

Applicability Within the Site: Extraction wells are not applicable for groundwater at the Site.

Decision Rationale: Hoopes Spring acts as a regional groundwater discharge feature and effectively captures the migration of COCs within Wells Formation groundwater. Groundwater reports to the surface without the need for extraction wells. Removal via extraction wells is not retained for the development of remedial alternatives.

Groundwater Disposal (Discharge to Onsite or Other Storage/Disposal Treatment Facility) – Groundwater collected at the springs complex could be routed to an onsite treatment or other storage/disposal facility using piping and pumps. Groundwater disposal could be applied with ex-situ treatment as part of an overall Site remedy.

Effectiveness: High. Conveyance of impacted groundwater discharged at the springs complex to the Hoopes WTP Pilot Study is proven effective in reducing the concentrations of selenium and arsenic in groundwater and in reducing the selenium mass load discharged to surface water downstream in Sage Creek.

Implementability: High. Piping and pumps from the pilot study are currently in place and would be easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Discharge of groundwater from Hoopes Spring and South Fork Sage Creek springs to an onsite treatment or other storage/disposal facility would

require a conveyance system. Piping and pumps are currently in place and effectively convey groundwater to the Hoopes WTP Pilot Study.

Applicability Within the Site: Groundwater conveyance/discharge to an onsite or other storage/disposal treatment facility is applicable in areas where MCLs are exceeded in alluvial or Wells Formation groundwater.

Decision Rationale: Discharge of extracted groundwater to an onsite treatment or other storage/disposal facility is effective and is retained for the development of remedial alternatives.

5.2.6 Ex-Situ Treatment

Ex-situ treatment technologies/process options applicable to groundwater include a variety of physical (gravity/mechanical separation, media filtration, and ultrafiltration/reverse osmosis), chemical (chemical precipitation and oxidation/reduction), and biological (biodegradation) technologies. Evaluation of each of these process options for effectiveness, implementability, and cost is provided below.

Gravity/Mechanical Separation – Gravity or mechanical methods could be used to separate suspended solids from groundwater. Gravity separation involves settling of suspended solids in ponds, basins, or tanks, using baffles or other devices and typically results in sludge with a solids content of 30% to 40% by weight. Mechanical separation involves using devices such as belt presses, filter presses, or vacuum filtration units to remove suspended solids and typically results in a sludge with up to 70% solids.

Effectiveness: Low by itself, High in combination with other technologies. Selenium is in the dissolved form in groundwater and therefore gravity/mechanical separation would not be effective as a stand-alone technology. However, it could be used as part of a treatment system that converts selenium to the solid phase.

Implementability: High. The implementability of gravity/mechanical separation as part of an overall treatment system is high.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Gravity/mechanical separation is used to settle waste streams in the Hoopes WTP Pilot Study and effectively removes reduced, elemental selenium from groundwater at the Site.

Applicability Within the Site: Gravity/mechanical separation is applicable for dewatering waste streams from other treatment technologies.

Decision Rationale: Gravity/mechanical separation is retained for use with other treatment technologies and is effective in removing reduced, elemental selenium from groundwater.

Media Filtration – Media filtration is a separation process that uses granular material through which influent water flows to filter suspended solids. Media filtration (i.e., sand filtration) is not a stand-alone treatment for groundwater but could be used to trap suspended solids on top of and within the sand filter bed while allowing effluent to flow through it.

Effectiveness: High. Media filtration is effective when used in conjunction with other treatment technologies.

Implementability: High. The implementability of media filtration as part of an overall treatment system is high.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Media filtration (typically using sand) is proven effective for removing suspended solids and trapping the particles on/in a filter bed at the Hoopes WTP Pilot Study.

Applicability Within the Site: Media filtration is applicable as a component of an overall treatment system for groundwater at the Site.

Decision Rationale: Media filtration is retained for use with other treatment technologies and is proven effective for removing suspended solids in groundwater.

Ultrafiltration/Reverse Osmosis – Ultrafiltration/reverse osmosis is a membrane-filtration technology that could be used to separate and concentrate selenium in groundwater. The pore size of the ultrafiltration membrane is slightly larger than the pore size of the reverse osmosis membrane. This technology would require further treatment to remove selenium and arsenic from the concentrate stream prior to discharge.

Effectiveness: High. Ultrafiltration/reverse osmosis is effective for separating dissolved selenium in groundwater load using a semipermeable membrane and has been tested at the Site for the Hoopes WTP Pilot Study.

Implementability: High. The implementability of ultrafiltration/reverse osmosis, as part of an overall treatment system, is high.

Cost: High capital costs. High O&M costs. Capital costs are high for construction of the treatment system. O&M costs are high due to the high electrical power requirements.

Site-Specific Considerations: Ultrafiltration/reverse osmosis (UF/RO) technologies are proven effective for producing concentrated selenium water for additional treatment and have been tested at the Hoopes WTP Pilot Study.

Applicability Within the Site: Ultrafiltration/reverse osmosis is applicable as a component of an overall treatment system for groundwater that discharges at Hoopes Spring.

Decision Rationale: Ultrafiltration/reverse osmosis technologies are proven effective for producing concentrated selenium water for additional treatment and have been tested at the Hoopes WTP Pilot Study at the Site. This technology could be combined with other technologies for improved selenium removal efficiency and is retained for development of alternatives for groundwater.

Chemical Precipitation – Chemical precipitation could be used to precipitate dissolved ions/salts in the form of insoluble salts by adding chemicals to reach chemical saturation and/or varying the pH. The insoluble salts may be removed from the groundwater by sedimentation, coagulation, and/or flocculation.

Effectiveness: Low. Chemical precipitation is not effective for oxidized forms of selenium (selenite) and would require a separate process to electrochemically reduce oxidized forms of selenium to reduced forms (selenite).

Implementability: High. The implementability of chemical precipitation is high because it is a common treatment process that is straightforward to implement for groundwater.

Cost: Moderate capital costs. High O&M costs.

Site-Specific Considerations: Chemical precipitation is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.

Applicability Within the Site: Chemical precipitation could be applicable for groundwater treatment but would require additional treatment trains.

Decision Rationale: Chemical precipitation is not retained due to low effectiveness for oxidized selenium.

Oxidation/Reduction – The chemical oxidation/reduction process uses agents such as oxidation, chlorination, hydrogen peroxide, and ultraviolet light to react with and oxidize contaminants in groundwater. Oxidation/reduction reactions may improve the separation characteristics for removal of selenium in groundwater if used in conjunction with other treatment technologies.

Effectiveness: Low. Oxidation/reduction is not effective for removal of oxidized selenium.

Implementability: High. Oxidation/reduction is implementable for groundwater treatment.

Cost: Moderate capital costs. High O&M costs.

Site-Specific Considerations: Oxidation/reduction is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.

Applicability Within the Site: Oxidation/reduction could be applicable for groundwater treatment but would require additional treatment trains.

Decision Rationale: Oxidation/reduction is not retained due to low effectiveness for oxidized selenium.

Ex-Situ Biological Treatment (Biodegradation) – Biological treatment could be used to degrade or reduce contaminants with microorganisms. Groundwater could be extracted and pumped to a process location (e.g., wetlands, anaerobic bioreactor, or fluidized bed bioreactor) for treatment. Metals and other inorganic contaminants could be removed from the water using anaerobic bacteria that decrease the solubility via biological processes and then precipitated or absorbed by the media in the wetlands or bioreactor.

Effectiveness: High. Biodegradation is effective as part of an active water treatment plant such as an anaerobic fluidized bed bioreactor.

Implementability: High. Ex-situ biodegradation is implementable. The Hoopes WTP Pilot Study started with one skid and has been sized up to a full-scale system.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Ex-situ biological treatment is proven effective for removing selenium at the Hoopes WTP Pilot Study fluidized bed bioreactor (FBR). Microbial reduction of selenate and selenite to elemental selenium allows for easier removal of selenium by other technologies in the treatment train.

Applicability Within the Site: Ex-situ biological treatment is applicable for groundwater that discharges at Hoopes Spring and South Fork Sage Creek springs.

Decision Rationale: Ex-situ biological treatment is retained because the process is effective for reducing selenium concentrations in groundwater and has been tested at the Site. As determined by design and operations testing, other process options (listed above) may be required to support an ex-situ biological treatment system.

5.2.7 In-Situ Treatment

In-situ treatment process options applicable to groundwater are limited to in-situ biological treatment/biodegradation. This option is evaluated for effectiveness, implementability, and cost.

In-Situ Biological Treatment (Biodegradation) – In-situ biological treatment of groundwater uses similar scientific principles as ex-situ biological treatment and is achieved by injecting carbon, nutrients, and bacteria into the aquifer to enable native microorganisms to metabolize the target contaminants. Treatment could require a large number of deep borings/wells for introduction of the nutrients and microorganisms to the groundwater system.

Effectiveness: Low. In-situ biological treatment is not effective for groundwater in the Wells Formation aquifer because of the large flow and depth to groundwater.

Implementability: Low. In-situ biological treatment could be difficult to implement for groundwater in the Wells Formation aquifer due to the number of deep wells required and the difficulty dispersing the carbon and nutrients throughout the aquifer.

Cost: High capital costs. Moderate O&M costs.

Site-Specific Considerations: In-situ biological treatment could be effective for removing selenium in groundwater; however, treatment would require a large number of borings/wells and removal effectiveness would be contingent on the selenium species present.

Applicability Within the Site: In-situ biodegradation could be applicable for treatment of alluvial or Wells Formation groundwater.

Decision Rationale: In-situ biological treatment is not retained due to low effectiveness and implementability for groundwater in the Wells Formation aquifer.

5.2.8 Monitored Natural Attenuation

MNA may be used in conjunction with the above-mentioned technologies and process options to achieve remedial objectives for groundwater. Natural processes can contribute to the reduction of COC concentrations in areas where releases and transport have already occurred. In groundwater, MNA can occur through physical (e.g., dilution, dispersion, sorption), geochemical (e.g., sorption, precipitation), and biochemical (biologically mediated reduction) processes. MNA would be applicable to alluvial and Wells Formation groundwater at the Smoky Canyon Mine Site. This technology is evaluated for effectiveness, implementability, and cost.

Effectiveness: Low. MNA could be effective for removing selenium in groundwater.

Implementability: High. MNA is a natural physical, chemical, and/or biological process that is readily implementable and could be most successful where the geochemical environment and hydraulic conditions are favorable for attenuation to occur.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Sorption and biologically mediated MNA processes are dependent on geochemical conditions in the alluvial and Wells Formation aquifers at the Site.

Applicability Within the Site: MNA could be applicable for alluvial and Wells Formation groundwater.

Decision Rationale: MNA is retained for alluvial and Wells Formation groundwater as a complimentary remedy component.

5.3 Surface Water

Retained technologies and process options for surface water are further screened against the effectiveness, implementability, and cost criteria (Table 5-3).

5.3.1 No Action

No Further Action – The No Further Action alternative would entail no additional work at the Site. NTCRAs that have already been implemented would continue. Pilot treatability studies would be terminated. As discussed in the RI/FS guidance (USEPA 1988), the No Action alternative is required by the NCP as a baseline for comparison with other remedial technologies.

Effectiveness: Moderate. The 2006 and 2013 NTCRAs have significantly reduced the loading of selenium to the environment from the Pole Canyon ODA. Selenium concentrations have been reduced to below water quality standards in Pole Canyon Creek as a result of these actions. However, there would be no additional actions to reduce infiltration into overburden materials in ODAs at the Site.

Implementability: High. The No Further Action alternative is easily implementable because it requires no additional work at the Site. O&M activities for the Pole Canyon ODA NTCRAs would continue.

Cost: No additional capital costs. No O&M costs (the costs for the Pole Canyon NTCRAs are included in the baseline alternative, i.e., zero for the detailed analysis).

Site-Specific Considerations: No further actions would be taken.

Applicability Within the Site: The No Further Action alternative is required by the NCP.

Decision Rationale: The No Further Action alternative is required by the NCP as a baseline against which other alternatives are compared and is retained for the development of remedial alternatives.

5.3.2 Institutional Controls/Access Controls

Options that are applicable to surface water are institutional controls (administrative orders/consent decrees and information programs) and access controls (fences/gates). Evaluation of each of these process options for effectiveness, implementability, and cost is provided below.

Administrative Orders/Consent Decrees – Administrative orders/consent decrees could be used to require monitoring and reporting of the performance and effectiveness of a remedy.

Effectiveness: High. Administrative orders and consent decrees are legally binding and may be enforced at a relatively low cost. They are effective in requiring monitoring or reporting of the performance and effectiveness of a remedy.

Implementability: High. Enforcement tools such as administrative orders and consent decrees may be issued unilaterally or negotiated by the Agencies participating in the RI/FS process at the mine and are easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Administrative orders and consent decrees are effective in requiring monitoring or reporting on the performance and effectiveness of a remedy.

Applicability Within the Site: Administrative orders and consent decrees are applicable for evaluation of the effectiveness of remedies implemented throughout the Site.

Decision Rationale: Administrative orders and consent decrees are effective in requiring monitoring for performance and effectiveness and are retained for the development of remedial alternatives.

Signs – Signs convey information on land use or land-use restrictions; materials used to produce the sign must last for the length of time that the warning will be posted. Signs posted at seep areas could be used to notify people that drinking the water is potentially unsafe.

Effectiveness: Moderate. Signage is moderately effective in notifying people that drinking the water in certain creeks/springs at the Site is potentially unsafe.

Implementability: High. Posting signs is easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Signage is moderately effective in notifying people that drinking the water in certain creeks/springs at the Site is potentially unsafe.

Applicability Within the Site: Posting signs would be applicable at Hoopes Spring and at South Fork Sage Creek springs.

Decision Rationale: Institutional controls such as signs are retained for use as part of an overall Site remedy.

Fences/Gates – Fencing could be used to restrict access and prevent direct exposure to surface water in seeps and detention basins (i.e., restrict large animal access). Fencing is typically part of an overall Site remedy.

Effectiveness: Moderate. Fencing is effective for restricting access and preventing exposure to selenium and arsenic in surface water in seeps and detention basins at the Site.

Implementability: High. The materials and equipment are readily available and building a fence to restrict access to seeps and detention basins would be easy to implement.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Fencing is effective in preventing large animal exposure to selenium and arsenic in surface water but would not prevent access to smaller animals or birds.

Applicability Within the Site: Fencing is potentially applicable to areas that have unacceptable risks.

Decision Rationale: Fencing is effective at limiting large animal access and preventing direct exposure to selenium and arsenic on the Site. Fencing is typically part of an overall Site remedy and is retained for use with other remedial technologies.

5.3.3 Containment

Containment options that are applicable to surface water include engineered cover systems (for example multi-layer covers using Dinwoody, Chert/Limestone, and/or Geosynthetic layers) which could be used to cover overburden areas, rock covers (Chert/Limestone cover) which could be used to cover seeps and/or detention basins, and sediment control features (dikes and berms, detention basins). Evaluation of these containment options for effectiveness, implementability, and cost is provided below. Note that the components of these types of covers were evaluated in detail in Section 5.2.3 for groundwater (because selenium migrates through groundwater to surface water).

Chert/Limestone Cover – Chert/Limestone or other constituents could be used as a physical barrier layer on seeps and/or detention basins to prevent direct contact with surface water containing selenium and/or arsenic. This was pilot tested at the ES-5 seep (NewFields 2004a) and at the D-P10 catch basin (NewFields 2004b).

Effectiveness: High. A Chert/Limestone rock cover is proven effective in preventing direct contact with surface water in seeps and/or detention basins.

Implementability: High. Chert/Limestone rock covers are implementable and are composed of proven, effective materials that have been used at the Site.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Chert/Limestone is readily available in the Rex Chert Member at the Site and could be effective in preventing direct contact with surface water in seeps and/or detention basins.

Applicability Within the Site: Chert/Limestone or other constituents are applicable for use as a rock cover on seeps and/or detention basins.

Decision Rationale: Chert/Limestone or other constituents could be effective as a barrier layer on seeps and/or detention basins and is retained for the development of remedial alternatives.

Dinwoody Cover – Containment of overburden sources using Dinwoody covers or other multi-layer cover systems are likely to be critical component of an overall surface water remedy.

Effectiveness: Moderate to High. Dinwoody covers could be moderately to highly effective in reducing infiltration to overburden and subsequent leaching and transport of selenium and arsenic to surface water. Containing the overburden source would be expected to reduce selenium concentrations in downstream surface water.

Implementability: High. Dinwoody covers are implementable because they are constructed using conventional techniques and the cover materials are available at the Site.

Cost: Moderate capital costs. Low to moderate O&M costs.

Site-Specific Considerations: Dinwoody covers are effective in containing overburden material and in controlling the source of selenium to surface water.

Applicability Within the Site: Dinwoody covers are applicable to ODAs that are sources of selenium to seeps and detention basins at the Site.

Decision Rationale: Containment of overburden using a Dinwoody cover is a potential component of an overall surface water remedy. This option is retained.

Geosynthetic Cover – Containment of overburden sources using a Geosynthetic cover (GM/GCL) is likely to be a critical component of an overall surface water remedy.

Effectiveness: Moderate to High. An engineered Geosynthetic cover could be effective in reducing infiltration to overburden and subsequent leaching and transport of selenium and arsenic to surface water.

Implementability: Moderate. Engineered multi-layer covers that include a GM or GCL are implementable because they are constructed using conventional techniques.

Cost: High capital costs. High O&M costs.

Site-Specific Considerations: Geosynthetic covers are effective in containing overburden material and in controlling the source of selenium and arsenic to surface water.

Applicability Within the Site: Geosynthetic covers are applicable to ODA that are sources of selenium to surface water at the Site.

Decision Rationale: Containment of overburden using a multi-layer Geosynthetic cover is a potential component of an overall surface water remedy. This option is retained.

Sediment Control Features (Dikes and Berms) – Dikes and berms reduce or eliminate loading of sediment in streams. Grading and shaping of the land during remedial actions allows for management of storm water infiltration and runoff. Control of storm water, surface runoff, and sediment are likely to be key components of an overall surface water remedy.

Effectiveness: Moderate. Dikes and berms are moderately effective in managing surface water infiltration and storm water runoff while controlling erosion.

Implementability: High. Dikes and berms are readily implementable using conventional construction techniques.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Dikes and berms are effective in managing surface water infiltration and runoff while controlling erosion.

Applicability Within the Site: Dikes and berms are applicable for controlling storm water runoff and sediment mobilization around ODAs and other mine features.

Decision Rationale: Dikes and berms are effective in managing storm water runoff and controlling erosion and can reduce sediment migration and are retained for development of alternatives.

Sediment Control Features (Detention Basins) – Detention basins, or sedimentation basins or ponds, detain storm water runoff allowing sediments to settle out of the water. A portion or all of the surface water is retained in the pond and may either evaporate or infiltrate into the ground below. Control of storm water, surface runoff, and sediment are likely to be critical components of an overall surface water remedy.

Effectiveness: Moderate. Detention basins are moderately to highly effective in settling and removing sediment from storm water and moderately effective at minimizing contaminant volume. Detention basins are also moderately effective in reducing the transport of selenium and arsenic off Site.

Implementability: High. Detention basins are readily implementable using conventional construction techniques.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Retaining contaminated surface water in detention basins is used at the Site and is effective in preventing surface migration to local creeks.

Applicability Within the Site: Detention basins are applicable in remedial construction areas and areas where contaminated surface water could flow off Site.

Decision Rationale: Detention basins are effective in reducing the transport of selenium to local creeks and are retained for development of alternatives.

5.3.4 Source Control and Routing

Source control and routing technologies and process options for surface water are limited to diversion (open/closed channels). Evaluation of this option for effectiveness, implementability, and cost is provided below.

Diversion (Open/Closed Channels) – Diversion channels could be used to divert surface water around an ODA or convey water to a treatment facility and are likely to be a critical component of an overall Site surface water remedy.

Effectiveness: High. Diversion channels are effectively used in the 2006 NTCRA at the Pole Canyon ODA to convey the flow in Pole Canyon Creek around the ODA (bypass pipeline) and to direct run-on from the slopes adjacent to the Pole Canyon ODA into the creek downstream (run-on control channel). They could be applicable to other areas of the Site to reduce contact between surface flow and overburden.

Implementability: High. Diversion channels are easy to implement using conventional construction equipment.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Open/closed channels are an effective means of diverting surface water around ODAs or conveying water to a treatment facility at the Site.

Applicability Within the Site: Diversion channels are applicable for preventing run-on to and diverting surface water around ODAs. Channels are also applicable for conveying surface water to a treatment facility.

Decision Rationale: Open/closed diversion channels are effective in conveying surface water and are typically part of an overall Site remedy and are retained for development of alternatives.

5.3.5 Removal and Disposal

Removal and disposal technologies and process options applicable to surface water are limited to surface water disposal. This option is evaluated for effectiveness, implementability, and cost.

Surface Water Disposal (Discharge to Onsite Treatment or Other Storage/Disposal Facility) – Surface water discharged at seeps could be routed to an onsite treatment or other storage/disposal facility. Surface water disposal would be applied with ex-situ treatment as part of an overall Site remedy. Collection of surface water in creeks is not feasible and is not discussed further.

Effectiveness: High. Surface water at seeps could be collected and conveyed to treatment systems at the Site. Considerations would need to be made for winter conditions. For example, seep flow at the toe of the Pole Canyon ODA could be collected and routed to a nearby treatment system or other storage/disposal facility.

Implementability: High. Routing surface water discharge from seeps to a nearby treatment or other storage/disposal facility is implementable.

Cost: Low capital costs. Low O&M costs.

Site-Specific Considerations: Collection of seep water is feasible.

Applicability Within the Site: Discharge of surface water to an onsite treatment facility is applicable for the Pole Canyon ODA seep. Seep flows and selenium concentrations are shown in Table 4-2. As shown, the Pole Canyon ODA seep has by far the highest load and is a candidate for treatment.

Decision Rationale: Discharge of surface water to an onsite treatment or other storage/disposal facility is retained for the Pole Canyon ODA seep.

5.3.6 Ex-Situ Treatment

Ex-situ treatment technologies and process options potentially applicable to surface water include a variety of physical (gravity/mechanical separation, media filtration, and ultrafiltration/reverse osmosis), chemical (chemical precipitation and oxidation/reduction), and biological

(biodegradation) technologies. Evaluation of each of these options for effectiveness, implementability, and cost is provided below.

Gravity/Mechanical Separation – Gravity or mechanical methods could be used to separate suspended solids from surface water. Gravity separation involves settling of suspended solids in ponds, basins, or tanks, using baffles or other devices. Mechanical separation involves using belt presses, filter presses, or vacuum filtration units to remove suspended solids.

Effectiveness: Low. Gravity/mechanical separation is not effective for surface water with dissolved selenium.

Implementability: Low. Gravity/mechanical separation is implementable for dewatering waste streams from other treatment technologies but is not implementable for dissolved selenium in surface water.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Gravity/mechanical separation is applicable for dewatering waste streams from other treatment technologies. It would not remove dissolved selenium from surface water at the Site.

Applicability Within the Site: Not applicable to Site conditions.

Decision Rationale: Gravity/mechanical separation is not retained because it is not effective for dissolved contaminants in surface water at the Site.

Media Filtration – Media filtration is a separation process that uses granular material through which influent water flows to filter suspended solids. Media filtration (i.e., sand filtration) is not a stand-alone treatment but is effective in trapping suspended solids on top of and within the sand filter bed while allowing effluent to flow through it.

Effectiveness: Moderate. Media filtration (typically using sand) is proven effective for removing suspended solids; however, the technology is not effective for dissolved selenium and arsenic in surface water.

Implementability: Low. Not implementable as a stand-alone treatment system and not applicable to contaminated surface water at the Site.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Media filtration (typically using sand) is proven effective for removing suspended solids and trapping the particles on/in a filter bed in conjunction with other technologies. It is not effective for dissolved selenium and arsenic in surface water in seeps and ponds.

Applicability Within the Site: Not applicable to Site conditions.

Decision Rationale: Media filtration is not retained because it is not applicable to contaminated surface water at the Site.

Ultrafiltration/Reverse Osmosis – Ultrafiltration/reverse osmosis is a membrane-filtration technology that could be used to separate and concentrate selenium and arsenic in surface water. The pore size of the ultrafiltration membrane is slightly larger than the pore size of the reverse osmosis membrane. This technology would require further treatment to remove selenium and arsenic from the concentrate stream prior to discharge.

Effectiveness: Moderate. Ultrafiltration/reverse osmosis is a membrane-filtration technology that is effective in removing selenium from surface water. However, the effectiveness is generally lower for high flow/low concentration waters and for low flow/high concentration waters.

Implementability: Low. Not implementable as a stand-alone treatment system.

Cost: High capital costs. High O&M costs.

Site-Specific Considerations: Although ultrafiltration/reverse osmosis technologies are proven effective for selenium removal and have been tested at the Hoopes WTP Pilot Study, the Site conditions do not favor its use for surface water (either due to high flow/low concentration water in creeks or to low but seasonally variable flow/high concentration water in the Pole Canyon ODA seep).

Applicability Within the Site: Could be applicable to the Pole Canyon ODA seep, but PRB technology is more applicable.

Decision Rationale: Ultrafiltration/reverse osmosis is not retained because it has a lower effectiveness and higher cost than PRB technology for treatment of the Pole Canyon ODA seep.

Chemical Precipitation – Chemical precipitation involves the precipitation of dissolved ions/salts in the form of insoluble salts by adding chemicals to reach chemical saturation and/or varying the

pH. The insoluble salts may be removed from the water by sedimentation, coagulation, and/or flocculation.

Effectiveness: Low. Chemical precipitation is effective for reduced forms of selenium. The treatment process generates a sludge that requires further treatment.

Implementability: Low. Chemical precipitation is not implementable for surface water in seeps and ponds at the Site.

Cost: Moderate capital costs. High O&M costs.

Site-Specific Considerations: Chemical precipitation is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.

Applicability Within the Site: Chemical precipitation is not applicable for surface water in seeps and ponds that requires treatment.

Decision Rationale: Chemical precipitation is not retained due to relatively lower effectiveness when compared to other treatment options.

Oxidation/Reduction – The chemical oxidation/reduction process uses agents such as oxidation, chlorination, hydrogen peroxide, and ultraviolet light to react with and oxidize contaminants in surface water. Oxidation/reduction reactions may improve the separation characteristics for removal of selenium if used in conjunction with other treatment technologies.

Effectiveness: Low. Oxidation/reduction is more effective for reduced forms of selenium and less effective for oxidized forms. Oxidation/reduction is not effective as a stand-alone treatment.

Implementability: Low. The implementability of oxidation/reduction is low because it is not a stand-alone treatment technology and is not applicable to surface water in seeps and detention basins at the Site.

Cost: Moderate capital costs. High O&M costs.

Site-Specific Considerations: Oxidation/reduction is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.

Applicability Within the Site: Oxidation/reduction is not applicable for surface water in seeps and ponds that requires treatment.

Decision Rationale: Oxidation/reduction is not retained due to relatively lower effectiveness when compared to other treatment options.

Ex-Situ Biological Treatment (Biodegradation) – Biological treatment involves the degradation or reduction of contaminants by microorganisms. Surface water is extracted or pumped to a process location (e.g., wetlands, anaerobic bioreactor, or fluidized bed bioreactor) for treatment. Metals and other inorganic contaminants could be removed from the water using anaerobic bacteria and then precipitated or absorbed by the media in the wetlands or bioreactor.

Effectiveness: High. Biodegradation is effective as part of an active water treatment plant such as an anaerobic fluidized bed bioreactor.

Implementability: Moderate. Ex-situ biodegradation is moderately implementable depending on the flows and concentrations of contaminants.

Cost: Moderate capital costs. Moderate O&M costs.

Site-Specific Considerations: Ex-situ biological treatment is proven effective at the Hoopes WTP Pilot Study fluidized bed bioreactor (FBR). However, in-situ biodegradation would be more effective for the Pole Canyon ODA seep, which has seasonally varying flows and concentrations.

Applicability Within the Site: Ex-situ biological treatment is not applicable for surface water in seeps and ponds that requires treatment.

Decision Rationale: Ex-situ biological treatment is not retained because Site conditions favor in-situ treatment.

5.3.7 In-Situ Treatment

In-situ treatment technologies and process options applicable to surface water are limited to in-situ biological treatment (biodegradation). This option is evaluated for effectiveness, implementability, and cost.

In-Situ Biological Treatment – In-situ biological treatment of surface water uses similar scientific principles as ex-situ biological treatment and is achieved by introducing carbon, nutrients, and possible bacteria into the water to enable native microorganisms to metabolize the target contaminants. A passive flow system (e.g., wetlands, bioreactor, or PRB) constructed directly in

the seep or pond location could be used for selenium removal. For a PRB, reactive media is placed in a trench aligned perpendicular to flow such as to intercept and treat contaminated water. To treat selenium, the reactive media uses chemical and microbial processes to chemically reduce and transform selenium from selenate to selenite and ultimately to elemental selenium. Reactive material suitable to treat selenium includes inert sand, wood chips, and alfalfa hay. Various factors influence the reduction speed of microbial processes, including pH, temperature, and salinity.

Effectiveness: High. Biodegradation is effective as a passive treatment technology for residual seeps following source controls (e.g., covering overburden).

Implementability: High. In-situ biodegradation is implementable and could be most successful where the geochemical environment and hydraulic conditions allow for control of the key growth variables (e.g., temperature, pH, and nutrients).

Cost: Moderate capital costs. Moderate to high O&M costs.

Site-Specific Considerations: Passive in-situ biological treatment, such as a PRB, is effective for removing selenium and could be used at seeps and ponds at the Site.

Applicability Within the Site: In-situ biodegradation is potentially applicable for the Pole Canyon ODA seep and for detention ponds.

Decision Rationale: In-situ biological treatment is retained because a passive treatment technology such as a PRB could be effective for treatment of seep and pond water.

5.4 Smoky Canyon Mine FS Technical Memorandum #2

Following Agency review and approval of Smoky Canyon Mine FSTM#1, FSTM#2 will be prepared in accordance with RI/FS Guidance Under CERCLA (USEPA 1988) to develop and screen remedial alternatives. The selected representative technologies for the impacted Site media (solids and soils, groundwater and surface water) will be assembled into remedial alternatives that represent a range of institutional controls and containment/engineered covers and treatment combinations. As described in the RI/FS guidance, the alternatives may be media-specific or if there are significant interactions among different media, they may be site-wide alternatives.

The assembled alternatives will be screened for effectiveness, implementability, and cost and the best or most promising will be retained for further consideration and analysis. Remedial alternatives carried through the screening process will be further refined and then individually evaluated in detail with respect to nine evaluation criteria (overall protection of human health and

the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; cost; state acceptance; and community acceptance). A comparative analysis will be performed to evaluate the relative performance of each alternative to identify the advantages and disadvantages of the alternatives relative to one another and the key tradeoffs that must be balanced for selection of a final remedy for the Smoky Canyon Mine.

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TABLES

TABLE 2-1. Reclamation Areas and Cover Types

Mine Panel Area	Subarea[1]	Cover Type	Area (acres)
Panel A	Area 1 - Backfilled Pits	Topsoil over Dinwoody and Chert	60
	Area 1 - External ODA	Topsoil over Dinwoody and Chert	20
	Area 2 - Backfilled Pits	Topsoil Only	115
	Area 2 - External ODA	Direct Revegetation, Topsoil Only	75
Panel C	Backfilled Pit	Topsoil over Dinwoody and Chert	105
Panel D	North - Backfilled Pits	Topsoil Only	95
	North - External ODA	Direct Revegetation	65
	South - Backfilled Pits	Topsoil over Chert	110
Panel E	Area 1 - Backfilled Pits	Topsoil over Chert	60
	Area 1 - External ODA	Topsoil over Chert	70
	Area 2 - Backfilled Pits	Topsoil over Dinwoody and Chert	150
	Pit E-0 - Backfilled Pits	Deep Dinwoody Store and Release [2]	60
Pole Canyon ODA	Pole Canyon ODA	Dinwoody over Chert [3]	130

Notes:

1 - Subareas are identified based on RI sampling areas (see RI Report, Formation 2014c), with further delineations of backfilled pits, external ODAs, and reclaimed areas (outside of RI sampling areas) based on mine reclamation data.

2 - A Deep Dinwoody Store and Release cover system was constructed on Pits E-0n and E-0s in 2014. These pits were open during soil sampling for the RI.

3 - A Dinwoody Over Chert cover was constructed on the Pole Canyon ODA in 2015 under a Non-Time-Critical Removal Action (NTCRA). During RI data collection and reporting (see RI Report, Formation 2014c), the cover types on the Pole Canyon ODA were Direct Revegetation and Topsoil Only.

TABLE 2-2. 2017 Pole Canyon ODA Water-Balance Model Outflow Summary

	Without NTCRAs (acre-feet)	With NTCRAs (acre-feet)	Estimated Reduction (percent)
Outflow			
Surface water discharge to lower Pole Canyon (measured at LP-1)	1087	20	98%
Average annual flow to alluvial groundwater	65	7	90%
Average annual flow to Wells Formation groundwater	676	16	98%
Total	**1828**	**43**	**98%**

TABLE 2-3. 2017 Pole Canyon ODA Mass-Balance Model Summary

	Without NTCRAs	With NTCRAs	Estimated Reduction (percent)
Annual Selenium Mass Transport			
Annual average selenium concentration in outflow surface water	1.1 mg/L	3.7 mg/L	---
Annual average selenium concentration in seepage to groundwater	0.44 mg/L	0.44 mg/L	---
Average annual load to surface water in lower Pole Canyon Creek	3249 lbs	206 lbs	94%
Average annual load to alluvial groundwater	78 lbs	8 lbs	90%
Average annual load to Wells Formation groundwater	813 lbs	19 lbs	98%
Total	**4140 lbs**	**233 lbs**	**94%**

TABLE 2-4. RI Model – Predicted Selenium Loading from Each Source Area to Springs Complex in 2050

Mine Feature	Area (acres)	Predicted Selenium Load to Springs in 2050 (No Further Action) (lbs/year)[3]	Percent of Total Load to Springs
		Direct Infiltration	
Panel A Area 2	180	130	41%
Pole Canyon ODA	130 [1]	16	5%
Panel D	250	104	33%
Panel E	340 [2]	68	21%
Total	900	**318**	**100%**

Notes:

lbs/year - pounds per year

1 - Area covered under the 2013 NTCRA.

2 - Area where seleniferous materials are present.

3 - Values are from the RI model. The model is being revised for the FS and updated estimates will be presented in FSTM#2.

TABLE 3-1. Applicable or Relevant and Appropriate Requirements (ARARs)

Type of ARAR	Statute, Regulation, Standard, or Requirement	Citation or Reference	General Description	Site-Specific Comments	Determination
Federal					
Chemical-Specific	National Primary Drinking Water Regulations (NPDWR)	40 C.F.R. Part 141	Establishes primary drinking water regulations pursuant to Section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act and related regulations for public water systems. Subpart F Section 141.51 lists maximum contaminant level goals (MCLGs) for inorganic contaminants. Subpart G Section 141.62 lists maximum contaminant levels (MCLs) for inorganic contaminants.	Hydrogeologic investigations for the RI at Smoky Canyon Mine show that the Thaynes-Dinwoody Formation and Wells Formation produce water. Groundwater from the Culinary Well is used as a private drinking water supply at the Smoky Canyon Mine. Primary drinking water regulations are applicable if groundwater beneath the Site will be used to supply public water systems.	Applicable
	Water Quality Standards	CWA Section 304 33 U.S.C. § 1314(a) 40 C.F.R. Part 131	Section 304 of the federal Clean Water Act (33 U.S.C § 1314) requires that individual states establish water quality standards for surface waters. The implementing regulation establishes the Ambient Water Quality Criteria (AWQC), which are the requirements for state water quality standards that are protective of human health and aquatic life. The standards incorporate designated uses for specific water bodies.	The State of Idaho has adopted the federal water quality criteria. Where numeric state water quality standards have not been promulgated, federal numeric water quality standards are applicable.	Applicable
	Resource Conservation and Recovery Act (RCRA)	40 C.F.R. §§ 261.20 to 261.24	Under RCRA, solid wastes that exhibit certain characteristics are subject to regulation as hazardous wastes. A solid waste is identified as hazardous if it exhibits the characteristic of ignitability, corrosivity, reactivity, or toxicity. Using the toxicity characteristic leaching procedure (Test Method 1311), if extract from the solid waste contains any of the contaminants at concentrations greater than or equal to those listed in Section 260.24, then the solid waste exhibits the characteristic of toxicity and is identified as a hazardous waste.	Potentially applicable if solid wastes are generated as part of the selected remedy. If the selected remedy includes a water treatment system, water treatment residual material or sludge will be tested to determine if the material exhibits the characteristic of toxicity and is hazardous under RCRA to determine proper disposal.	Applicable
	National Pollutant Discharge Elimination System (NPDES)	CWA Section 402 33 U.S.C 1342 40 C.F.R. §§ 122 to 125	Permitting requirements for the discharge of pollutants from any point source. USEPA considers discharges from waste dumps or overburden disposal areas (ODAs) (e.g., springs and seeps at the base of the dumps) as point sources. The NPDES regulations establish requirements for point source discharges and stormwater runoff.	NPDES regulations are potentially applicable for any point source discharge of contaminated water or stormwater runoff at the Smoky Canyon Mine, and management of stormwater runoff during construction where the construction site is 1 acre or more in size. Best Management Practices (BMPs) will be used to manage stormwater runoff during construction of the remedy.	Applicable
Action-Specific	Clean Water Act (CWA)	CWA Section 301(b) CWA Section 402 40 C.F.R. § 125.3	Sections 301(b) and 402 of the Clean Water Act establish criteria and standards for technology-based treatment requirements, including the application of EPA promulgated effluent limitations. The effluent limitations require the best treatment and control technology prior to discharge.	The Hoopes Water Treatment Plant (WTP) pilot study at the Smoky Canyon Mine currently discharges to Hoopes Spring. Technology-based treatment requirements are applicable if the final remedy involves water treatment and discharge. Best treatment and control technology will be developed as part of the FS process and implemented during remedial design.	Applicable
		CWA Section 303(d) 33 U.S.C. §1251 et seq. 40 C.F.R. § 130.7	Under Section 303(d) of the Clean Water Act, states, territories and authorized tribes are required to submit lists of impaired waters. These are waters not meeting applicable water quality standards for one or more beneficial uses by one or more pollutants. The law requires that the states develop EPA approved Total Maximum Daily Loads (TMDL) for those Category 5 waters found on the 303(d) list.	The Salt River subbasin waterbodies on the 303(d) list have a medium priority for TMDL development. Streams near the Smoky Canyon Mine listed on the 2014 303(d) list include the following: Smoky Creek, Roberts Creek, Crow Creek, Tygee Creek, North Fork Sage Creek, Sage Creek, Pole Canyon, and South Fork Sage Creek. Those stream segments listed specifically for selenium include: Crow Creek (Deer Creek to border), North Fork Sage Creek, Pole Canyon Creek, South Fork Sage Creek, Sage Creek (confluence with North Fork Sage Creek to mouth). Those 303(d) waterbodies listed for selenium will be assessed for applicability of ARARs and considered in the selection of the remedial alternative.	Applicable
		CWA Section 401 13 U.S.C. § 1341 40 C.F.R. § 124.53	Under Section 401 of the Clean Water Act, a federal agency cannot issue a permit (e.g., Section 402 NPDES permit, or Section 404 permit for discharge of dredged or fill material) or license for an activity that may result in a discharge to waters of the U.S. until the state where the discharge would originate has granted or waived the Section 401 certification. The Section 401 certification can be an effective tool for protecting water quality.	Potentially applicable for remedial actions that result in a point source discharge (i.e., discharge from a water treatment system) or discharge of dredged and fill material (e.g., road building, construction of a cover system, or other activities that cross or impact stream channels) that requires a permit. Simplot would be required to submit a Section 401 certification with the federal permit application.	Applicable
		CWA Section 402 13 U.S.C. § 1342 40 C.F.R. Parts 122 to 124	The NPDES program under Section 402 of the Clean Water Act establishes a comprehensive framework for addressing waste water and storm water discharges, and requires that point-source discharges not cause the exceedance of surface water quality standards outside the mixing zone. The NPDES program requires permits for the discharge of pollutants from any point source into waters of the U.S. Section 122.26 specifies requirements for point source discharge of storm water from construction sites to surface water and provides for Best Management Practices (BMPs) such as erosion control for removal and management of sediment to prevent run-on and runoff.	A water treatment system and/or storm water conveyance systems such as run-on/runoff control ditches or detention basins may be constructed as part of the final remedy. Potentially applicable if the remedy creates a point source discharge (i.e., from a water treatment system) or for storm water management during construction or for any storm water conveyance systems constructed at the Smoky Canyon Mine. A Section 402 NPDES permit would be required for any such discharge.	Applicable
		CWA Section 404 33 U.S.C. §1344 40 C.F.R. Part 230	Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into waters of the U.S. including wetlands. Section 404 requires a permit before dredged or fill material may be discharged. No discharge of dredged or fill material may be permitted if a practicable alternative exists that is less damaging to the aquatic environment, or the waters would be significantly degraded.	A Section 404 permit for discharges of dredged or fill material to wetlands is required for remedial actions that may result in a discharge to surface water (e.g., road building, construction of a cover system, or other activities that cross or impact stream channels). The design of the final remedy will be developed to minimize or avoid impacts. Compensatory mitigation for unavoidable loss of aquatic habitat and/or wetlands will be developed during remedial design and constructed during implementation of the remedy.	Applicable
	Resource Conservation and Recovery Act (RCRA)	42 U.S.C. § 6901 et seq. 40 C.F.R. Parts 260 to 265 and 268	Subtitle C of RCRA addresses requirements for hazardous waste from the point of generation to disposal. Any solid waste that exhibits a characteristic of hazardous waste or falls under a category of listed hazardous waste must be managed under these requirements. The requirements apply to transportation, treatment, storage, or disposal of the hazardous waste.	Potentially applicable if solid wastes are generated as part of the selected remedy. For example, if the selected remedy includes a water treatment system, water treatment residual material or sludge will be tested to determine if the material is hazardous prior to transport or disposal.	Applicable

TABLE 3-1. Applicable or Relevant and Appropriate Requirements (ARARs)

Type of ARAR	Statute, Regulation, Standard, or Requirement	Citation or Reference	General Description	Site-Specific Comments	Determination
Federal					
Action-Specific	Mineral Leasing Act (MLA)	30 USC § 181 et seq. 43 CFR Parts 3500 and 3590	Regulates discovery, mining, processing and reclamation on federal phosphate leases. Section 3592.1 establishes requirements for operating plans that detail exploration and mining operations. The plans must be responsive to the lease requirements for the protection of nonmineral resources and for reclamation of the surface of the lands affected by the operations.	Provisions regarding reclamation are potentially applicable. For affected areas that require revegetation (e.g., covers on overburden disposal areas), the plan will include the proposed methods of preparation and fertilizing of the soil prior to replanting, the types and mixtures of grasses to be planted, and the methods of planting including the amount of grasses per acre.	Applicable
	Surface Mining Control and Reclamation Act (SMCRA)	30 U.S.C §§ 1201–1326 30 C.F.R. Part 816.43, 45–47, 111 30 C.F.R Part 784	The SMCRA establishes permanent program performance standards for surface mining operations. The SMCRA also establishes minimum requirements for coal mining operations and reclamation of mined areas to protect society and the environment.	These requirements are not applicable because the Smoky Canyon Mine is not a coal mine. The requirements may be relevant and appropriate to the design of a cover and runoff and run-on control system as part of the final remedy.	Relevant and Appropriate
	Clean Air Act (CAA)	40 C.F.R. Part 50 40 C.F.R § 52.670	Establishes National primary and secondary ambient air quality standards under Section 109 of the CAA to protect the public health and welfare.	Federal standards for particulate matter (PM) may be relevant and appropriate if dust is generated during construction of the remedy.	Relevant and Appropriate
	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 C.F.R Part 61	Establishes numerical emission limits under the CAA for hazardous air pollutants and other substances that cause serious health effects emitted from stationary sources. In addition to complying with the provisions of this part, the owner or operator of a stationary source may be required to obtain an air pollution control permit.	The State of Idaho's air quality standards govern air quality at the Smoky Canyon Mine; therefore, NESHAP requirements are not applicable but may be relevant and appropriate for stationary sources of air pollution.	Relevant and Appropriate
	National Environmental Policy Act (NEPA)	40 C.F.R. Parts 1500–1508 42 U.S.C § 4321 et seq.	NEPA requires federal agencies to assess the environmental effects of proposed actions prior to making decisions, and includes making decisions on permit applications, adopting land management actions, and constructing facilities. NEPA provides for consideration of the potential impacts of response actions on the environment and provides for significant public participation.	The NEPA process was completed for each of the active permitted mine panels at Smoky Canyon. An environmental impact statement (EIS) was prepared to consider the environmental effects of the proposed mining actions. The permit approvals included stipulations for protection or management of water resources, fish and wildlife, recreation and public access, transportation and utility corridors, livestock, air resources, housing and community facilities, slurry pipeline, timber, reclamation and revegetation, fire and safety, refuse and garbage, cultural and visual resources, and provide for environmental monitoring. The NEPA process is applicable to any future mining projects for assessment of individual and cumulative impacts.	Applicable
	Migratory Bird Treaty Act (MBTA)	16 U.S.C. § 703 et seq.	Prohibits pursuing, hunting, taking, capturing, killing, or possessing migratory birds and migratory game birds. The provision incudes any part, nest, or egg of any such bird, or any product composed of any such bird.	Several species of birds including raptors, upland gamebirds, passerines, waterfowl, and shorebirds nest in the area in aspen or conifer stands, sagebrush and grassland habitat, and in riparian habitat along some of the creeks at the mine. Remedial actions will be designed and implemented to avoid harm to migratory birds, their nests, or eggs. Construction schedules will be planned to avoid conflicts with migratory bird activities.	Applicable
	Fish and Wildlife Coordination Act	50 C.F.R. §10.12	Under the Fish and Wildlife Coordination Act, federal agencies involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose, are required to take action to protect the fish and wildlife resources that may be affected by the action.	Perennial streams within and adjacent to the mine contain several species of fish. The mainstem of Crow Creek has the most diverse fish species assemblages, while Sage Creek has the highest trout biomass. Potentially applicable if remedial action affects any of the natural creeks and streams at the mine or damages any of the fish habitat. Remedial actions will be designed to protect fish and fish habitat.	Applicable
	Endangered Species Act (ESA)	7 U.S.C. 136 16 U.S.C. 460 16 U.S.C. § 1531 et seq. 50 C.F.R. Part 402 40 C.F.R. § 6.302	Federal Agencies are prohibited from jeopardizing threatened and endangered species or adversely modifying habitats essential to their survival. Substantive requirements include prohibition against taking an endangered or threatened species and consultation with the U.S. Fish and Wildlife Service (USFWS) if any threatened or endangered species are present.	May be applicable if remedial action activities jeopardize threatened or endangered species or adversely modify their habitat. The only federally-listed threatened and endangered species in Caribou County is the Canada lynx (*Lynx canadensis*) (FWS 2013). Although potential "linkage" habitat for the lynx is present (Ruediger et al. 2000; USFS 2007), surveys for lynx indicate that this species is not present in the Smoky Canyon Mine area (Maxim 2002, 2004; BLM and USFS 2007). If lynx are observed in the vicinity of the mine during implementation of the final remedy, then the USFWS will be consulted.	Applicable
	Bald and Golden Eagle Protection Act	16 U.S.C. § 668 et seq. 50 C.F.R. 22	Prohibits any person from knowingly, or with wanton disregard, selling, offering to sell, taking, purchasing, transferring, bartering, exporting, importing, or possessing or harming a bald or golden eagle, or any part, nest, or egg thereof without obtaining a permit.	Bald eagles and golden eagles may use the Smoky Canyon Mine area for hunting and/or nesting. These raptors may be expected to nest in aspen or conifer stands in the mid- to higher elevation areas and north and west aspects that receive sufficient moisture to support aspen and conifer stands. Remedial actions will be designed and implemented to avoid harm to bald and golden eagles, their nests, or eggs.	Applicable
Location-Specific	National Historic Preservation Act (NHPA)	54 U.S.C. § 300101 et seq. 36 C.F.R. Parts 60, 63, and 800	The NHPA requires federally funded projects to identify and mitigate impacts of project activities on properties listed on or eligible for listing on the National Register. Section 106 of the NHPA requires that the historic preservation review process balances needs of federal undertaking with effects the undertaking may have on historic properties.	An archaeological team surveyed all areas that might be affected by mining activities at Smoky Canyon (USFS and USGS 1981). A few historic artifacts were found and two sawmills were located in the vicinity of project areas. There are four known historic sites near the lease area (Lander Trail, Crow Creek Wagon Road, Fairview Cutoff, and Oneida Salt Works). Potentially applicable if additional historic sites are found in areas to be disturbed by remedial actions. Impacts of remedial actions will be mitigated in accordance with the NHPA.	Applicable
	Archaeological Resources Protection Act (ARPA)	43 C.F.R. Part 7	Establishes procedures to provide protection for archaeological resources located on public lands. Prohibits any person from excavating, removing, damaging, or otherwise altering or defacing any archaeological resource.	Archaeological resources were investigated for all areas potentially affected by proposed mining activities for the original Environmental Impact Statement (EIS) (USFS and USGS 1981), and an archaeological survey of the borrow areas was conducted in 2017. No archaeological resources were found at the Smoky Canyon Mine. Potentially applicable if archeological resources are found in areas to be disturbed by remedial actions. If archaeological resources are identified during construction of the final remedy, the resources will be protected.	Applicable
	Native American Graves Protection and Repatriation Act (NAGPRA)	25 U.S.C. §§ 3001 to 3013 43 C.F.R. 10	Requires federal agencies and institutions that receive federal funding to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes. It also establishes procedures for the inadvertent discovery or planned excavation of Native American cultural items on federal or tribal lands. These regulations apply to human remains, funerary objects, sacred objects, or objects of cultural patrimony that are indigenous to the continental United States.	Archaeological and historical resources were investigated for all areas potentially affected by proposed mining activities for the EIS (USFS and USGS 1981). The Smoky Canyon Mine area is largely free of cultural resources. Potentially relevant and appropriate if cultural items are identified in USFS lease areas during construction of the final remedy. Any cultural items found will be returned to the tribes.	Relevant and appropriate

TABLE 3-1. Applicable or Relevant and Appropriate Requirements (ARARs)

Type of ARAR	Statute, Regulation, Standard, or Requirement	Citation or Reference	General Description	Site-Specific Comments	Determination
Federal					
Location-Specific	National Environmental Policy Act (NEPA) Protection of Wetlands	40 C.F.R. § 6.302 40 C.F.R. 6 Appendix A	Executive Order 11990 (as amended by Executive Order 12608) was established to implement NEPA and requires agencies conducting certain activities to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists.	Riparian areas occur along the creeks and streams at the mine and in the vicinity of Hoopes Spring and South Fork Sage Creek Springs. Vegetation in riparian areas is dominated by willows, sedges, and reedgrass. The wetlands protection order may be applicable if remedial actions are planned in areas that contain wetlands and the construction activities planned will impact the wetlands. Compensatory mitigation for loss of wetlands will be developed during remedial design and implemented during construction of the final remedy.	Applicable
	National Forest Management Act	16 U.S.C. §§ 1601 to 1614 36 C.F.R. 219	The Caribou-Targhee Land Use Management Plan establishes multiple use goals and objectives, forest-wide management requirements, and monitoring and evaluation requirements. Establishes direction so that future decisions affecting the Forest will include an interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences.	The management plan provides requirements to maintain and restore National Forest System land and water ecosystems under multiple uses. Requirements of the plan are applicable for any remedial actions.	Applicable
	2003 Revised Forest Plan Caribou National Forest 1997 Revised Forest Plan Targhee National Forest	USFS (2003) USFS (1997)	Provides guidance for all natural resource management activities and establishes management standards within the Caribou-Targhee National Forest in order to sustain watersheds, forests, and rangelands and provide for multiple uses of these lands.	The Smoky Canyon Mine is on National Forest System land in the Caribou-Targhee National Forest and is operated under a Special Use Permit and BLM phosphate leases. Remedial action must take into account the requirements of the Caribou and Targhee Forest Plans.	Applicable
	Federal Land Policy and Management Act of 1976 (FLPMA)	43 U.S.C. §§1701 to 1785	Public lands and their resources are periodically and systematically inventoried and their present and future use is projected through a land use planning process. Public lands are managed for use and protection of the land and its natural resources.	Provisions regarding undue degradation are potentially applicable to actions conducted on the portion of the Smoky Canyon Mine that is on public lands.	Applicable
State of Idaho					
Chemical-Specific	Idaho Water Quality Standards	IDAPA 58.01.02	Idaho water quality standards and wastewater treatment requirements include but are not limited to the following: Administrative policy for protection of waters of the State (.050.02); Antidegradation policy (.051); Mixing zone policy (.060); Violation of water quality standards (.080); Analytical procedures (.090); Surface water use designations and nondesignated surface waters (.100 to .101); Designations of surface waters found within Salmon Basin (.130); General surface water quality criteria (.200); Surface water quality criteria for aquatic life, recreation, water supply, wildlife and aesthetics use designations (.250 to .253); Variances from water quality standards (.260); and Site-specific surface water quality criteria (.275).	The State of Idaho standards and requirements are applicable to surface water bodies at the Site or surface water impacted by the selected remedy.	Applicable
	Idaho Public Drinking Water Systems Rules	IDAPA 58.01.08	Controls and regulates the design, construction, operation, maintenance, and quality control of public drinking water systems to provide a degree of assurance that such systems are protected from contamination and maintained free from contaminants which may injure the health of the consumer.	Hydrogeologic investigations for the RI at Smoky Canyon Mine show that the Thaynes-Dinwoody Formation and Wells Formation produce water. Primary drinking water regulations are applicable if the potential exists for construction of a public drinking water system in the future.	Applicable
	Idaho Ground Water Quality Rule	IDAPA 58.01.11	The Idaho Ground Water Quality Rule (GWQR) establishes minimum requirements for protection of groundwater quality through numerical standards and an aquifer categorization process. The rule addresses protection of groundwater quality, maintaining existing and projected future beneficial uses, categorization of groundwater, establishing groundwater quality standards, and preventing groundwater contamination while allowing for mineral extraction. Section 200 establishes numerical groundwater quality standards. Section 401 describes the process for setting a point of compliance (POC) at which the mine operator must meet the groundwater standards.	State numerical groundwater quality standards are applicable to groundwater at the Site. Groundwater is currently monitored and compared to these standards. Following completion of the remedial actions, a POC may be set in accordance with Section 401 of Idaho's GWQR. Simplot will submit an application to establish a monitored outer boundary where groundwater resources must comply with Idaho's GWQR and will propose monitoring wells as POC and indicator wells. DEQ may determine that additional POC wells are necessary to ensure that there is no injury to current or projected future beneficial uses of groundwater or violation of surface water standards.	Applicable
	Idaho Rules and Standards for Hazardous Waste	IDAPA 58.01.05	Rules adopted pursuant to the Hazardous Waste Management Act (HWMA) establish methods for the identification and listing of hazardous waste, and standards applicable to generators, transporters, and owners and operators of treatment, storage, and disposal facilities.	Numerical standards are potentially applicable to wastes generated by remedial action at the Site. If the selected remedy includes a water treatment system, water treatment residual material or sludge will be tested to determine if the material is hazardous prior to transport or disposal.	Applicable
	Idaho Hazardous Substance Emergency Response Act	Idaho Code §§ 39-7101 to 7115	Facilitates emergency response planning and requires expedient response and/or containment for hazardous substance release in order to protect the health, safety, and welfare of the people of Idaho.	Potentially relevant and appropriate during remedial action construction if there is a release of a hazardous substance.	Relevant and Appropriate

TABLE 3-1. Applicable or Relevant and Appropriate Requirements (ARARs)

Type of ARAR	Statute, Regulation, Standard, or Requirement	Citation or Reference	General Description	Site-Specific Comments	Determination
State of Idaho					
Action-Specific	Idaho Solid Waste Management Rules	IDAPA 58.01.06	Establishes requirements for operation and closure of solid waste and solid waste management facilities. Solid Waste Management Rules and programs administered under the rules are adopted to protect air quality, surface water quality, and groundwater quality.	The Solid Waste Management Rules do not apply to overburden, waste dumps, stockpiles, tailings and other materials associated with phosphate mining (see IDAPA 58.01.06.001.03(b)(iv)). Potentially relevant and appropriate if solid waste management units are constructed as part of the remedy or solid waste is generated during the remedial action.	Relevant and Appropriate
	Idaho Hazardous and Deleterious Material Storage	IDAPA 58.01.02.800	Rules prohibit storage, disposal or accumulation of hazardous and deleterious material adjacent to or in the immediate vicinity of state waters unless adequate measures and controls are provided to ensure that those materials will not enter state waters as a result of high water, precipitation runoff, wind, storage facility failure, accidents in operation, or unauthorized third party activities.	Potentially applicable for chemicals associated with the Hoopes Water Treatment Plant (WTP), which is located in the vicinity of the springs complex upstream of South Fork Sage Creek.	Applicable
	Idaho Surface Mining Act	Idaho Code Title 47, Chapter 15	The Surface Mining Act requires reclamation of the surface of all lands disturbed by mining operations in order to protect public health and wildlife. Section 47-1509 includes procedures for reclamation (i.e., for leveling overburden piles, controlling erosion, preventing surface runoff, abandoning roads, revegetating overburden piles, and reclaiming tailings ponds). Section 47-1510 requires planting of vegetation comparable to the vegetation growing before mining and is required on mined areas.	The final remedy for the mine may include construction of cover systems, abandonment of roads, construction of run-on and runoff controls, and planting of vegetation. Procedures listed in Section 47-1509 should be considered in the selection of reclamation techniques for overburden piles, tailings ponds, haul roads, etc. Seed mixtures for revegetation efforts will be comparable to pre-mining vegetation as described in Section 47-1510.	Relevant and Appropriate
	Idaho Rules for Exploration and Surface Mining	IDAPA 20.03.02	Rules pursuant to the Idaho Surface Mining Act to reclaim the surface of lands and thereby conserve natural resources, protect wildlife and aquatic resources, and reduce soil erosion. Section 20.03.02-140 includes BMPs and reclamation for surface mining operations.	BMPs (e.g., nonpoint source sediment controls, clearing and grubbing, overburden/topsoil, backfilling and grading, and abandonment of tailings impoundments) and reclamation procedures should be considered in the selection of reclamation techniques for pits, overburden areas, and the tailings impoundments.	Relevant and Appropriate
	Idaho Well Construction Standards Rules	IDAPA 37.03.09	Describes requirements for well construction and abandonment. Rule 25 pertains to construction of cold water wells. Monitoring and remediation wells must be constructed and maintained in a manner that prevents waste or contamination. Rules state that when a monitoring well is no longer useful or needed, it must be decommissioned in accordance with Rule 25 Subsection 025.16.	There are 24 active groundwater monitoring wells at the Site. Some of these wells may be targeted for abandonment or new wells may be installed as part of the remedial action. Well construction/abandonment procedures must be followed and materials prescribed under Rule 25 must be used during construction or abandonment of groundwater monitoring wells.	Applicable
	Idaho Uniform Environmental Covenants Act	Idaho Code Title 55 Chapter 30 Sections 55-3001 to 3015	Describes requirements for environmental covenants which include a legal description of the property subject to the covenant, a description of the activity and use limitations on the property, an identification of every holder, and the name and location of any administrative record for the environmental response project reflected in the covenant.	Potentially applicable for portions of the Smoky Canyon Mine where remedial actions are implemented that are on private lands (i.e., Sage Valley).	Applicable
	Rules for the Control of Air Pollution in Idaho and Rules for Control of Fugitive Dust	IDAPA 58.01.01	These rules provide for the control of air pollution in Idaho. Rules 650 to 651 require that precautions be taken to prevent the generation of fugitive dust.	Potentially relevant and appropriate if remedial actions generate fugitive dust. Precautions appropriate to construction for remedial actions may include the use of water or chemicals, the application of dust suppressants, and/or covering of dump trucks used for hauling soils.	Relevant and Appropriate
	Rules Governing Point Source Discharges and Point Source Wastewater Treatment Requirements	IDAPA 58.01.02.400--401	Provides limits and restrictions on temperature and turbidity for point source discharges to waters of the state. Under Rule 401, the wastewater or discharge must not affect the temperature of the receiving or downstream waters so as to interfere with designated beneficial uses. Rule 401 also requires that the wastewater or discharge must not increase the turbidity of the receiving or downstream waters more than 5 Nephelometric Turbidity Units (NTU) over background when background is 50 NTU or less.	Potentially applicable for remedial actions that result in a point source discharge such as discharge from the Hoopes WTP to the Hoopes Spring drainage before it joins South Fork Sage Creek. Effluent and surface water downstream must comply with these limits and restrictions.	Applicable
	Idaho Stream Channel Alteration Rules	IDAPA 37.03.07	State of Idaho rules for alteration of stream channels that include minimum standards for construction to prevent alterations that will be a hazard to a stream channel and its environment. Requires a joint permit with the Idaho Department of Water Resources (IDWR), Idaho Department of Lands (IDL), and the US Army Corps of Engineers (USACE) under the Stream Protection Act.	The final remedy will be designed to minimize or avoid impacts to stream channels. For areas where construction does alter, modify, relocate, or change the natural existing shape of the channel or change the direction of flow of water in the stream channel, minimum standards for construction (e.g., construction procedures, temporary structures, dumped rock riprap, culverts, etc.) shall apply. Potentially applicable to prevent alterations that will be a hazard to a stream channel and its environment during remedial actions.	Applicable
	Idaho Classification and Protection of Wildlife Rule	IDAPA 13.01.06	Rules establish the classification and protection of wildlife including big game animals, upland game animals, game birds, game fish, fur-bearing animals, threatened or endangered species, protected nongame species, and predatory wildlife. State of Idaho law prohibits taking or possessing protected nongame and threatened or endangered species. Game species may be taken in accordance with Idaho law and rules established by the Idaho Fish and Game Commission. Idaho law and rules are enforced by the Idaho Department of Game and Fish (IDGF). Wildlife species classified as unprotected and predatory may be taken in any amount at any time.	Big game animals (deer, elk, black bear, mountain lion), migratory game birds (duck, goose, dove), upland birds (partridge, grouse), upland game/furbearers (rabbit, marten, mink, weasel, red fox, skunk, badger, bobcat, coyote), and game fish (trout, whitefish) are present in and around the mine and may be taken in accordance with hunting and fishing rules established by IDGF. Protected nongame fish (blue-head sucker) and any threatened or endangered species (lynx) may not be harvested or possessed. Monitoring programs for wildlife currently conducted at the Smoky Canyon Mine in conjunction with the IDFG deal with big game special-use areas and sage grouse leks. Remedial action must be designed and implemented to comply with these rules to protect wildlife and threatened or endangered species.	Applicable
	Idaho Protection of Animals and Birds	Idaho Code Title 36, Chapter 11	Idaho law prohibits taking of wildlife, birds or fur-bearing animals and declares exceptions. For the protection of animals and birds, it is unlawful to hunt from motorized vehicles or aircraft or hunt using artificial light. Property owners have the right to control, trap, or remove any wild animal damaging private property.	Remedial action must be designed and implemented to comply with these rules with restrictions on the taking of wildlife, protection of wildlife, and control of predators.	Applicable

TABLE 3-1. Applicable or Relevant and Appropriate Requirements (ARARs)

Type of ARAR	Statute, Regulation, Standard, or Requirement	Citation or Reference	General Description	Site-Specific Comments	Determination
Location-Specific	Idaho Preservation of Historical Sites	Idaho Statutes Title 67, Chapters 46 and 41	Authorization to preserve historical, archeological, architectural, and cultural heritage. Provides for designation as historic property if property meets criteria established for inclusion in the national register of historic places. Historic property is any building, structure, area, or site that is significant in the history, architecture, archaeology, or culture of the State of Idaho.	An archaeological team surveyed all areas that might be affected by mining activities at Smoky Canyon (USFS and USGS 1981). A few historic artifacts were found and two sawmills were located in the vicinity of project areas. There are four known historic sites near the lease area (Lander Trail, Crow Creek Wagon Road, Fairview Cutoff, and Oneida Salt Works). Potentially applicable if additional historic sites are found in areas to be disturbed by remedial actions (i.e., borrow areas).	Applicable
	Rules for Fences in General	Idaho Code Title 35, Chapter 1	Provides specifications for lawful fences in the State of Idaho and requirements for erection of partition fences, care of fences, and establishment of gates. Fences must not be less than 4-1/2 feet high and the bottom board, rail, pole, or wire of the fence must not be more than 20 inches above the ground.	Fences are currently in place in lower South Fork Sage Creek to restrict access by wildlife. Potentially applicable if fencing is required as part of the selected remedy. Fences installed for the remedy would have to meet state specifications.	Applicable
	Idaho Stream Channel Alteration Rules	IDAPA 37.03.07	State of Idaho rules for alteration of stream channels that include minimum standards for construction to prevent alterations that will be a hazard to a stream channel and its environment. Requires a joint permit with the Idaho Department of Water Resources (IDWR), Idaho Department of Lands (IDL), and the US Army Corps of Engineers (USACE) under the Stream Protection Act.	The design of the final remedy will be developed to minimize or avoid impacts to stream channels. For areas where construction does alter the natural existing shape of the channel or change the direction of flow of water in the stream channel, minimum standards for construction (e.g., construction procedures, temporary structures, dumped rock riprap, culverts, etc.) shall apply. Potentially applicable to prevent alterations that will be a hazard to a stream channel and its environment.	defer to Action-specific ARAR

TABLE 3-2. Criteria or Guidance To Be Considered (TBCs)

Type of TBC	Statute, Regulation, Requirement, or Reference	Citation or Reference	Description	Site-Specific Comments	Determination
Chemical-Specific	National Secondary Drinking Water Regulations	42 U.S.C 300g-1 40 C.F.R. Part 143	Establishes secondary drinking water regulations (secondary MCLs) pursuant to Section 1412 of the Safe Drinking Water Act, as amended. These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may exist as well as aesthetic degradation. The regulations are not Federally enforceable but are intended as guidelines for public water systems.	Hydrogeologic investigations for the Remedial Investigation (RI) at the Smoky Canyon Mine show that the Thaynes-Dinwoody Formation and Wells Formation produce water. Groundwater from the Culinary Well is used as a private drinking water supply at the mine. Secondary drinking water regulations are to be considered if groundwater beneath the Site will be used to supply public water systems.	TBC
	Idaho Secondary Drinking Water Regulations	IDAPA 58.01.08.400	Section 400 of the Idaho Department of Environmental Quality (IDEQ) Rules for Public Drinking Water Systems establishes secondary MCLs (as defined in 40 C.F.R. Part 143) for public water systems. These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may exist as well as aesthetic degradation. The regulations are not Federally enforceable but are intended as guidelines for public water systems.	Hydrogeologic investigations for the RI at Smoky Canyon Mine show that the Thaynes-Dinwoody Formation and Wells Formation produce water. Groundwater from the Culinary Well is used as a private drinking water supply at the mine. Secondary drinking water regulations should be considered if groundwater beneath the Site will be used to supply public water systems.	TBC
	Idaho Ground Water Quality Rule	IDAPA 58.01.11	The Idaho GWQR establishes minimum requirements for protection of groundwater quality through numerical standards.	The State numerical groundwater quality standard for arsenic is to be considered for areas of the Site with arsenic contamination in groundwater.	TBC
	USEPA Regional Screening Levels (RSLs)	USEPA (2018) [1]	US Environmental Protection Agency (USEPA) establishes acceptable risk levels for individual contaminants to protect human health drinking water uses at the 1×10^{-6} level for individual carcinogens or a hazard quotient (HQ) of 1 for non-carcinogens. The RSLs are risk-based concentrations derived from standardized equations combining exposure information assumptions with USEPA toxicity data.	RSLs are to be considered if groundwater or surface water is used as drinking water. These standards are only for carcinogenic contaminants for which there are no maximum contaminant level goals (MCLGs) or maximum contaminant levels (MCLs) established.	TBC
	Sediment Quality Assessment Guidelines (SQAGS)	McDonald et al. (2003) [2]	Sediment quality assessment guidelines (SQAGS) are numerical guidelines for assessing the potential for adverse biological effects associated with exposure to contaminated sediments. Both threshold effect concentrations (TEC) and probable effect concentrations (PEC) are included in the guidelines. SQAGS are used to conduct sediment quality assessments and to support defensible sediment management decisions.	The Site Specific Ecological Risk Assessment (SSERA) for the Smoky Canyon Mine used the SQAGS threshold effect concentration values as initial risk screening values for sediment concentrations at the Site. In the end, the SSERA stated that any risk conclusions for selenium in aquatic environments should be made based on concentrations in fish tissues. If sediment in streams or other aquatic habitats at the mine is impacted by remedial actions, then the SQAGS are to be considered. Site-specific selenium criterion (SSSC) for Hoopes Spring, Sage Creek, and Crow Creek near the Smoky Canyon Mine have been approved by IDEQ. Although USEPA approval of these SSSC is pending, these site-specific standards are a chemical-specific ARAR for sediments and protection of aquatic life until promulgation of the SSSC.	TBC
	NOAA Freshwater Sediment Benchmarks	NOAA (2008) [3]	The NOAA Screening Quick Reference Tables (SQuiRTs) are screening concentrations or benchmarks for freshwater sediments. The benchmarks are for preliminary screening purposes and do not constitute clean-up levels.	NOAA SQuiRT concentration values were used in the SSERA for the Smoky Canyon Mine as secondary risk screening values for sediment concentrations. The values for selenium are conservative. In the end, the SSERA stated that any risk conclusions for selenium in aquatic environments should be made based on concentrations in fish tissues. If sediment in streams or other aquatic habitats at the mine is impacted by remedial actions, then the SQuiRTs are to be considered.	TBC
	Proposed Selenium Benchmarks for Freshwater Sediment	Lemly (2002) [4] Vanderveer and Canton (1997) [5]	Two different studies (Lemly 2002; Venderveer and Canton 1997) arrived at two different potential protective levels in sediments. Neither is quantitatively derived nor based on effects to benthic macroinvertebrates.	The range of 2 to 4 milligram per kilogram dry weight (mg/kg dw) provides for a screening level for selenium in sediments. These values do not constitute effects thresholds or clean up values. Background should be considered in the context of these values. More specifically, because fish are a more sensitive indicator of effects for selenium in the aquatic environment, tissue concentrations for fish should be considered as the threshold values for effects and potential cleanup.	TBC

TABLE 3-2. Criteria or Guidance To Be Considered (TBCs)

Type of TBC	Statute, Regulation, Requirement, or Reference	Citation or Reference	Description	Site-Specific Comments	Determination
Action-Specific	American Indian Religious Freedom Act (AIRFA) Religious Freedom Restoration Act (RFRA)	42 U.S.C. § 1996 et seq. H.R. 4155 42 U.S.C. §§ 2000bb-200bb-4	The AIRFA protects and preserves the traditional religious rights and cultural practices of Native Americans. These rights include access of sacred sites, repatriation of sacred objects held in museums, freedom to worship through ceremonial and traditional rites, and use and possession of objects considered sacred. The Act, as amended, provides for the management of federal lands in a way that does not frustrate the traditional religions and religious purposes of Native Americans. The RFRA protects religious practices that are substantially burdened by governmental actions.	The Shoshone-Bannock Tribes is a federally recognized sovereign nation located on the Fort Hall Reservation in southeast Idaho. The Smoky Canyon Mine and all public lands in the vicinity of the mine may be used for Tribal ceremonial activities consistent with the Shoshone-Bannock Tribe treaty-reserved rights. These rights are to be considered before any remedial actions are implemented at the Site.	TBC
	Idaho Nonpoint Source Management Plan	IDAPA 58.01.02.350 IDEQ (2015)	Idaho's Nonpoint Source (NPS) Management Plan, developed as required by USEPA under Section 319 of the Clean Water Act, provides guidance to protect or restore (where possible) the beneficial uses of the State's surface water and groundwater. The plan includes both groundwater and surface water protection programs, which are coordinated and administered by Idaho DEQ. Water quality goals include monitoring and assessing water quality conditions to determine compliance with standards and support of beneficial use.	Surface water and groundwater at Smoky Canyon Mine are monitored to assess water quality conditions and determine compliance with aquatic water quality criteria and groundwater standards. The NPS Management Plan provides guidance to be considered under the various monitoring programs at the mine.	TBC
	Surface Mine and Reclamation Plan Smoky Canyon Project	Idaho Code Title 47, Chapter 15 Simplot (1981)	The Surface Mine and Reclamation Plan provides Simplot's proposal to develop the Smoky Canyon phosphate lease I-012890 as an open pit mine. The plan includes exploration drilling to delineate the ore body within each mine panel, development drilling to be conducted in conjunction with production to resolve structure problems, and a reclamation program to optimize surface mine rehabilitation.	The Surface Mine and Reclamation Plan is to be considered during mining and reclamation activities. The sequence of mine panel development began in accordance with the preferred approach in the mine plan, but has changed over time as the needs of the mine changed. The reclamation plan at the Smoky Canyon Mine is conducted concurrently with development to minimize the amount of disturbed acreage and facilitate reclamation of waste disposal sites and reestablishment of cover and forage.	TBC
	Idaho Department of Lands (IDL) Best Management Practices for Mining in Idaho	IDL (1992) [6]	The IDL handbook presents best management practices (BMPs) for surface dredge and placer mining which help minimize nonpoint source water quality impacts from mining as well as promote and enhance the natural recovery of mined sites. Identification of BMPs is mandated by Section 319 of the Clean Water Act.	Although not required by statute, BMPS are recommended for use both during and after mining to minimize water quality impacts from increased sedimentation to surface waters from areas cleared for mining, roads built for access to the site, stockpiles of topsoil, ore, and waste rock, and stream channel alterations. BMPs are to be considered during the implementation of remedial actions.	TBC
	Catalog of Stormwater Best Management Practices for Idaho Cities and Counties	IDEQ (2005)	The catalog provides technical guidance for construction site design and the selection of stormwater BMPs. The objective of stormwater management is to minimize damage to natural resources, minimize the amount of sediment and other contaminants in runoff, and preserve the stability of stream corridors.	Procedures contained in the Catalog of BMPs for Idaho to control erosion and sediment during and after construction are to be considered during implementation of the final remedy.	TBC
Location-Specific	Considering Wetlands at CERCLA Sites Guidance	OSWER 9280.03 (May 1994)	Provides guidance when considering the potential impacts of remedial actions on wetlands in order to protect wetlands under the substantive requirements of the Floodplain Management Executive Order (EO 11988) and the protection of Wetlands Executive Order (EO 11990).	Riparian areas occur along the creeks and streams at the mine and in the vicinity of Hoopes Spring and South Fork Sage Creek Springs. Vegetation in riparian areas is dominated by willows, sedges, and reedgrass. The wetlands protection order may be applicable if remedial actions are planned in areas that contain wetlands and the construction activities planned will impact the wetlands. Prior to initiating any action that might impact wetlands, mitigation measures such as impact avoidance, impact minimization, and compensatory mitigation should be considered.	TBC
	Bureau of Land Management Record of Decision (ROD) and Approved Pocatello Resource Management Plan (RMP) with amendments	BLM (2012)	RMP ensures that impacted lands will be rehabilitated to accommodate productive, post-mining land uses by establishing multiple use goals and objectives, BLM management and monitoring and evaluation guidelines. Establishes direction so that future decisions affecting BLM managed lands will include an interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences. Provides the direction for how the public lands are to be managed/administered by the Pocatello Field Office.	The Pocatello Field Office RMP provides guidelines for management of reclamation activities to ensure containment and control of selenium and other contaminants. The guidelines provided in the plan are to be considered during remedial actions.	TBC
	Selenium Area-Wide Investigation Area-Wide Risk Management Plan	IDEQ (2004)	The Area-Wide Investigation (AWI) required IDEQ to develop an Area-Wide Risk Assessment and Risk Management Plan. The Area-Wide Risk Management Plan (AWRMP) provides discretionary guidance to assist in mine-specific risk management under CERCLA. Specific removal action goals, objectives, and action levels presented in the plan were developed to assist in focusing resources, identifying releases and areas of concern, and making decisions.	The Area-Wide removal action goals and objectives In the AWRMP target the protection of surface water, groundwater, wildlife, and multiple beneficial uses in the Southeast Idaho phosphate resource area. These goals and objectives are to be considered in making decisions about site-specific activities at the Smoky Canyon Mine.	TBC

Notes:

1 - U.S. Environmental Protection Agency Regional Screening Levels (RSLs) accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

2 - MacDonald, D.D., C.G. Ingersoll, D.E. Smorong, R.A. Lindskoog, G. Sloane, and T. Biernacki. 2003. Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters. Florida Department of Environmental Protection, Tallahassee, FL.

3 - National Oceanic and Atmospheric Association (NOAA). 2008. Screening Quick Reference Tables (SQuiRTs). NOAA Office of Response and Restoration Division, NOAA OR&R Report 08-1, Seattle, WA. Available at http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf.

4 - Lemley, A.D. 2002. Selenium assessment in aquatic ecosystems. A Guide for Hazard Evaluation and Water Quality Criteria. Springer-Verlag, New York, NY.

5 - Vanderveer, W.D., and S.P. Canton. 1997. Selenium Sediment Toxicity Thresholds and Derivation of a Water Quality Criteria for Freshwater Biota of Western Streams. Environmental Toxicology and Chemistry. Vol 16, No. 6. 1260-1268.

6 - Idaho Department of Lands (IDL) in conjunction with Other State and Federal Agencies through The Idaho Mining Advisory Committee. 1992. Best Management Practices for Mining in Idaho.

TABLE 3-3. Preliminary Remediation Goals

Remedial Action Objective (RAO)	Preliminary Remediation Goal (PRG)
Non-Regulated Surface Water	
Reduce or eliminate unacceptable risks to human receptors from ingestion of non-regulated surface water (seeps and detention ponds) due to arsenic.	MCL 0.01 mg/L Arsenic
Groundwater	
Prevent future use of alluvial or Wells Formation groundwater with arsenic or selenium concentrations above MCLs as a drinking water source.	MCL 0.05 mg/L Selenium MCL 0.01 mg/L Arsenic
Reduce or eliminate concentrations of arsenic and selenium in contaminated Wells Formation and alluvial groundwater to below MCLs within a reasonable time frame given the circumstances of the Site.	MCL 0.05 mg/L Selenium MCL 0.01 mg/L Arsenic
Reduce or eliminate loading of selenium from groundwater to surface water so that it does not result in concentrations that represent an unacceptable risk to aquatic life and comply with ARARs (IDAPA 58.01.02 – Water Quality Standards) in the lower Sage Creek and Crow Creek watersheds.	Site-Specific Standard for Selenium[1] Hoopes Spring and Sage Creek - 20.5 mg/kg egg/ovary; 13.6 mg/kg whole body; 16.7 ug/L water. Crow Creek - 20.5 mg/kg egg/ovary; 12.5 mg/kg whole body; 4.2 ug/L water.
Regulated Surface Water	
Reduce selenium concentrations in lower Sage Creek and Crow Creek watersheds to below levels that pose unacceptable risks for aquatic life and comply with ARARs (IDAPA 58.01.02 – Water Quality Standards).	Site-Specific Standard for Selenium[1] Hoopes Spring and Sage Creek - 20.5 mg/kg egg/ovary; 13.6 mg/kg whole body; 16.7 ug/L water. Crow Creek - 20.5 mg/kg egg/ovary; 12.5 mg/kg whole body; 4.2 ug/L water.
Soils/Overburden	
Reduce or eliminate unacceptable risks to future Seasonal Ranchers from ingestion of beef (livestock grazing on ODAs) as the primary contributor of cancer risk, due to arsenic concentrations (calculated on a Site-wide basis) for soil.	Risk-Based Level 11.5 mg/kg Arsenic (Site-wide 95UCL of the mean concentration)
Reduce or eliminate unacceptable risks to terrestrial biota populations from soil with elevated selenium concentrations on overburden or backfilled pits and external ODAs with minimal or no covers and in overburden seep/riparian areas downgradient of ODAs.	Risk-Based Level[2] <u>Small Mammals</u> 0.9 mg/kg Selenium (HQ = 1) 9.4 mg/kg Selenium (HQ = 5) 16 mg/kg Selenium (HQ =7.5) 23 mg/kg Selenium (HQ = 10) 56 mg/kg Selenium (HQ = 20) <u>Birds</u> 1.4 mg/kg Selenium (HQ = 1) 14 mg/kg Selenium (HQ = 5) 24 mg/kg Selenium (HQ =7.5) 35 mg/kg Selenium (HQ = 10) 84 mg/kg Selenium (HQ = 20) (95UCL of the mean concentration in surface soil)[3]

Notes:

95UCL - 95% upper confidence limit of the mean concentration
95USL - 95% upper simultaneous limit
95-95UTL - 95% upper tolerance limit with 95% coverage
mg/L - milligrams per liter
mg/kg - milligrams per kilogram
ug/L - micrograms per liter

1. Tissue criterion elements take precedence over the water element when data for either tissue are available. Egg/ovary data takes precedence over whole body data when both tissue data types are available.
2. The PRG for an HQ=1 is below the background level at the nearby Ballard Mine Site (6.67 mg/kg 95UCL of the mean). A range of HQs is provided to inform the detailed analysis of site-wide remedial alternatives in the detailed analysis and ultimately the risk management decisions to be made by the agencies. The soil selenium 95USL and 95-95UTL (29 mg/kg) for the Ballard Mine background data set was used to establish the cleanup level in the Ballard Mine Proposed Plan.
3. For small mammal populations, the exposure unit is each panel (Panel A, Panel C, Pole Canyon ODA, Panel D, Panel E). For bird populations the exposure unit is Site-wide.

TABLE 4-1. Water Flow and Selenium Concentrations at Overburden Seeps

Seep	Date	Flow (cfs)	Selenium, Total (mg/L)	Selenium, Dissolved (mg/L)
Panel A				
AS-1	5/14/2002	0.22	0.005 J	0.005 J
AS-2	5/25/2003	0.004	3.1	3.15
	5/18/2004	---	3.62	3.78
Panel D				
DS-7	5/17/2016	0.008	4.73	4.51
	11/8/2016	---	3.64	3.66
	5/16/2017	0.0041	4.88	4.59
DS-10	5/25/2003	0.00002	1.05	1.09
Panel E				
ES-3	5/17/2016	0.0078	0.0062	0.0062
	11/8/2016	---	0.0067	0.0074
	5/16/2017	0.0033	0.0068	0.0059
ES-4	5/19/2008	0.007	11.2	11.9
	6/2/2009	---	23.4	23.4
	5/7/2015	---	26.1	18.7
ES-5	5/7/2004	0.013	1.66 J-	1.61 J-
	7/23/2004	0.01	3.26	2.62
	9/19/2005	0.001	15	11.4
Pole Canyon				
LP-1 [1]	5/15/2017	0.21	3.72	3.79
	8/1/2017	0.064	4.12	4.03
	11/13/2017	0.0072	3.31	2.85

Notes:
cfs - cubic feet per second
mg/L - milligrams per liter

1 - Flow at LP-1 will likely decrease as effects from the Non-Time-Critical Removal Actions are realized.

TABLE 4-2. Selenium Concentrations at Detention Basins

Detention Pond	Date	Selenium, Total (mg/L)	Selenium, Dissolved (mg/L)
Panel A			
AP-2	5/25/2003	2.1	1.07
	7/22/2004	0.101	0.0941
AP-5	5/12/2012	0.007	0.007
	6/21/2012	0.0076	0.0075
	9/26/2013	0.0038	0.0033
AP-6	3/31/2005	0.019	0.0177
AP-13	6/21/2012	0.0288	0.0284
	4/11/2013	0.47	0.039
	9/26/2013	0.0107	0.0091
AR-1	5/3/2006	0.00044	0.00038
	9/18/2006	0.0012	0.00088
	6/3/2008	0.00086	0.00058
Panel D			
DP-1	7/26/2004	0.0044	0.0015
DP-2	7/27/2004	0.0022 U	0.002
DP-3	7/27/2004	0.0016 U	0.00058 J
DP-7	5/25/2003	3	2.9
	7/22/2004	0.247	0.0906
	9/15/2010	1.6	1.39
DP-10	10/29/2003	0.0359	0.0267 J-
	5/7/2004	0.412 J-	0.309 J-
	7/22/2004	0.338	0.0738
DP-15	7/27/2004	0.0027 U	0.0035 J+
Panel E			
EP-2	7/29/2004	0.0035 J-	0.0017 J-
	7/10/2010	0.0513	0.0424
EP-3	7/23/2004	0.00045 U	0.00034 J+
	7/10/2010	0.0029	0.0023
EP-4	5/21/2003	6.9	7.2
	7/23/2004	2.27	1.69
EP-5	7/23/2004	0.101	0.0898
	7/9/2010	0.0074	0.0054
EP-7L	7/10/2010	0.0016	0.0009
EP-7U	7/10/2010	0.0026	0.002
EP-11	7/29/2004	0.00412	---

Notes:
mg/L - milligrams per liter

TABLE 4-3. Remedial Technologies and Process Options Retained for Further Evaluation by Media

Remedial Technology	Process Option
No Further Action	None
Institutional Controls	Land-Use Controls
	Deed Restrictions
	Administrative Orders/Consent Decrees
	Information Programs/Signs
Access Controls	Fences/Gates
Containment/Engineered Covers	Tailings Cover
	Chert/Limestone Cover
	Dinwoody Cover
	Water Balance Cover
	Geosynthetic Cover (GM/GCL)
Sediment Control Features	Dikes/Berms/Detention Basins
Surface Controls	Grading/Erosion Control/Vegetation
	Slope Reduction/Retaining Walls
Diversion	Open/Closed Channels
Removal	Excavation
	Extraction Wells
Disposal	Onsite Disposal/Onsite Consolidation
	Offsite Disposal
	Onsite Treatment of Other Storage/Disposal Facility
Physical Treatment	Gravity Separation
	Mechanical Separation
	Media Filtration
	Ultrafiltration/Reverse Osmosis
	Stabilization/Fixation
Chemical Treatment	Chemical Precipitation
	Oxidation/Reduction
Biological Treatment	Biodegradation
Natural Physical/Chemical/Biological Process	Monitored Natural Attenuation

TABLE 5-1. Evaluation of Technologies for Solids and Soils

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Solids/Soils Screening Result
NO ACTION							
No Action							
No Further Action	Moderate	High	No Capital No O&M	No further actions would be taken.	Required by the National Contingency Plan (NCP).	No further action is retained as required by the NCP to provide a baseline against which other alternatives can be compared.	Retained
INSTITUTIONAL CONTROLS / ACCESS CONTROLS							
Institutional Controls							
Land-Use Controls / Grazing Controls	High	High	Low Capital Low O&M	Land-use controls are effective in limiting access and preventing activities that could compromise the integrity of remedial actions.	Land-use controls are applicable for areas of the Site on public lands.	Land-use controls are effective in limiting access and preventing exposure to selenium and arsenic in overburden materials and are retained.	Retained
Administrative Orders / Consent Decrees	High	High	Low Capital Low O&M	Enforcement tools are effective in requiring the performance of monitoring or reporting on the effectiveness of a remedy.	Administrative orders and consent decrees are applicable for evaluation of the effectiveness of a remedy such as a cover system.	Administrative orders/consent decrees are effective in requiring effectiveness monitoring and reporting and are retained.	Retained
Information Programs	High	High	Low Capital Low O&M	Information programs are effective in restricting activities that could compromise remedial actions and in notifying the public that covered contamination remains at the Site.	Information programs are applicable for areas of the Site on public lands.	Information programs are retained for use with other remedial technologies.	Retained
Access Controls							
Fences / Gates	Moderate	High	Low Capital Low O&M	Fencing is effective in preventing large animal exposure to selenium in soil and vegetation on ODAs but would not prevent access to smaller animals or birds.	Fencing is potentially applicable to areas that have unacceptable risks (for example soil at seeps or ponds).	Fencing is effective at limiting access and direct exposure to selenium and arsenic in soils and overburden material on the Site. Fencing is typically part of an overall Site remedy and is retained.	Retained
CONTAINMENT							
Engineered Covers							
Chert / Limestone Cover	High	High	Moderate Capital Low O&M	Chert/Limestone is readily available in the Rex Chert Member at the Site and is proven effective in preventing vegetation from rooting.	Chert/Limestone is applicable as a capillary break layer and/or a barrier layer in different cover types.	Chert/Limestone is effective as a barrier layer or a water conveyance layer and is typically combined with other materials for an effective cover system and is retained.	Retained
Dinwoody Cover	High	High	Moderate Capital Low O&M	Dinwoody Formation material is available at the Site and is proven effective in preventing contact with overburden material. Dinwoody material could be used as a single layer or as a component in combination with other materials in a multi-layer cover (i.e., Enhanced Dinwoody Cover currently in use at Panel F).	Dinwoody material is applicable as a soil layer with a low saturated hydraulic conductivity and a high moisture storage capacity that would support vegetation growth as part of a barrier cover system.	Dinwoody material is effective in preventing direct contact with overburden, is present at the Site, and can support vegetation growth. Dinwoody material could be combined with other materials in a multi-layer cover system and is retained.	Retained
SOURCE CONTROLS AND ROUTING							
Surface Controls							
Grading / Erosion Control	Moderate	High	Low to Moderate Capital Low O&M	Grading could be implemented to increase or direct water runoff and as part of installation of a cover. Erosion control is effective in reducing the migration of solids from covered or uncovered areas.	Grading is applicable for eliminating areas where pooling of water occurs and to manage surface water infiltration. Erosion control is applicable for use during and after cover construction to reduce transport of solids by storm water runoff.	Grading/erosion controls are retained for use in cover construction due to their benefit during construction and on covered/uncovered areas in reducing transport of solids in storm water.	Retained
Vegetation	Moderate	High	Moderate Capital Low O&M	Vegetation is effective in stabilizing surface materials, reducing erosion potential, and increasing evapotranspiration. Species management could also reduce selenium uptake.	Vegetation is applicable for use on covered and uncovered ODAs at the Site.	Vegetation is an effective element of cover systems and could be used to stabilize surfaces and reduce selenium uptake on covered and uncovered areas and is retained.	Retained
Slope Stabilization							
Slope Reduction / Retaining Walls	Moderate	High	Low to Moderate Capital Low O&M	Slope stabilization was used in the 2013 Pole Canyon NTCRA and is readily implementable using conventional construction techniques.	Slope reduction and retaining walls are applicable for stabilization of slopes during construction of cover systems on ODAs.	Slope stabilization is retained for use in conjunction with cover construction.	Retained

TABLE 5-1. Evaluation of Technologies for Solids and Soils

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Solids/Soils Screening Result
REMOVAL AND DISPOSAL							
Removal							
Excavation	High	High	Low to High Capital Low to Moderate O&M	Conventional excavation of overburden solids/soils is not effective or implementable for pit backfill or overburden material in external ODAs. Excavation is effective and implementable for small volumes of materials such as sediment in seep areas or ponds and treatment residuals.	Excavation may be applicable for small volumes of materials.	Excavation is not applicable for overburden solids/soil and is not retained. Excavation is retained for small volumes of sediment and/or in-situ treatment residuals.	Retained for Small Volumes
Disposal							
Onsite Consolidation / Disposal	High	High	Low Capital Low O&M	Onsite consolidation/disposal of overburden solids/soils is readily implementable and effective using conventional construction techniques. Onsite consolidation/disposal is effective for small volumes of material such as sediment in seep areas or ponds and treatment residuals.	Onsite consolidation/disposal is not applicable because existing mine pits have already been backfilled and overburden material has already been consolidated into ODAs. However, onsite consolidation/disposal may be applicable for small volumes of material from sedimentation basins or seep areas.	Onsite consolidation/disposal is not applicable for overburden solids/soils and is not retained. Onsite consolidation/disposal is retained for small volumes of material such as seep or pond sediment and/or treatment residuals.	Retained for Small Volumes
Offsite Disposal	High	Low to High	High Capital No O&M	Offsite disposal is not implementable for the large volumes of overburden solids/soils at the Site. Offsite disposal is effective and implementable for small volumes of material such as treatment residuals.	Offsite disposal is not applicable because the overburden material at the Site has already been consolidated into ODAs onsite. However, offsite disposal may be applicable for small volumes of material.	Offsite disposal is not applicable for overburden solids/soils and is not retained. Offsite disposal is retained for small volumes of material such as treatment residuals.	Retained for Small Volumes
SOILDS AND SOILS TREATMENT							
Ex-Situ Treatment							
Stabilization / Fixation	Low	Low	Very High Capital Low O&M	Ex-situ stabilization/fixation is not effective or implementable for immobilizing contaminants in overburden solids and soils.	Ex-situ stabilization/fixation is not applicable for treatment of the large volumes of overburden solids and soils at the Site.	Ex-situ stabilization/fixation is not retained because it is not effective or implementable for conditions found at the Site.	NOT Retained
In-Situ Treatment							
Stabilization / Fixation	Low	Low	High Capital Low O&M	In-situ stabilization/fixation is not effective or implementable for immobilizing contaminants in overburden solids.	In-situ stabilization/fixation is not applicable for treatment of the large volumes of overburden solids at the Site.	In-situ stabilization/fixation is not retained because it is not effective or implementable for conditions found at the Site.	NOT Retained

TABLE 5-2. Evaluation of Technologies for Groundwater

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Groundwater Screening Result
NO ACTION							
No Action							
No Further Action	Moderate	High	No Capital No O&M	No further actions would be taken.	Required by the National Contingency Plan (NCP).	No further action is retained as required by the NCP to provide a baseline against which other alternatives can be compared.	Retained
INSTITUTIONAL CONTROLS							
Institutional Controls							
Administrative Orders / Consent Decrees	High	High	Low Capital Low O&M	Enforcement tools could be effective in requiring groundwater monitoring to evaluate the effectiveness of containment/source control remedies at the Site.	Administrative orders and consent decrees are applicable for compliance monitoring at the Site.	Administrative orders/consent decrees are effective in requiring effectiveness monitoring and reporting and are retained.	Retained
Deed Restrictions / Restrictive Covenants	Moderate	High	Low Capital Low O&M	Deed restrictions could be implemented to prevent the use of groundwater with selenium or arsenic concentrations above MCLs as a domestic water supply.	Deed restrictions are applicable on Simplot-owned land in Sage Valley.	Deed restrictions could be effective in protecting people until the remedy becomes effective and are retained.	Retained
CONTAINMENT							
Engineered Covers							
Tailings Cover	Moderate	Low	Moderate Capital Moderate O&M	Tailings material is available at the Area B tailings impoundments.	Tailings material is potentially applicable for use as a layer in a multi-layer cover system to reduce infiltration into ODAs.	Because tailings material could be highly erodible on ODA slopes, it is not suitable as surface material but could be used as a subsurface layer (though it would be difficult to place on a slope during cover construction). Erodibility on slopes and performance make tailings less desirable than other materials that are available at the Site so the tailings cover is eliminated.	NOT Retained
Chert / Limestone Cover	High	High	Moderate Capital Low O&M	Chert/Limestone is readily available in the Rex Chert Member at the Site and is proven effective in preventing vegetation from rooting.	Chert/Limestone is applicable as a capillary break layer and/or a barrier layer in different cover types.	Chert/Limestone is effective as a barrier layer or a water conveyance layer and is typically combined with other materials for an effective cover system and is retained.	Retained
Dinwoody Cover	High	High	Moderate Capital Low O&M	Dinwoody Formation material is available at the Site and is proven effective in reducing infiltration and the mobility of selenium. The volume and suitability of the Dinwoody material on Site still needs to be evaluated.	Dinwoody material is applicable as a soil layer with a low saturated hydraulic conductivity to reduce infiltration and a high moisture storage capacity that would support vegetation growth as part of a multi-layer cover system.	Dinwoody material is effective in reducing infiltration to overburden and is present at the Site. Dinwoody material could be combined with other cover layers and is retained.	Retained
Geosynthetic Cover (GM/GCL)	High	Moderate	High Capital High O&M	Geosynthetic covers are effective in limiting infiltration and reducing the mobility of selenium but are more difficult to implement than other types of covers because of problems related to tearing the membrane.	Geosynthetic covers are applicable as a low permeability layer of a multi-layer cover system.	Geosynthetic cover layers are effective in reducing infiltration into the ODAs but have lower implementability and higher capital and O&M costs relative to other types of cover layers. Geosynthetic covers are retained.	Retained
SOURCE CONTROLS AND ROUTING							
Diversion							
Open / Closed Channels	High	High	Low Capital Low O&M	Open or closed channels are effective means of conveying groundwater that discharges to the surface at springs to a treatment facility at the Site.	Diversion channels are applicable for conveying groundwater to a treatment facility.	Diversion channels are effective in conveying groundwater and may be used as part of an overall Site remedy and are retained.	Retained
REMOVAL AND DISPOSAL							
Removal							
Extraction Wells	Low	High	High Capital Low O&M	Use of extraction wells upgradient of Hoopes Springs is unlikely to be effective due to known hydrogeologic complexities. Groundwater reports to the surface at Hoopes Spring and South Fork Sage Creek Springs and can be collected for treatment there if necessary.	Extraction wells are not applicable for groundwater at the Site.	Hoopes Spring acts as a regional groundwater discharge feature and effectively captures the migration of COCs within Wells Formation groundwater. Groundwater reports to the surface without the need for extraction wells.	NOT Retained

TABLE 5-2. Evaluation of Technologies for Groundwater

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Groundwater Screening Result
Groundwater Disposal							
Discharge to Onsite Treatment or Other Storage/Disposal Facility	High	High	Low Capital Low O&M	Discharge of groundwater from Hoopes Spring and South Fork Sage Creek springs to an onsite treatment or other storage/disposal facility would require a conveyance system. Piping and pumps are currently in place and effectively convey groundwater to the Hoopes Water Treatment Plant (WTP) Pilot Study.	Groundwater conveyance/discharge to an onsite treatment or other storage/disposal facility is applicable in areas where MCLs are exceeded in alluvial or Wells Formation groundwater.	Discharge of extracted groundwater to an onsite treatment or other storage/disposal facility is effective and is retained.	Retained
GROUNDWATER TREATMENT							
Ex-Situ Treatment							
Gravity / Mechanical Separation	Low to High	High	Moderate Capital Moderate O&M	Gravity/mechanical separation is used to settle waste streams in the Hoopes WTP Pilot Study and effectively removes reduced, elemental selenium from groundwater at the Site.	Gravity/mechanical separation is applicable for dewatering waste streams from other treatment technologies.	Gravity/mechanical separation is retained for use with other treatment technologies and is effective in removing reduced, elemental selenium from groundwater.	Retained
Media Filtration	High	High	Moderate Capital Moderate O&M	Media filtration (typically using sand) is proven effective for removing suspended solids and trapping the particles on/in a filter bed at the Hoopes WTP Pilot Study.	Media filtration is applicable as a component of an overall treatment system for groundwater at the Site.	Media filtration is retained for use with other treatment technologies and is proven effective for removing suspended solids in groundwater.	Retained
Ultrafiltration / Reverse Osmosis	High	High	High Capital High O&M	Ultrafiltration/reverse osmosis (UF/RO) technologies are proven effective for reducing selenium concentrations in groundwater at the Site and have been tested at the Hoopes WTP Pilot Study.	Ultrafiltration/reverse osmosis (UF/RO) is applicable as a component of an overall treatment system for groundwater that discharges at Hoopes Spring.	Ultrafiltration/reverse osmosis (UF/RO) technologies are retained because they are proven effective for producing concentrated selenium water for additional treatment and have been tested at the Hoopes WTP Pilot Study.	Retained
Chemical Precipitation	Low	High	Moderate Capital High O&M	Chemical precipitation is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.	Chemical precipitation could be applicable for groundwater treatment but would require additional treatment trains.	Chemical precipitation is not retained due to low effectiveness for oxidized selenium.	NOT Retained
Oxidation / Reduction	Low	High	Moderate Capital High O&M	Oxidation/reduction is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.	Oxidation/reduction could be applicable for groundwater treatment but would require additional treatment trains.	Oxidation/reduction is not retained due to low effectiveness for oxidized selenium.	NOT Retained
Biodegradation	High	High	Moderate Capital Moderate O&M	Ex-situ biological treatment is proven effective for removing selenium at the Hoopes WTP Pilot Study fluidized bed bioreactor (FBR). Microbial reduction of selenate and selenite to elemental selenium allows for easier removal of selenium by other technologies in the treatment train.	Ex-situ biological treatment is applicable for groundwater that discharges at Hoopes Spring and South Fork Sage Creek springs.	Ex-situ biological treatment is retained because it is effective for reducing selenium concentrations in groundwater and has been tested at the Site. As determined by design and operations testing, other process options may be required to support an ex-situ biological treatment system.	Retained
In-Situ Treatment							
Biodegradation	Low	Low	High Capital Moderate O&M	In-situ biological treatment could be effective for removing selenium in groundwater; however, treatment would require a large number of borings/wells and removal effectiveness would be contingent on the selenium species present.	In-situ biodegradation could be applicable for treatment of alluvial or Wells Formation groundwater.	In-situ biological treatment is not retained due to low effectiveness and implementability for groundwater in the Wells Formation aquifer.	NOT Retained
Natural Physical/Chemical/Biological Treatment							
Monitored Natural Attenuation (MNA)	Low	High	Low Capital Low O&M	MNA could be effective for removing selenium in groundwater; however, sorption and biologically-mediated MNA processes are dependent on geochemical conditions in the alluvial and Wells Formation aquifers at the Site.	MNA could be applicable for Wells Formation and alluvial groundwater.	MNA is retained for Wells Formation and alluvial groundwater.	Retained

TABLE 5-3. Evaluation of Technologies for Surface Water

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Surface Water Screening Result
NO ACTION							
No Action							
No Further Action	Moderate	High	No Capital No O&M	No further action would be taken.	Required by the National Contingency Plan (NCP).	No further action is retained as required by the NCP to provide a baseline against which other options can be compared.	Retained
INSTITUTIONAL CONTROLS / ACCESS CONTROLS							
Institutional Controls							
Administrative Orders / Consent Decrees	High	High	Low Capital Low O&M	Enforcement tools are effective in requiring monitoring and reporting on the performance and effectiveness of a remedy.	Administrative orders and consent decrees are applicable for evaluation of the effectiveness remedies implemented throughout the Site.	Administrative orders and consent decrees are effective in requiring monitoring for performance and effectiveness and are retained.	Retained
Signs	Moderate	High	Low Capital Low O&M	Signage is moderately effective in notifying people that drinking the water in certain creeks/springs at the Site is potentially unsafe.	Posting signs would be applicable at Hoopes Spring and at South Fork Sage Creek Springs.	Institutional controls such as signs are retained for use as part of an overall Site remedy.	Retained
Access Controls							
Fences/Gates	Moderate	High	Low Capital Low O&M	Fencing is effective in preventing large animal exposure to selenium in surface water but would not prevent access to smaller animals or birds.	Fencing is potentially applicable to areas that have unacceptable risks.	Fencing is effective at limiting large animal access and direct exposure to selenium in surface water on the Site. Fencing is typically part of an overall Site remedy and is retained.	Retained
CONTAINMENT							
Engineered Covers							
Chert / Limestone Cover	High	High	Low Capital Low O&M	Chert/Limestone is readily available in the Rex Chert Member at the Site and could be effective in preventing direct contact with surface water in seeps and/or detention basins.	Chert/Limestone is applicable for use as a rock cover on seeps and/or detention basins.	Chert/Limestone could be effective as a barrier layer on seeps and/or detention basins and is retained.	Retained
Dinwoody Cover	Moderate to High	High	Moderate Capital Low to Moderate O&M	Dinwoody material is available at the Site and is proven effective in containing overburden material and controlling the source of selenium to surface water.	Dinwoody covers are applicable to ODAs that are sources of selenium to surface water at the Site.	Dinwoody material is effective in reducing infiltration to overburden and is present at the Site. Dinwoody material could be combined with other cover layers and is retained.	Retained
Geosynthetic Cover (GM/GCL)	Moderate to High	Moderate	High Capital High O&M	Geosynthetic covers are effective in containing overburden material and controlling the source of selenium to surface water but are more difficult to implement than other types of covers because of problems related to tearing the membrane.	Geosynthetic covers are applicable as a low permeability layer of a multi-layer cover system on ODAs that are a source of selenium to surface water.	Geosynthetic cover layers are effective in reducing infiltration into the ODAs but have lower implementability and higher capital and O&M costs relative to other types of cover layers. Geosynthetic covers are retained.	Retained
Sediment Control Features							
Dikes and Berms	Moderate	High	Low Capital Low O&M	Dikes and berms are effective in managing surface water infiltration and runoff while controlling erosion.	Dikes and berms are applicable for controlling storm water runoff and sediment mobilization around ODAs.	Dikes and berms are effective in managing runoff and controlling erosion and are retained.	Retained
Detention Basins	Moderate	High	Low Capital Low O&M	Retaining contaminated surface water in detention basins is used at the Site and is effective in preventing surface migration to local creeks.	Detention basins are applicable in remedial construction areas and areas where contaminated surface water could flow off Site.	Detention basins are effective in reducing the transport of selenium to local creeks.	Retained
SOURCE CONTROLS AND ROUTING							
Diversion							
Open / Closed Channels	High	High	Low Capital Low O&M	Open/closed channels are effective means of diverting surface water around ODAs or conveying water to a treatment facility at the Site.	Diversion channels are applicable for preventing run-on to and diverting surface water around ODAs. Channels are also applicable for conveying surface water to a treatment facility.	Open/closed diversion channels are effective in conveying surface water and are typically part of an overall Site remedy.	Retained

TABLE 5-3. Evaluation of Technologies for Surface Water

Technology/Process Option	Effectiveness	Implementability	Cost	Site-Specific Considerations	Applicability Within the Site	Decision Rationale	Surface Water Screening Result
DISPOSAL							
Surface Water Disposal							
Discharge to Onsite Treatment or Other Storage/Disposal Facility	High	High	Low Capital Low O&M	Collection of seep water is feasible.	Discharge of surface water to an onsite treatment or other storage/disposal facility is applicable for the Pole Canyon ODA seep.	Discharge of surface water to an onsite treatment or other storage/disposal facility is retained for the Pole Canyon ODA seep.	Retained
SURFACE WATER TREATMENT							
Ex-Situ Treatment							
Gravity / Mechanical Separation	Low	Low	Moderate Capital Moderate O&M	Gravity/mechanical separation is applicable for dewatering waste streams from other treatment technologies. It would not remove dissolved selenium from surface water at the Site.	Gravity/mechanical separation is not applicable to Site conditions.	Gravity/mechanical separation is not retained because it is not effective for dissolved contaminants in surface water at the Site.	NOT Retained
Media Filtration	Moderate	Low	Moderate Capital Moderate O&M	Media filtration (typically using sand) is proven effective for removing suspended solids and trapping the particles on/in a filter bed in conjunction with other technologies. It is not effective for dissolved selenium in surface water in seeps and ponds.	Media filtration is not applicable to Site conditions.	Media filtration is not retained because it is not applicable to contaminated surface water at the Site.	NOT Retained
Ultrafiltration / Reverse Osmosis	Moderate	Low	High Capital High O&M	Although ultrafiltration/reverse osmosis technologies are proven effective for selenium removal and have been tested at the Hoopes WTP Pilot Study, the Site conditions do not favor its use for surface water (either due to high flow/low concentration water in creeks or to low but seasonally variable flow/high concentration water in the Pole Canyon ODA seep).	Could be applicable to the Pole Canyon ODA seep, but PRB technology is more applicable.	Ultrafiltration/reverse osmosis is not retained because it has a lower effectiveness and higher cost than PRB technology for treatment of the Pole Canyon ODA seep.	NOT Retained
Chemical Precipitation	Low	Low	Moderate Capital High O&M	Chemical precipitation is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.	Chemical precipitation is not applicable for surface water in seeps and ponds that requires treatment.	Chemical precipitation is not retained due to relatively lower effectiveness when compared to other treatment options.	NOT Retained
Oxidation / Reduction	Low	Low	Moderate Capital High O&M	Oxidation/reduction is more effective for reduced forms of selenium. Because selenium at the Site generally occurs in oxidized forms, additional steps may be required for removal efficiency.	Oxidation/reduction is not applicable for surface water in seeps and ponds that requires treatment.	Oxidation/reduction is not retained due to relatively lower effectiveness when compared to other options.	NOT Retained
Biodegradation	High	Moderate	Moderate Capital Moderate O&M	Ex-situ biological treatment is proven effective at the Hoopes WTP Pilot Study fluidized bed bioreactor (FBR). However, in-situ biodegradation would be more effective for the Pole Canyon ODA seep, which has seasonally-varying flows and concentrations.	Ex-situ biological treatment is not applicable for surface water in seeps and ponds that requires treatment.	Ex-situ biological treatment is not retained because Site conditions favor in-situ treatment.	NOT Retained
In-Situ Treatment							
Biodegradation	High	High	Moderate Capital Moderate to High O&M	Passive in-situ biological treatment, such as a permeable reactive barrier (PRB), is effective for removing selenium and could be used at seeps and ponds at the Site.	In-situ biodegradation is potentially applicable for the Pole Canyon ODA seep and for detention ponds.	In-situ biological treatment is retained because a passive treatment technology such as a PRB could be effective for treatment of seep and pond water.	Retained

FIGURES

J.R. SIMPLOT COMPANY
SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1

FIGURE 1-1

LOCATION OF THE SMOKY CANYON MINE

DATE: AUG 2019

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

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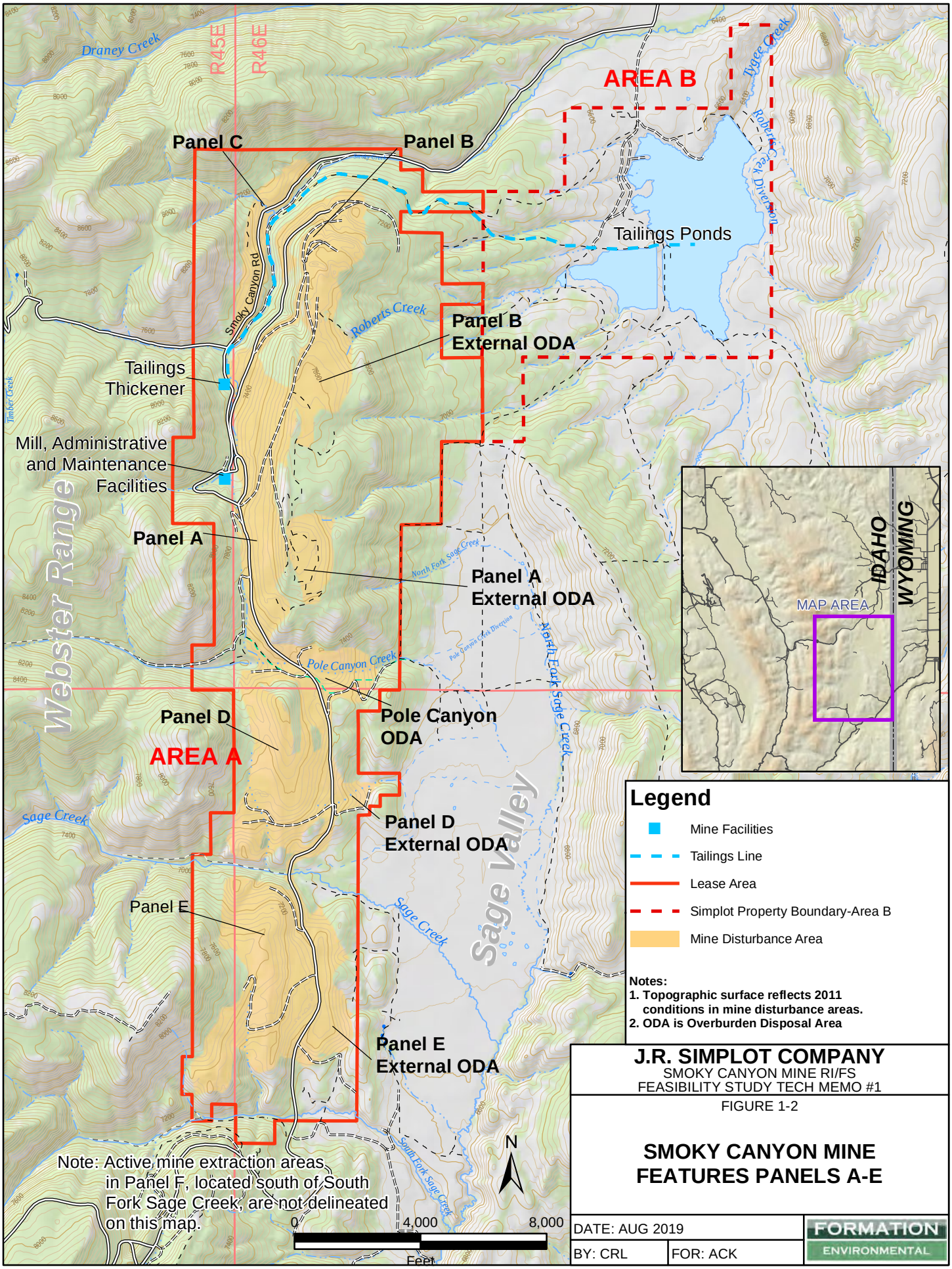

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FEASIBILITY STUDY TECH MEMO #1

FIGURE 1-2

SMOKY CANYON MINE FEATURES PANELS A-E

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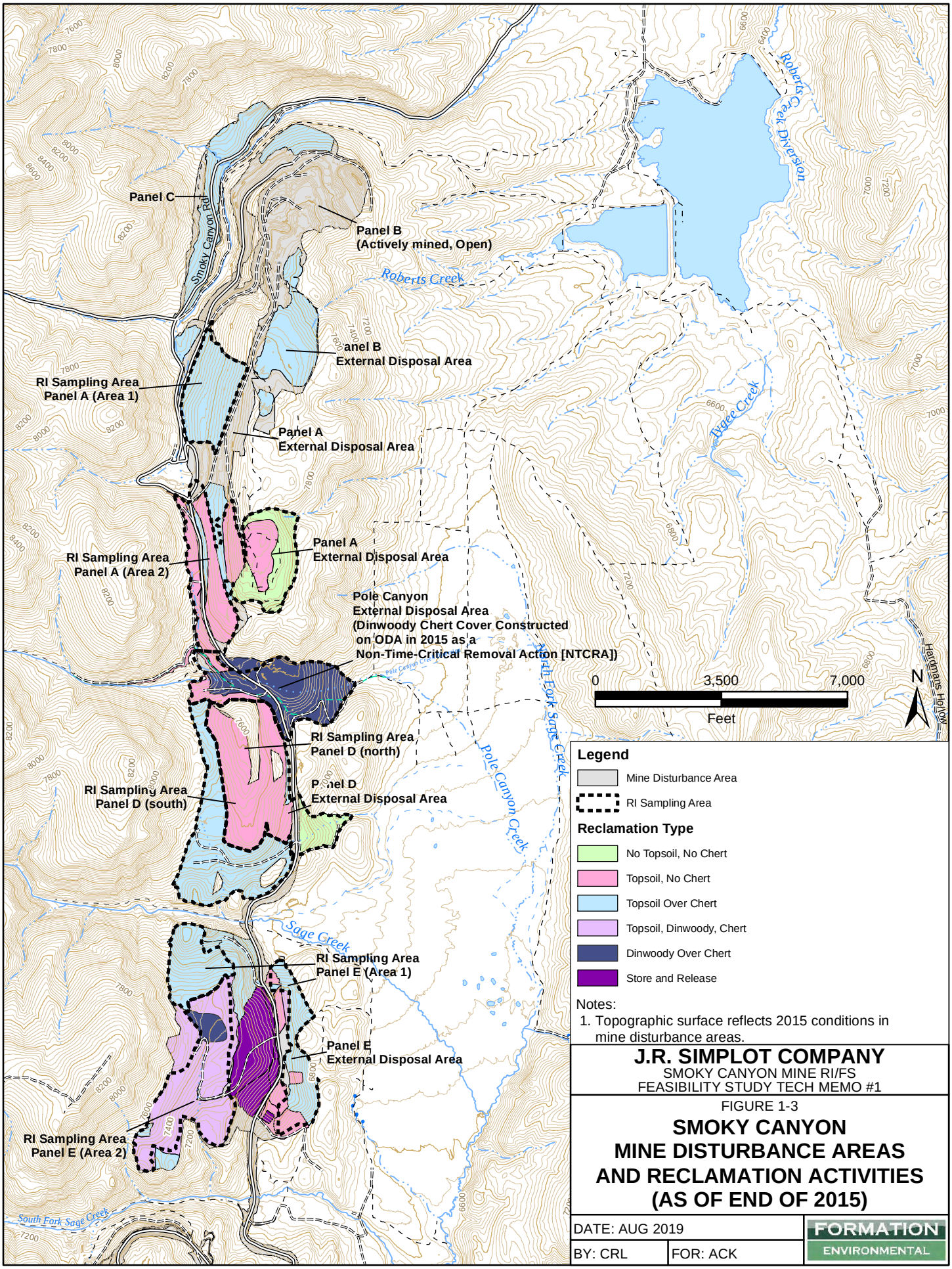
Panel C
Panel B
(Actively mined, Open)
Smoky Canyon Rd
Roberts Creek
Roberts Creek Diversion
Panel B
External Disposal Area
RI Sampling Area
Panel A (Area 1)
Panel A
External Disposal Area
Tygee Creek
RI Sampling Area
Panel A (Area 2)
Panel A
External Disposal Area
Pole Canyon
External Disposal Area
(Dinwoody Chert Cover Constructed
on ODA in 2015 as a
Non-Time-Critical Removal Action [NTCRA])
Pole Canyon Creek
North Fork Sage Creek
Hardmans Hollow
0
3,500
7,000
Feet
N
RI Sampling Area
Panel D (north)
RI Sampling Area
Panel D (south)
Panel D
External Disposal Area
Pole Canyon Creek
Sage Creek
RI Sampling Area
Panel E (Area 1)
Panel E
External Disposal Area
RI Sampling Area
Panel E (Area 2)
South Fork Sage Creek
Legend
Mine Disturbance Area
RI Sampling Area
Reclamation Type
No Topsoil, No Chert
Topsoil, No Chert
Topsoil Over Chert
Topsoil, Dinwoody, Chert
Dinwoody Over Chert
Store and Release
Notes:
1. Topographic surface reflects 2015 conditions in mine disturbance areas.
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SMOKY CANYON MINE RI/FS
FEASIBILITY STUDY TECH MEMO #1
FIGURE 1-3
SMOKY CANYON
MINE DISTURBANCE AREAS
AND RECLAMATION ACTIVITIES
(AS OF END OF 2015)
DATE: AUG 2019
BY: CRL
FOR: ACK
FORMATION
ENVIRONMENTAL
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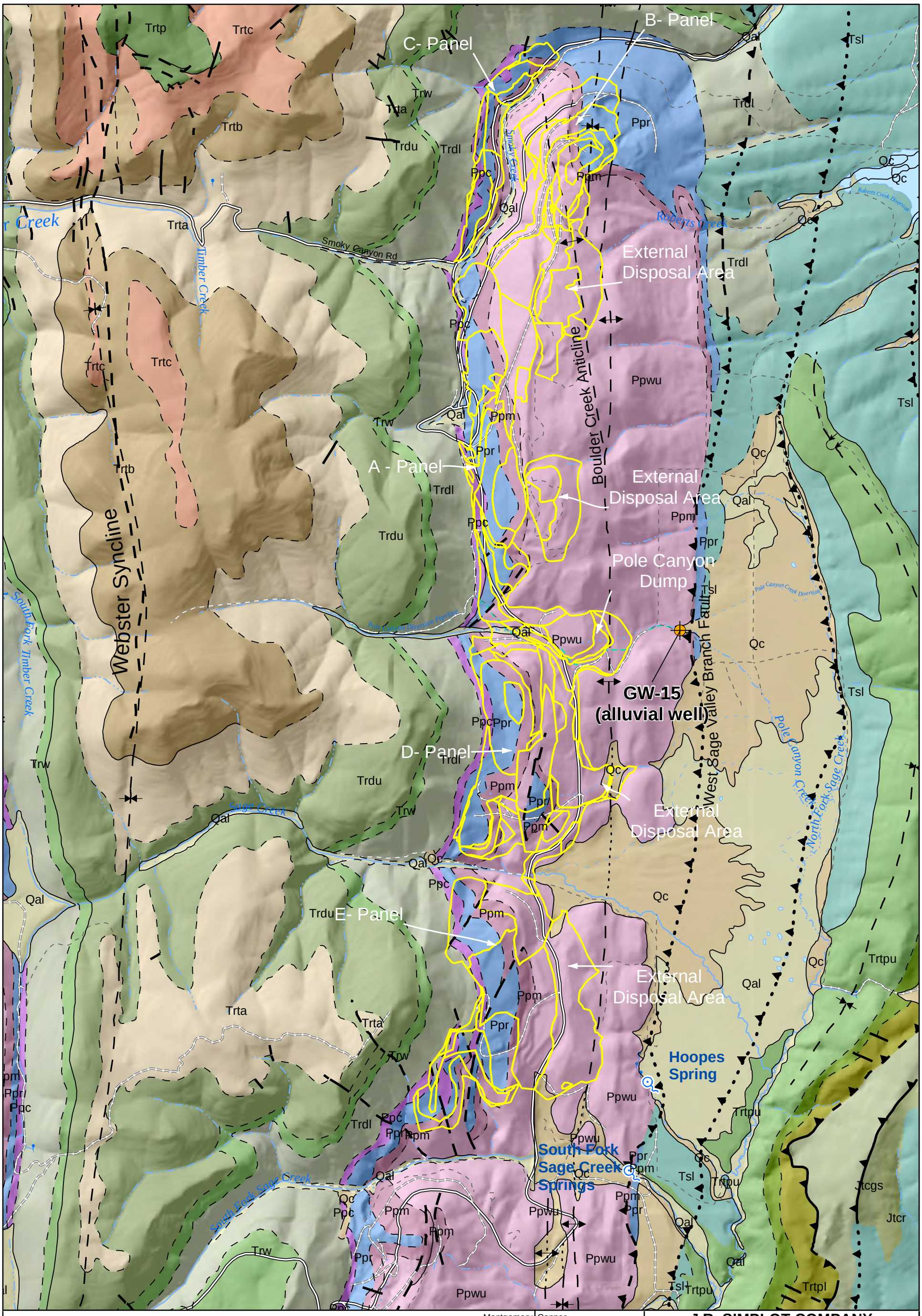

Legend

Geologic Features

- Contact (Dashed where inferred, dotted where buried)
- Normal Fault (Dashed where inferred, dotted where buried)
- Thrust Fault (Dashed where inferred, dotted where buried)
- Syncline Axis
- Anticline Axis

Hydrology

- Perennial Stream
- Intermittent Stream

Mine Features

- Areas of Mine Disturbance

Montgomery & Cheney (1967) | Conner (1980)

See Figure 2.3-2 for Explanation of Geologic Map Units.

0 1,500 3,000 Feet

N

Geology:
Geology of the Sage Valley Quadrangle, Idaho-Wyoming. John L. Conner, BYU, 1980
Geology of the Stewart Flat Quadrangle, Caribou County, Idaho. Kathleen M. Montgomery and T. M. Cheney, USGS, 1967

Topography:
2011 aerial survey (shown as hillshade).

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FIGURE 2-1

GEOLOGIC MAP OF SMOKY CANYON MINE AND VICINITY

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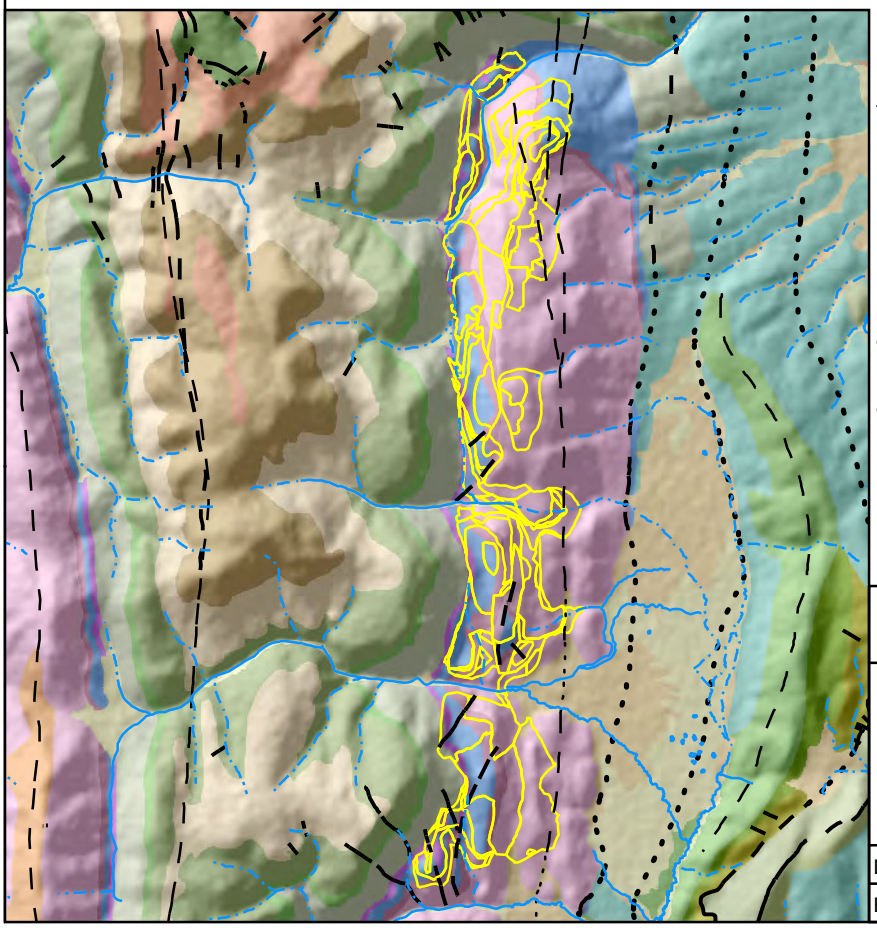
EXPLANATION FOR GEOLOGIC MAP

Geologic Map Units and Symbols

Age	Formation	Map Symbol	Description
Quaternary		Qt	Travertine
		Qc	Colluvium
		Qal	Alluvium
Tertiary	Salt Lake	Tsl	Salt Lake Formation
	Unconformity		
Jurassic	Nugget Sandstone	Jn	Nugget Sandstone
Triassic	Thaynes	Trtpu	Upper Portneuf Limestone Member
		Tral	Ankareh Formation - Lane Tongue
		Trtpl	Lower Portenuf Limestone Member
		Trtc	Thaynes C Member
		Trtb	Thaynes B Member
		Trta	Thaynes A Member
	Dinwoody	Trdu	Upper Dinwoody Formation
	Woodside	Trw	Woodside Formation
	Dinwoody	Trdl	Lower Dinwoody Formation
Permian	Phosphoria	Ppc	Cherty Shale Member
		Ppr	Rex Chert Member
		Ppm	Meade Peak Member
Pennsylvanian/Permian	Park City & Wells	Ppwu	Grandeur Member of Park City Formation and Upper Wells Formation
	Wells	Ppwl	Lower Wells Formation



Geologic Map Symbols

Contact (Dashed where inferred, dotted where buried)

Normal Fault (Dashed where inferred, dotted where buried)

Thrust Fault (Dashed where inferred, dotted where buried)

Syncline Axis

Anticline Axis

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FIGURE 2-2

EXPLANATION FOR GEOLOGIC MAP

DATE: AUG 2019

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

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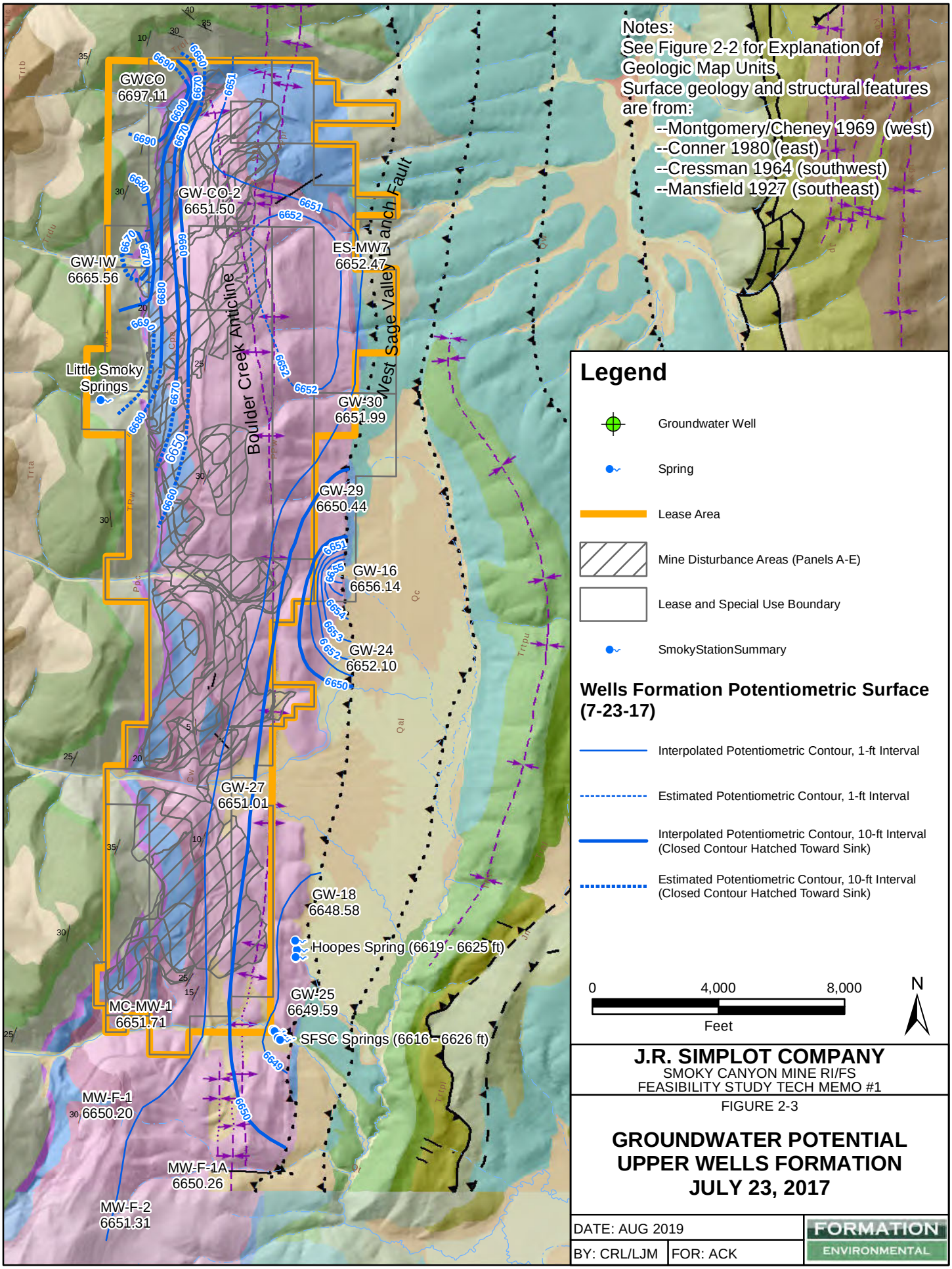

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FIGURE 2-3

GROUNDWATER POTENTIAL UPPER WELLS FORMATION JULY 23, 2017

DATE: AUG 2019
BY: CRL/LJM | FOR: ACK

FORMATION ENVIRONMENTAL

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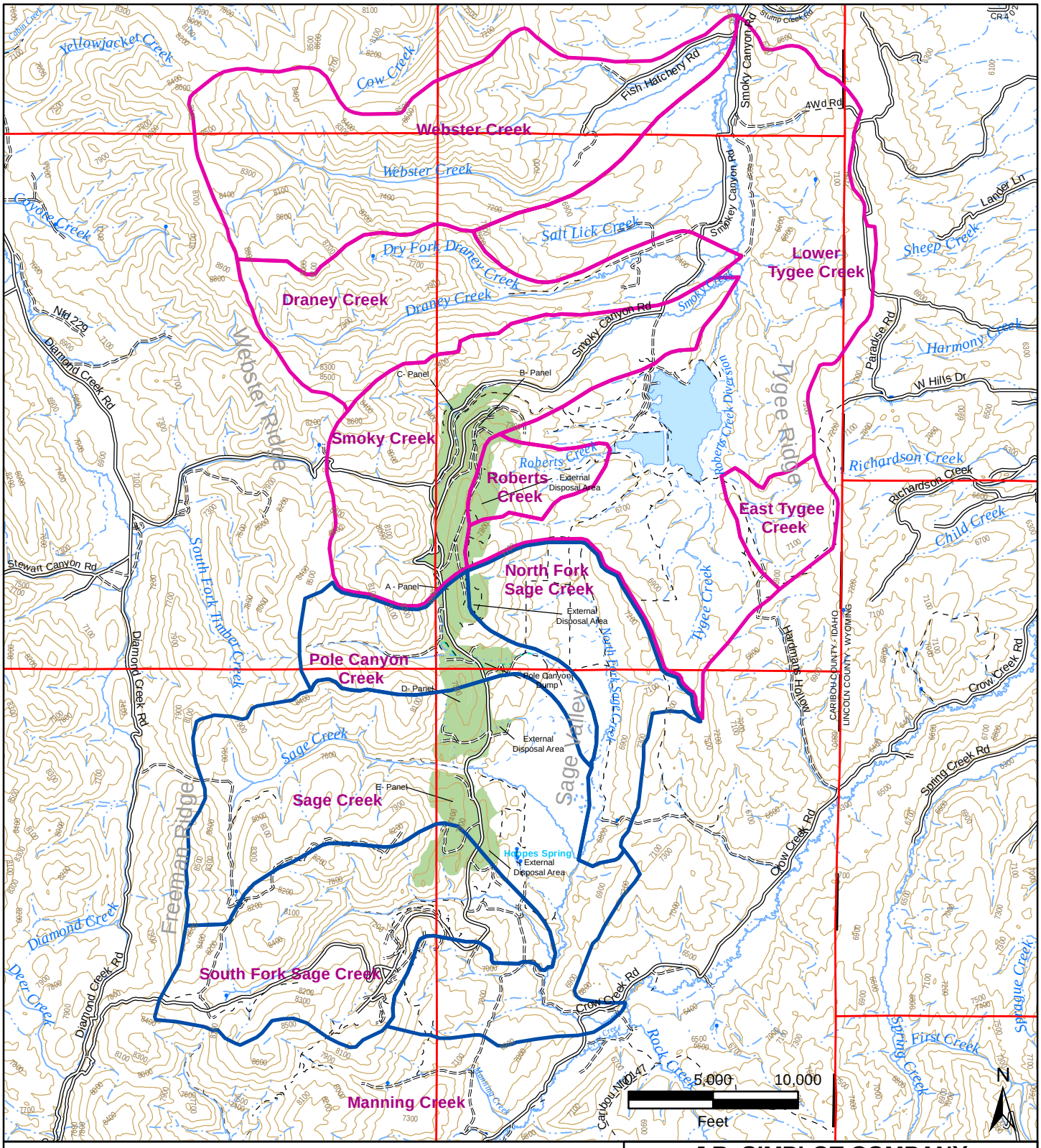

Legend

- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Pipeline
- Historic Flow Path
- Canal Ditch
- Intemittent Stream
- Perennial Stream
- Lake/Pond
- Mine Disturbance

Watershed Features

- Sage Creek Basin (Drains to Crow Creek)
- Tygee Creek Basin (Drains to Stump Creek)

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FIGURE 2-4

SMOKY CANYON MINE AND VICINITY HYDROLOGIC FEATURES

DATE: AUG 2019	FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK

S:\GIS\arcprj2\010109\plt\FS\TechMemo1\Fig2_04_wshed.mxd

S:\Jobs\0442-004-900-Simplot-Smoky\FeasibilityStudy\FSTM1\Revised FSTM1\Figures\Fig2-5_SeMassLoad_rev.pptx

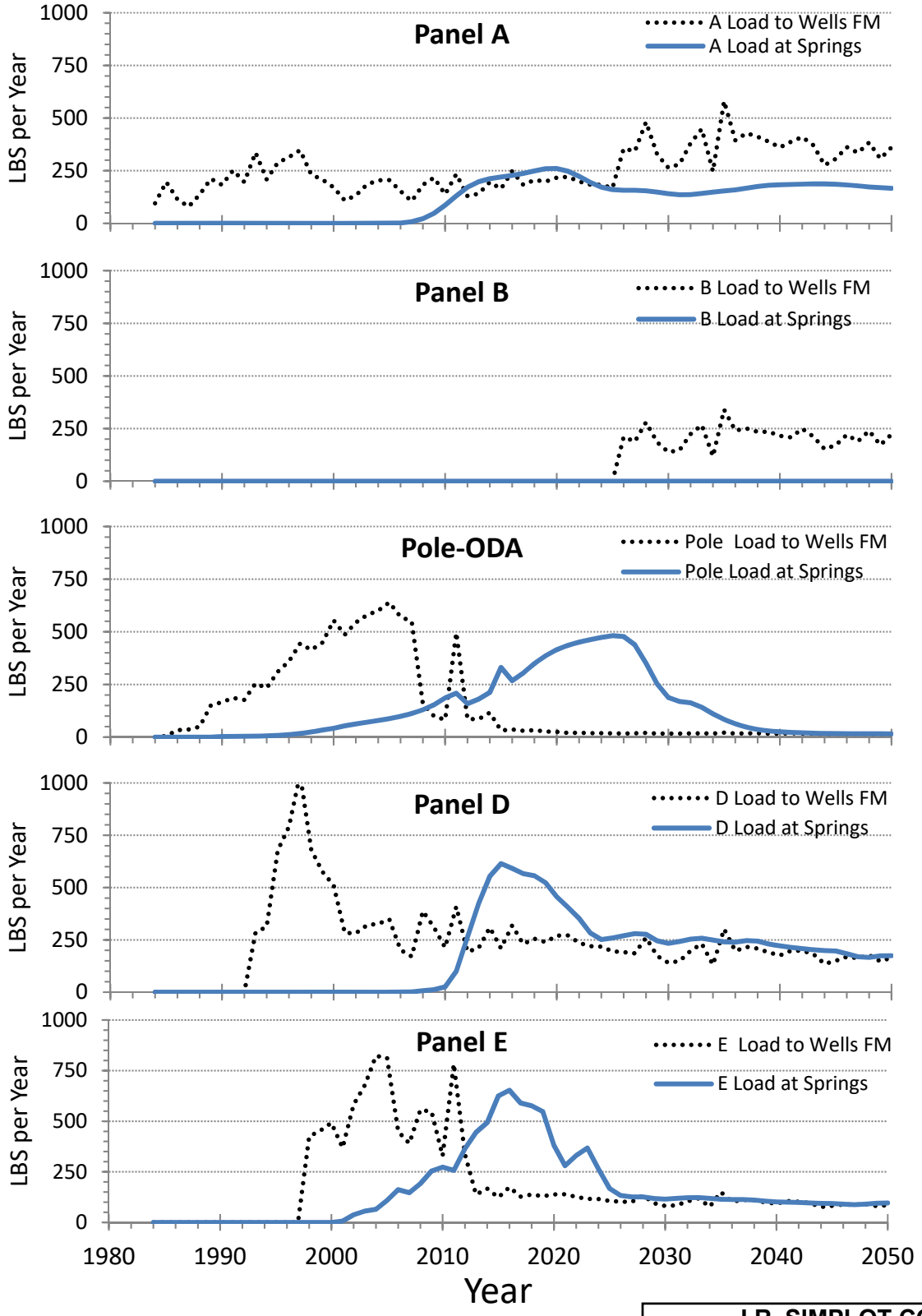

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FIGURE 2-5

ESTIMATED SELENIUM MASS LOAD TO THE WELLS FORMATION AND ARRIVAL AT SPRINGS COMPLEX FOR EACH SOURCE AREA

DATE: AUG 2019	FORMATION ENVIRONMENTAL
BY: PHT FOR: ACK	

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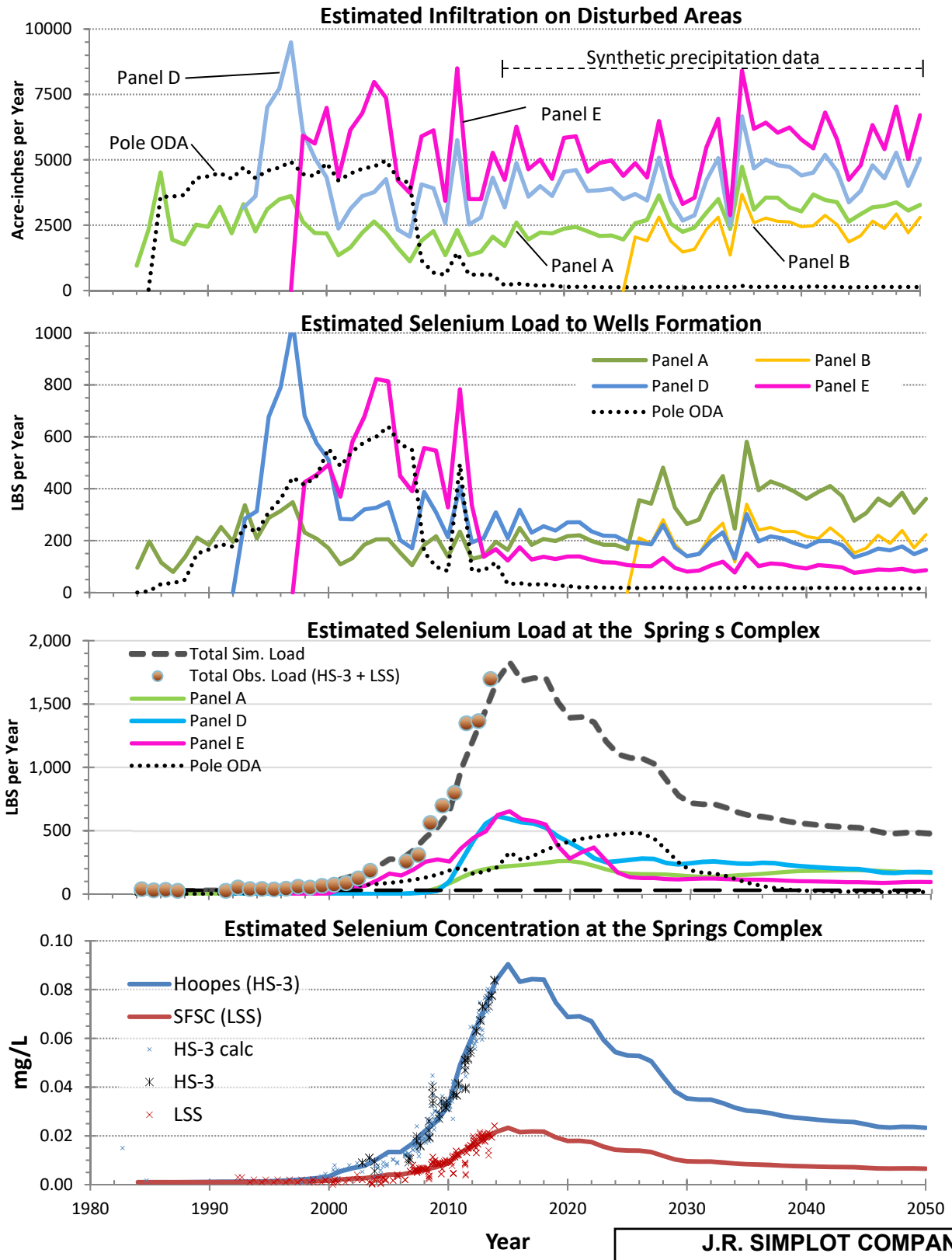

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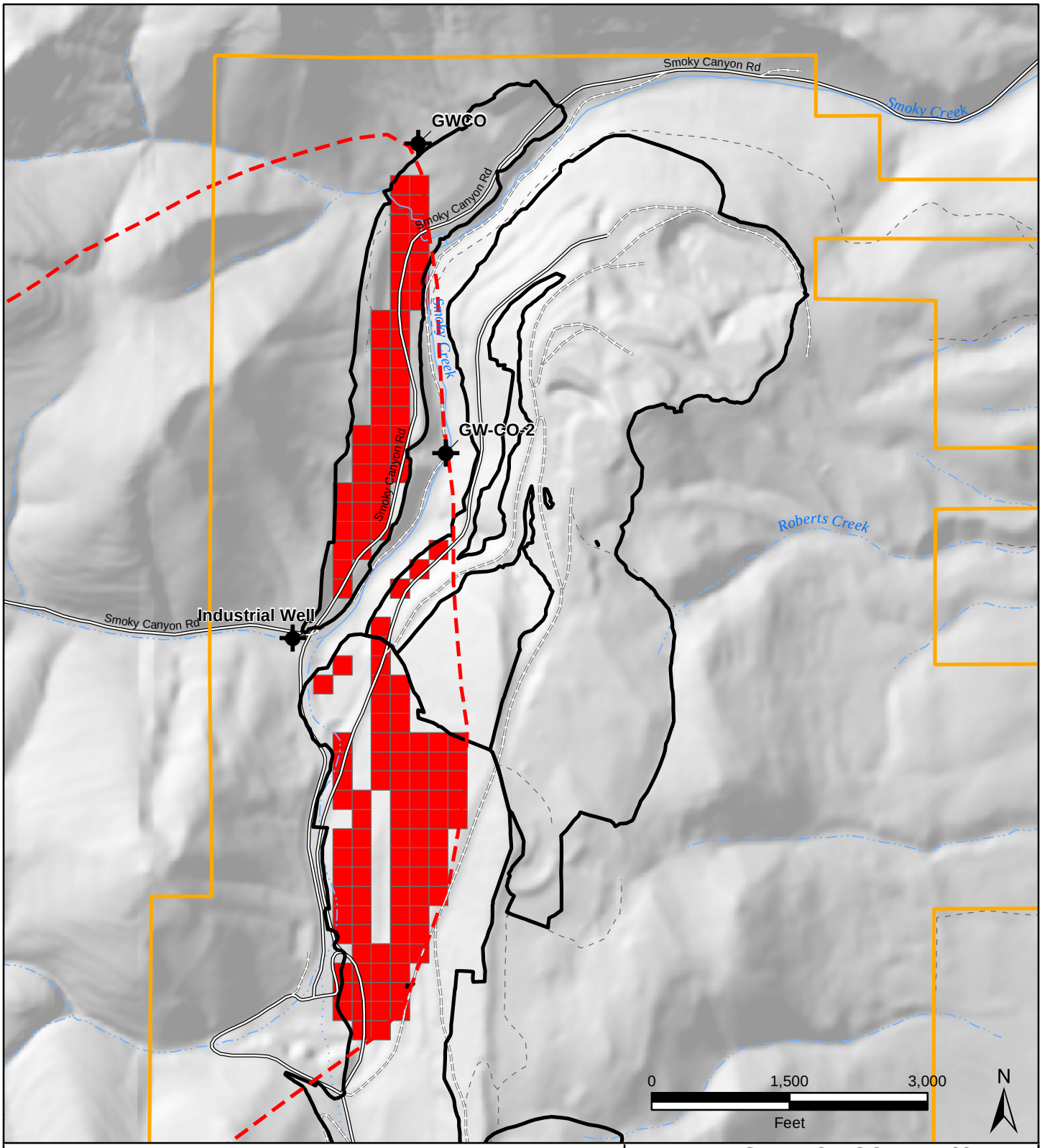
FIGURE 2-6

ESTIMATED INFILTRATION ON DISTURBERD AREAS, ESTIMATED SELENIUM LOADING TO WELLS FORMATION AND SPRINGS COMPLEX

DATE: AUG 2019

BY: PHT | FOR: ACK

FORMATION ENVIRONMENTAL



Legend

- Groundwater Monitoring Locations
- Minor Road
- Unimproved Road
- Trail (4WD)
- Historic Flow Path
- Intemittent Stream
- Perennial Stream
- Lease Area
- Structural Influence
- Approximate Mine Panel Boundaries
- Backfilled Areas (Source Cells) v2

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FIGURE 2-7

MODEL GRID CELLS REPRESENTING AREAS OF SELENIFEROUS BACKFILL (2012 CONDITIONS) INSIDE ASSUMED GW-IW CAPTURE ZONE

DATE: AUG 2019

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

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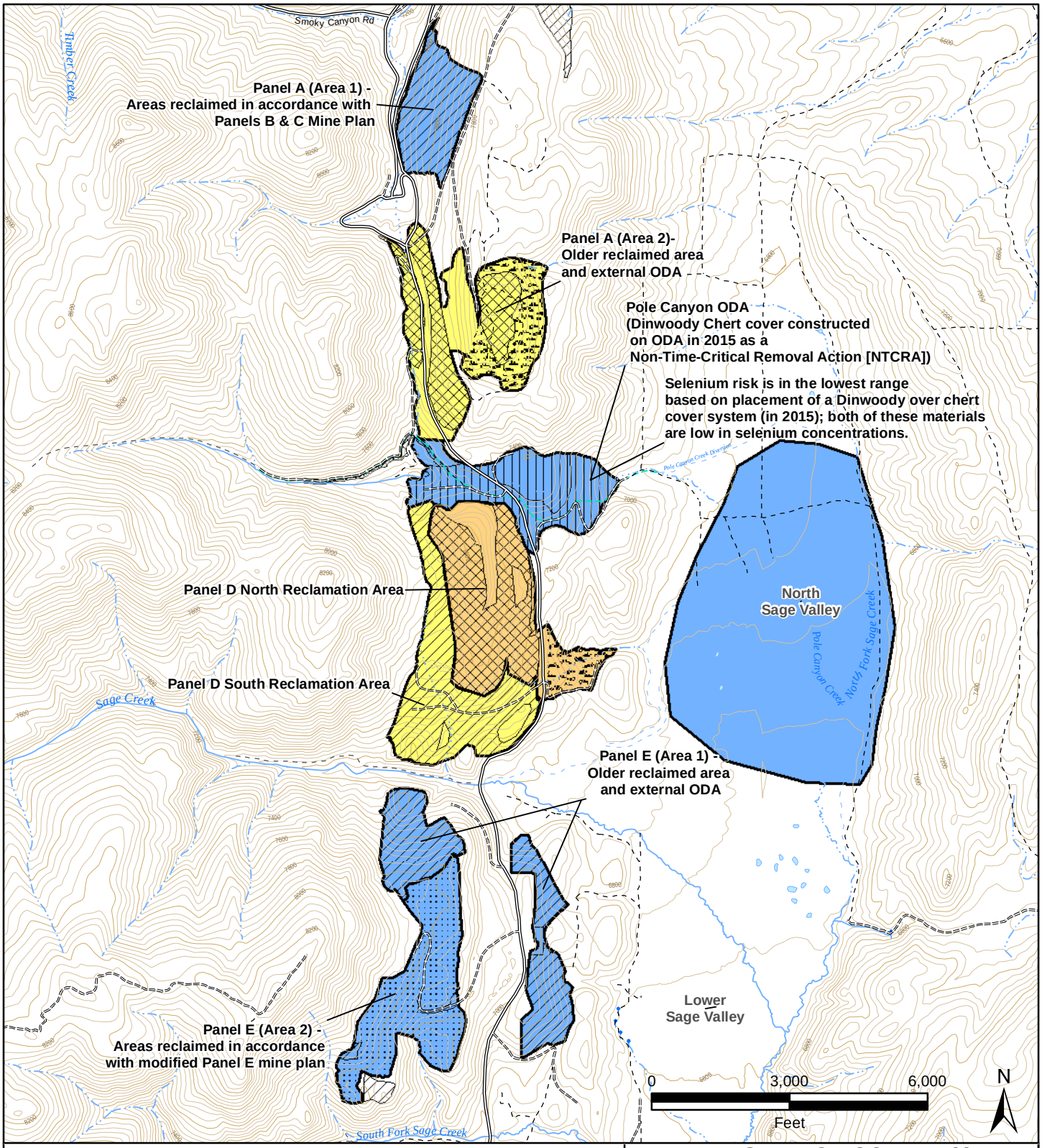

Legend

Cover Type

- DINWOODY CHERT (2015)
- TOPSOIL DINWOODY CHERT
- NO TOPSOIL NO CHERT
- TOPSOIL OVER CHERT
- TOPSOIL NO CHERT

Selenium Risk

- Lowest Risk
- Moderate - High Risk
- Highest Risk

- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)

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FIGURE 2-8

SUMMARY OF SELENIUM RISK TO TERRESTRIAL BIOTA

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FORMATION ENVIRONMENTAL

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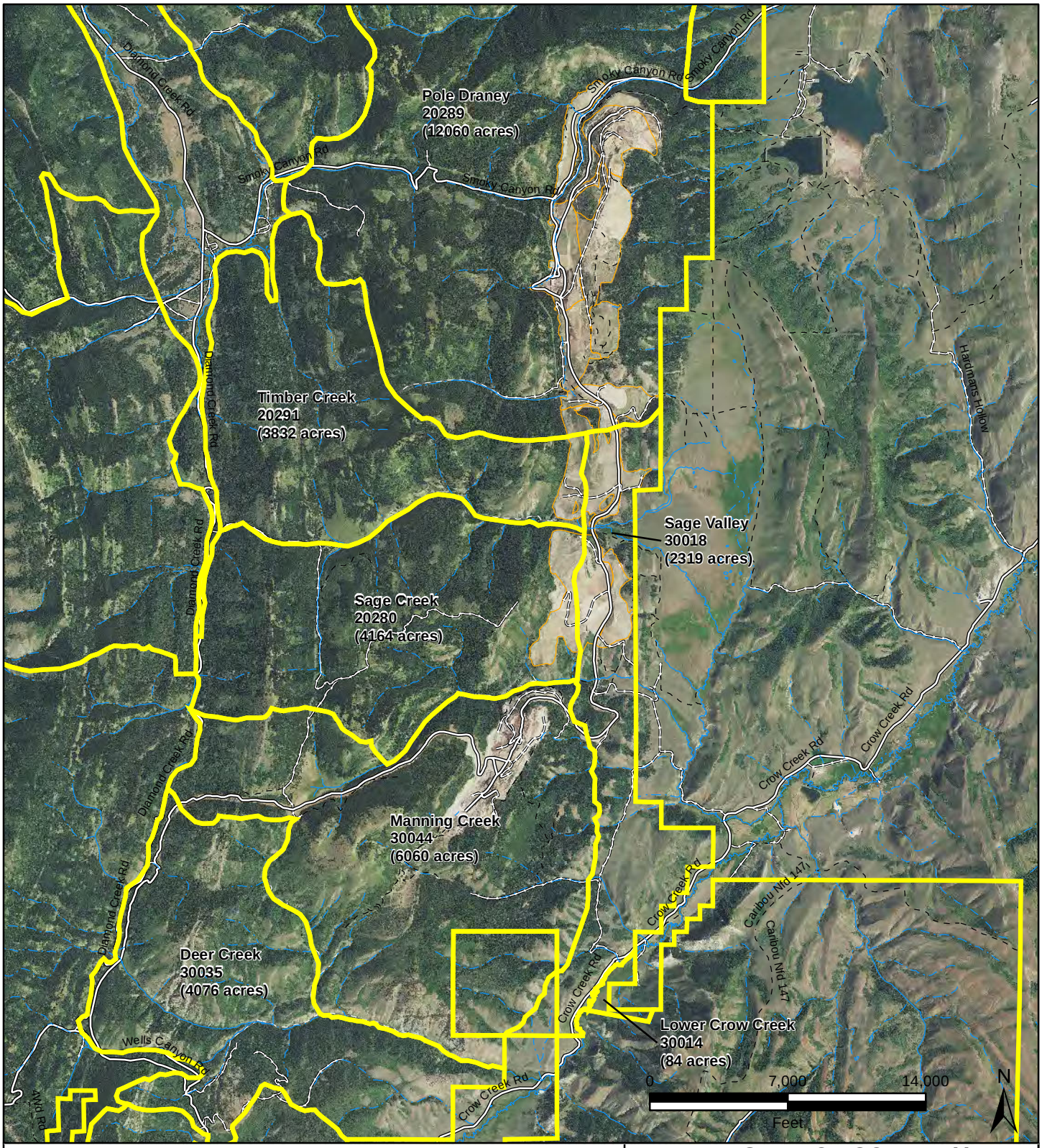

Legend

- Grazing Allotment
- Mine Disturbance Area (Panels A-E)
- Perennial Stream
- Intermittent Stream

Allotments in vicinity of Smoky Canyon Mine are labeled.
Source: U.S. Forest Service (USFS). 2008. Range allotments shapefile - in Geographic Information System (GIS) coverages provided by Caribou National Forest, via e-mail. April 2008.
Aerial Source: 2013 NAIP photo from USDA

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FIGURE 2-9

USFS GRAZING ALLOTMENTS - WITH SATELLITE IMAGERY

DATE: AUG 2019		FORMATION ENVIRONMENTAL
BY: CRL	FOR: ACK	

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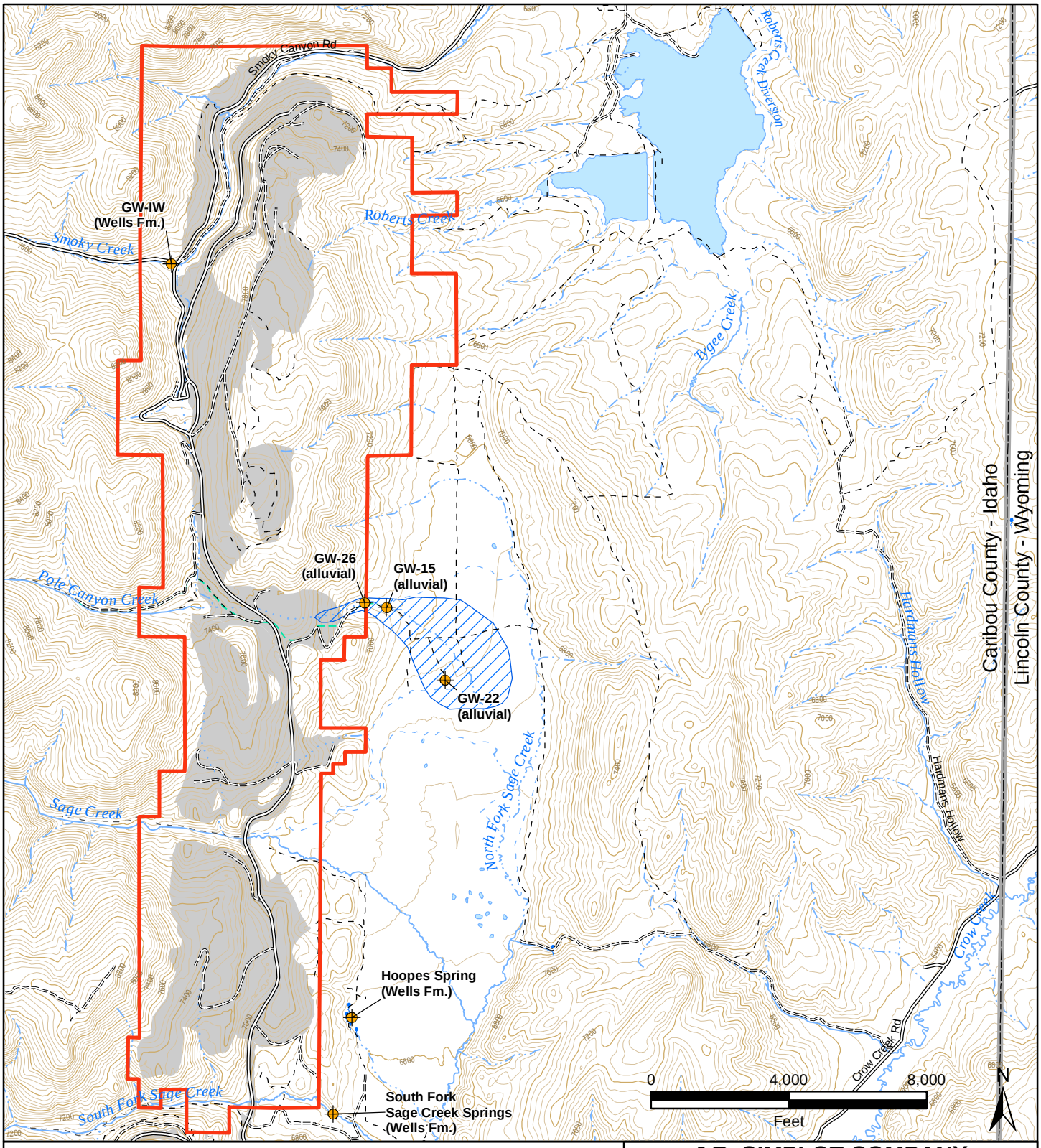

Legend

- Groundwater Monitoring Locations Exceeding Selenium MCL (0.05 mg/L)
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Lake/Pond
- Mine Disturbance Area
- Estimated Extent of Affected Alluvial Groundwater
- Lease Area

MCL = Maximum Contaminant Level (0.05 mg/L)

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FIGURE 3-1

EXCEEDANCES OF SELENIUM MCL IN GROUNDWATER

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BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

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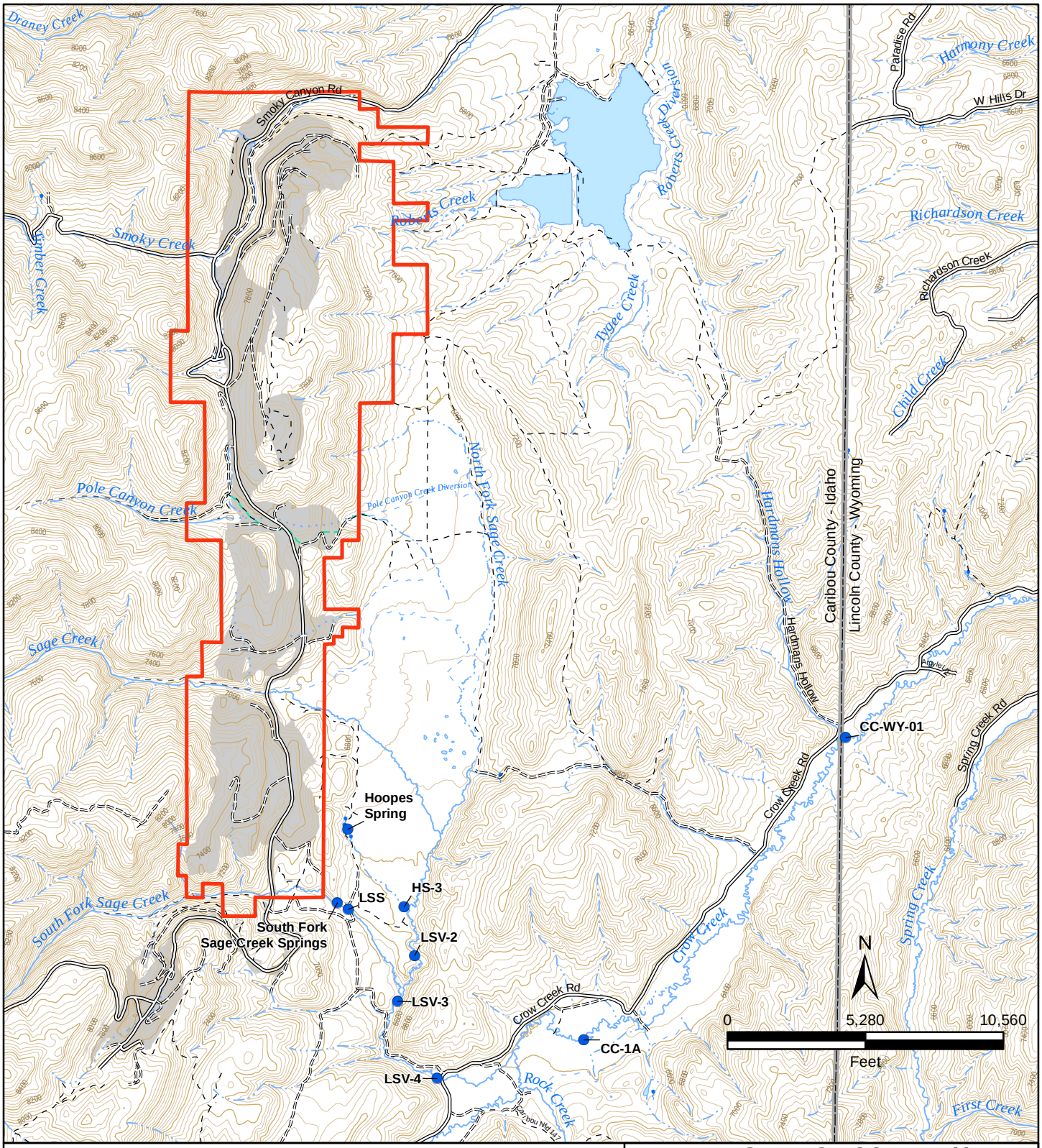

Legend

- Surface Water Monitoring Locations Exceeding State of Idaho Surface Water Quality (Selenium) Criteria for Aquatic Life (Whole Body Fish Tissue Criterion)
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Lake/Pond
- Mine Disturbance Area
- Lease Area

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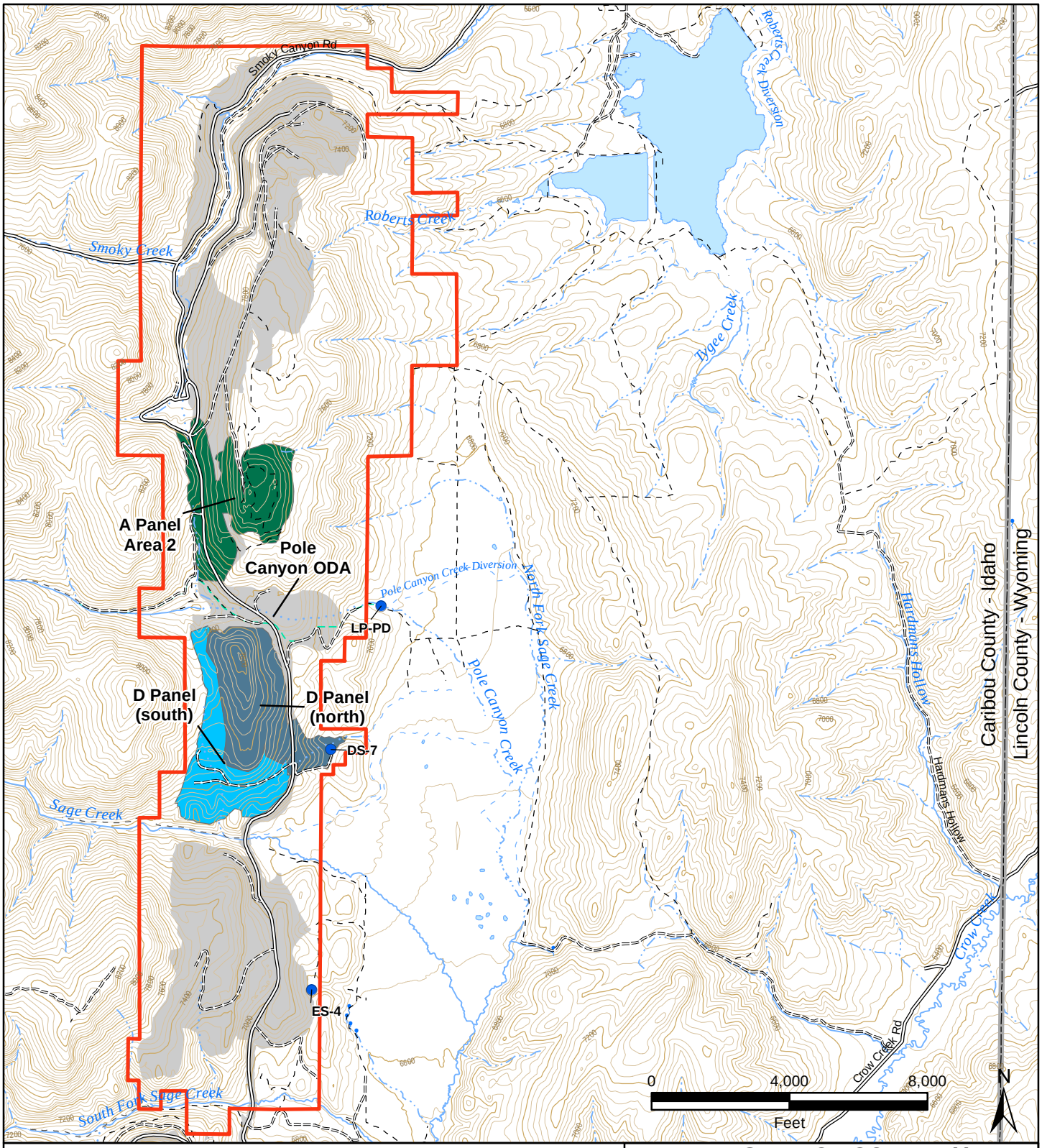
FIGURE 3-2

EXCEEDANCES OF SELENIUM CRITERION IN SURFACE WATER

DATE: AUG 2019
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj2\010109\plt\FS\TechMemo1\Fig3_02_Se_MCL_SW.mxd



Legend

- Monitoring Locations with Elevated Selenium Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lease Area
- Lake/Pond
- Mine Disturbance Area

Sampling Areas with Elevated Selenium Risk

- Panel A (Area 2)
- Panel D (north)
- Panel D (south)

Note: Selenium risk to terrestrial biota on the Pole Canyon ODA has been eliminated as a result of the Pole Canyon ODA NTCRA cover constructed in 2015.

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FIGURE 3-3

ELEVATED SELENIUM RISK TO TERRESTRIAL BIOTA FROM SOIL AND BIOTIC MEDIA

DATE: AUG 2019
BY: CRL
FOR: ACK

FORMATION ENVIRONMENTAL

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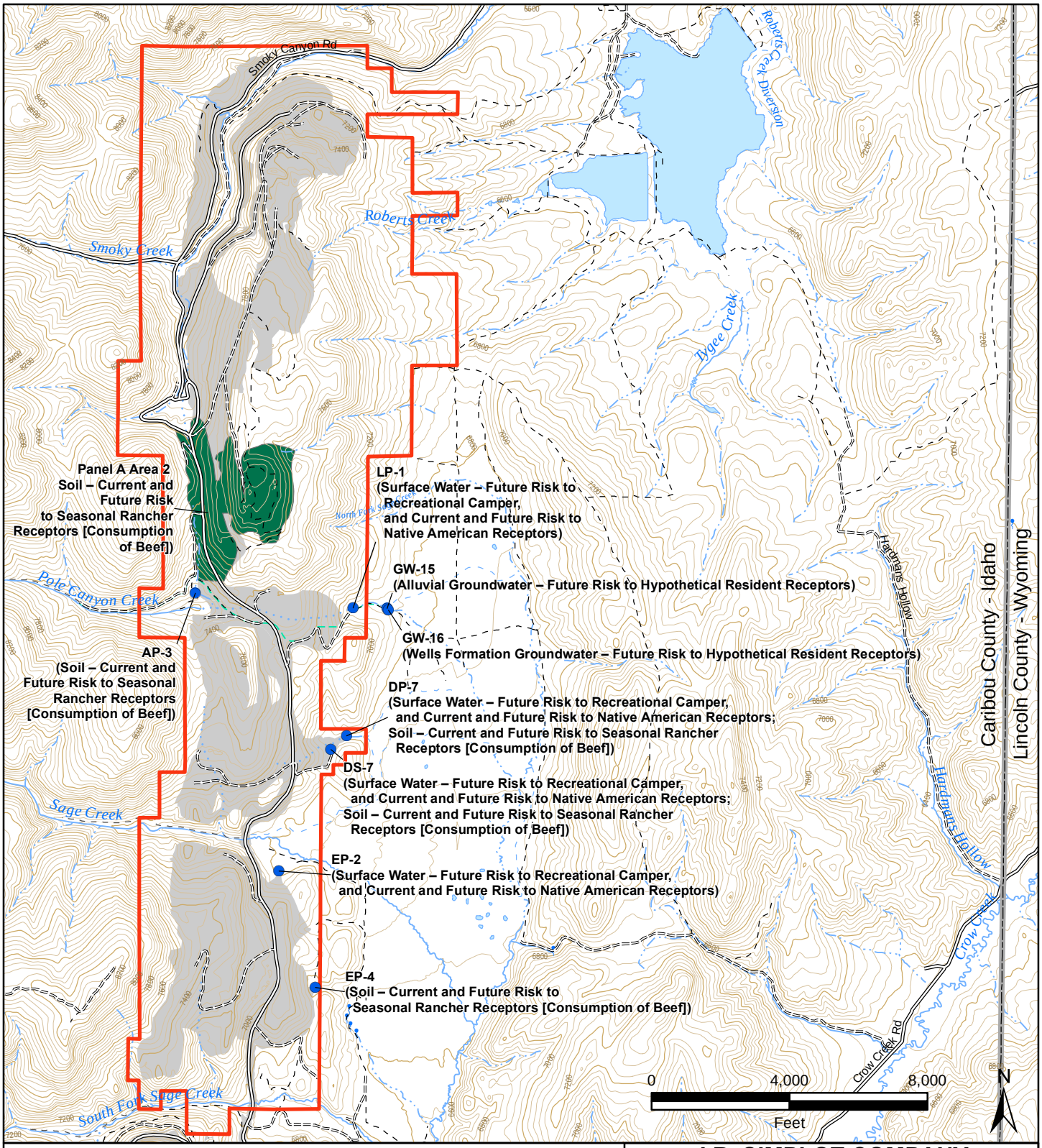

Legend

- Monitoring Locations with Elevated Arsenic Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lease Area
- Lake/Pond
- Mine Disturbance Area

Sampling Area with Elevated Arsenic Risk

- Panel A (Area 2)

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FIGURE 3-4

ELEVATED ARSENIC RISK TO HUMAN RECEPTORS

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BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

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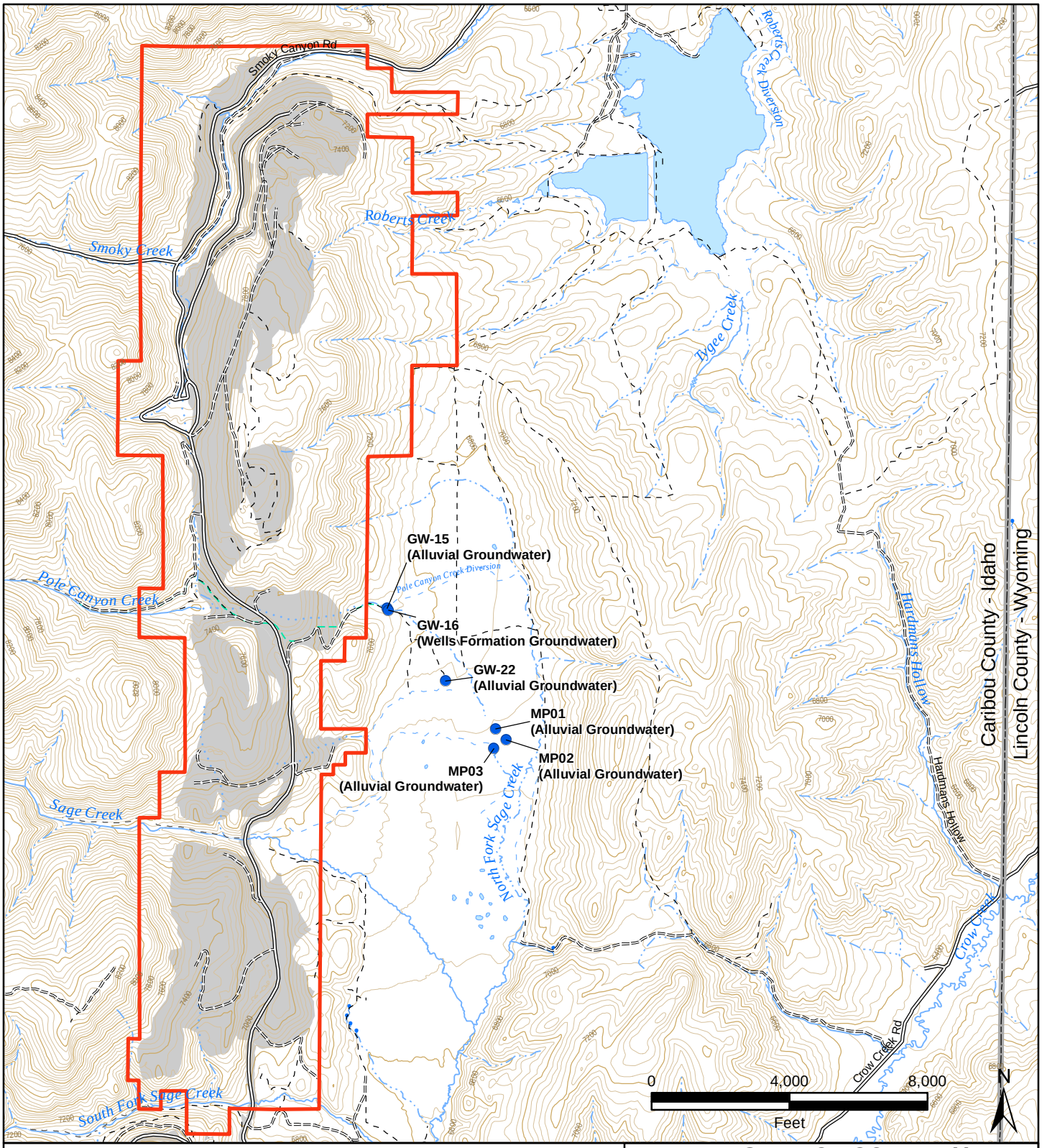

Legend

- Monitoring Locations with Future Elevated Selenium Risk
- Minor Road
- Unimproved Road
- Trail (4WD)
- Trail (Other than 4WD)
- Index Contour (200 ft)
- Intermediate Contour (40 ft)
- Perennial Stream
- Intemittent Stream
- Canal Ditch
- Historic Flow Path
- Pipeline
- Lake/Pond
- Mine Disturbance Area
- Lease Area

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FIGURE 3-5

FUTURE ELEVATED SELENIUM DRINKING WATER RISK TO HYPOTHETICAL RESIDENT HUMAN RECEPTORS

DATE: AUG 2019

BY: CRL | FOR: ACK

FORMATION ENVIRONMENTAL

S:\GIS\arcprj2\010109\plt\FS\TechMemo1\Fig3_05_As_HypoRes_Human.mxd

FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

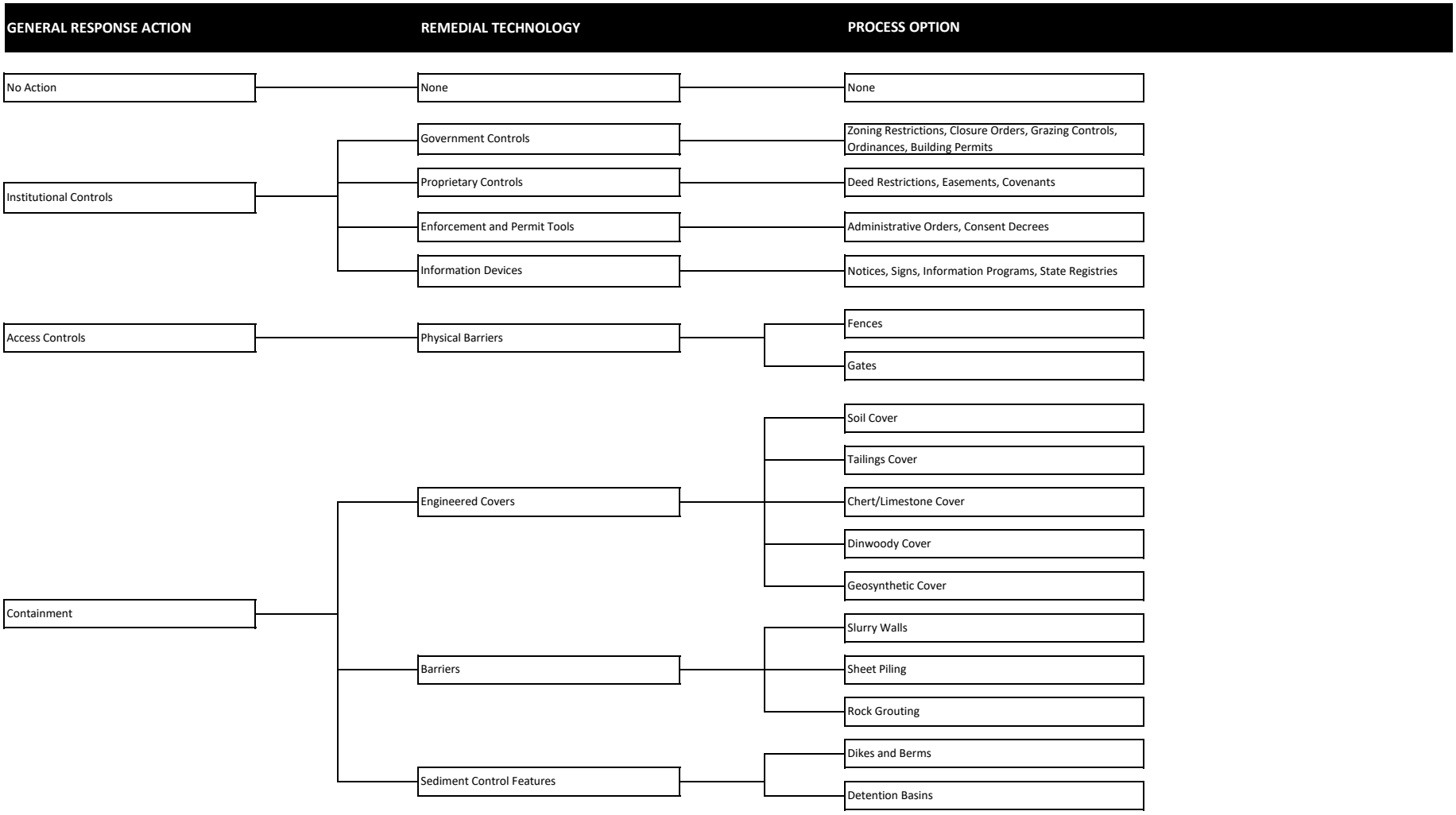


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

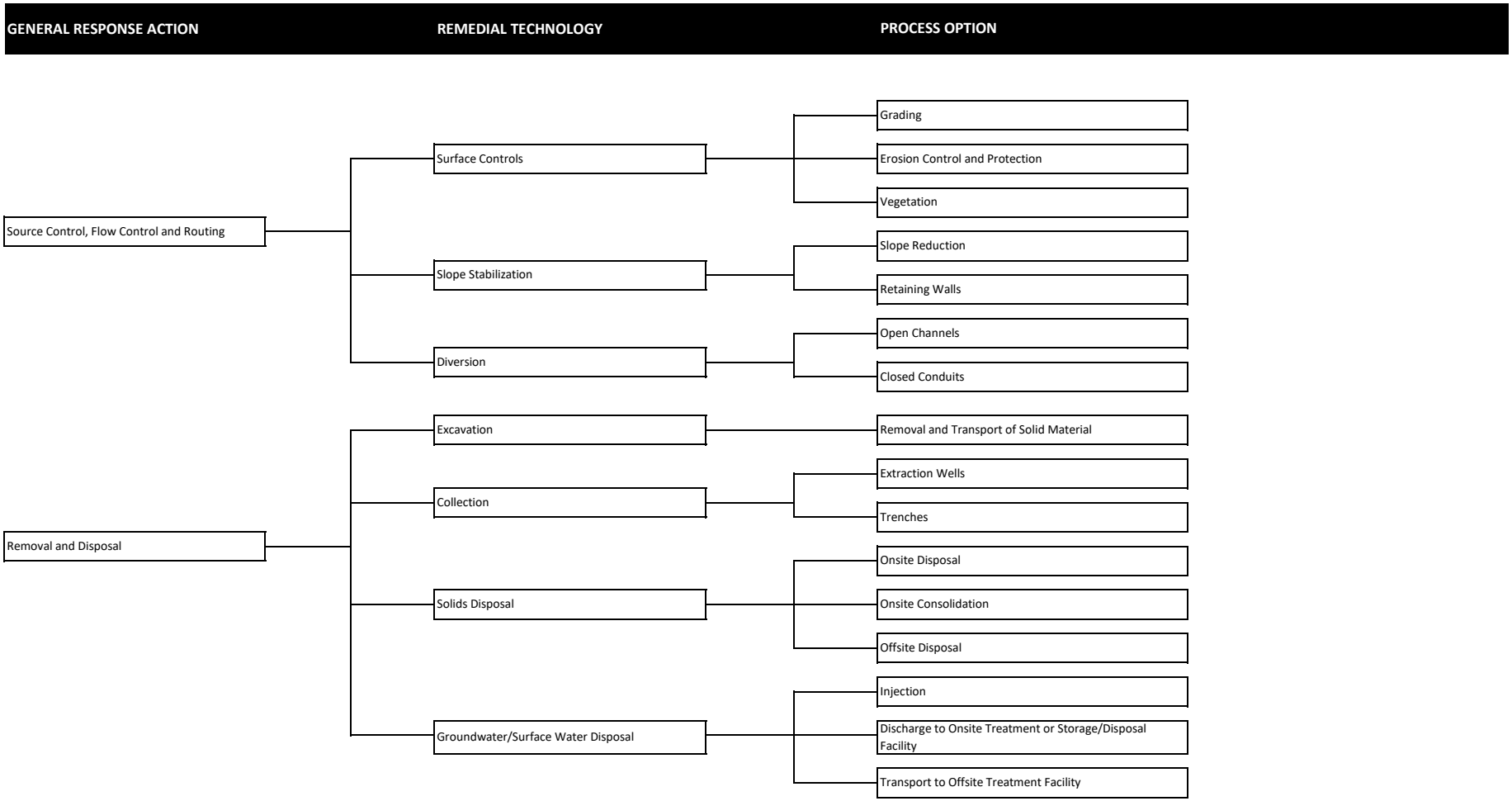


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

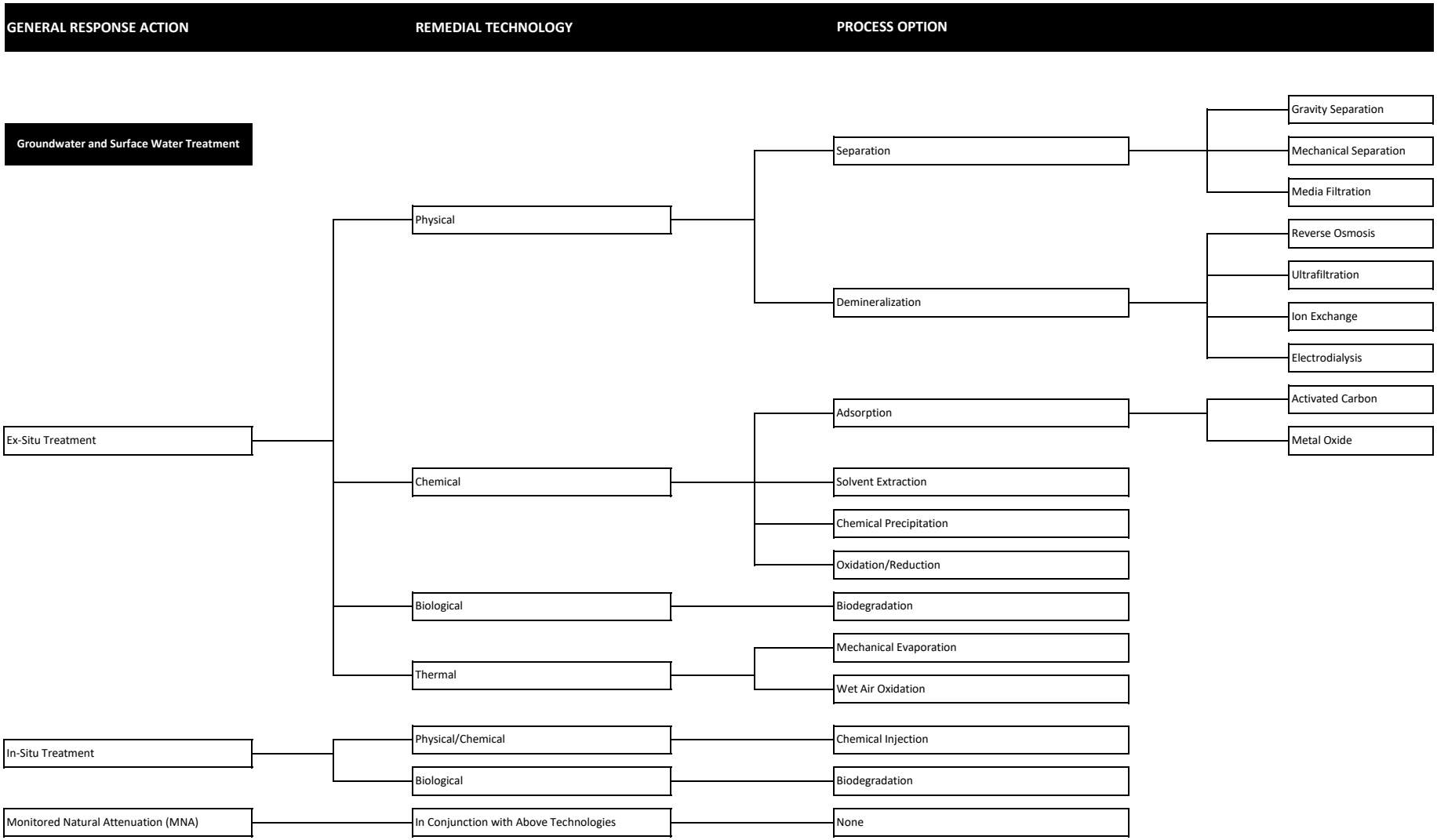


FIGURE 4-1. IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

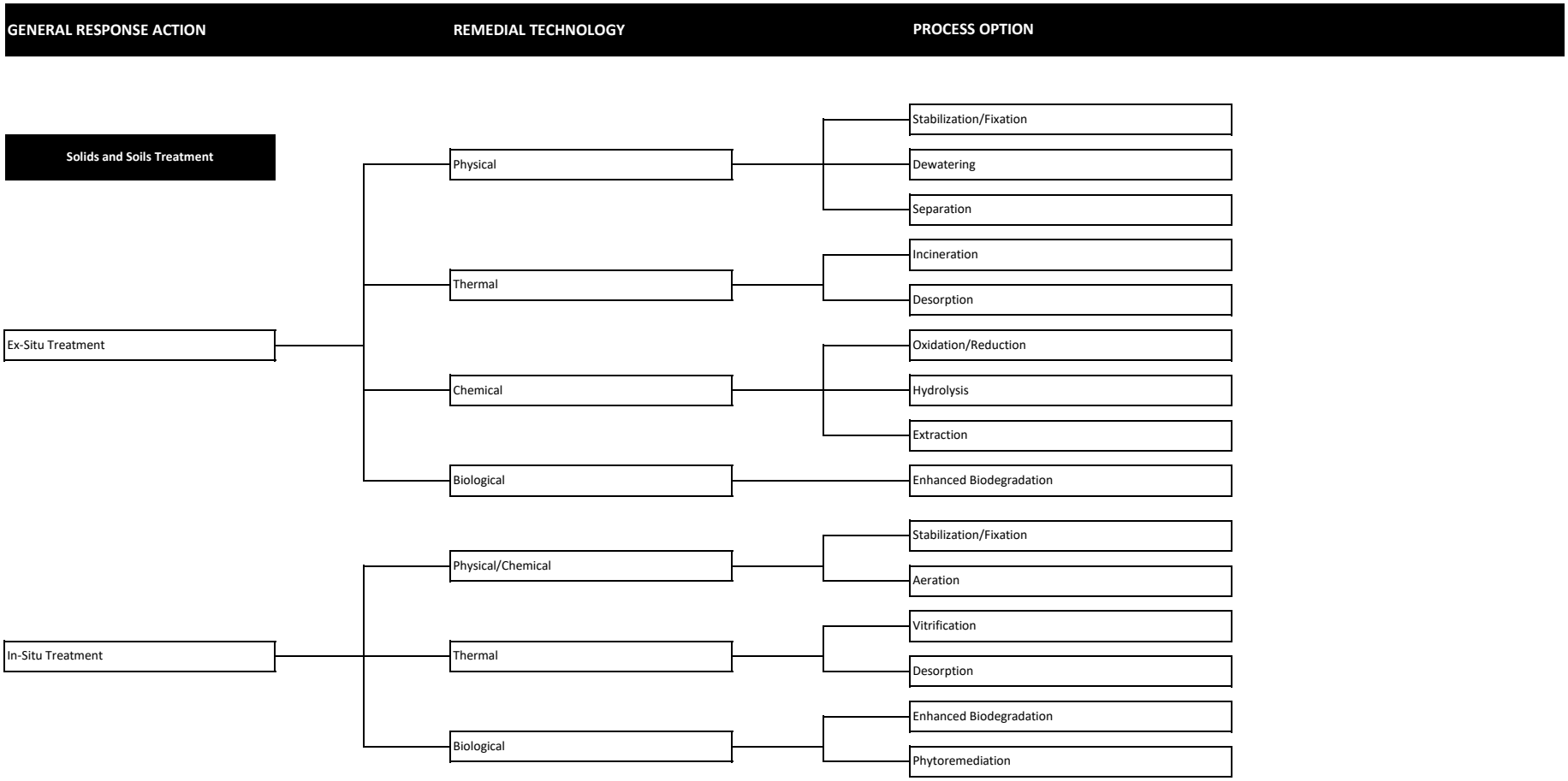


FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
No Action	None	None		No Action. Because previous work has occurred at Smoky Canyon Mine this becomes No Further Action.	No Action required by the NCP as a baseline for comparison.	Retained
Institutional Controls	Government Controls	Zoning Restrictions, Closure Orders, Grazing Controls, Ordinances, Building Permits		Federal, state, or county laws or regulations that restrict or control land or resource use.	Potentially implementable.	Retained
	Proprietary Controls	Deed Restrictions, Easements, Covenants		Deed restrictions prevent use of groundwater as drinking water.	Potentially implementable.	Retained
	Enforcement and Permit Tools	Administrative Orders, Consent Decrees		Legal tools that limit ceratin activities or require the performance of specific activities.	Potentially implementable.	Retained
	Information Devices	Notices, Signs, Information Programs, State Registries		Notification that residual or covered contamination remains at a site.	Potentially implementable.	Retained
Access Controls	Physical Barriers	Fences		Fixed structures that function as boundaries or barriers.	Potentially implementable.	Retained
		Gates		Fixed structures that limit access.	Potentially implementable.	Retained
Containment	Engineered Covers	Soil Cover		Soil cover layer to limit infiltration, reduce seepage, and reduce uptake of selenium by plants.	Potentially implementable.	Retained
		Tailings Cover		Tailings cover layer to limit infiltration, reduce seepage, and reduce uptake of selenium by plants.	Potentially implementable.	Retained
		Chert/Limestone Cover		Chert/limestone layer to provide a capillary break and minimize burrowing and root growth.	Potentially implementable.	Retained
		Dinwoody Cover		Dinwoody cover layer to limit infiltration, reduce seepage, and reduce selenium uptake by plants.	Potentially implementable.	Retained
		Geosynthetic Cover		Clay and synthetic membrane (GCLL or GM) covered by soil to prevent infiltration and reduce seepage.	Potentially implementable.	Retained
	Barriers	Slurry Walls		Trench around ODAs or source materials filled with a soil bentonite slurry.	Not implementable due to the number of sources and depth/extent required to control groundwater.	NOT Retained
		Sheet Piling		Cutoff walls formed of wood, synthetics, pre-fabricated concrete, or steel.	Not implementable due to the number of sources and depth/extent required to control groundwater.	NOT Retained
		Rock Grouting		Pressure injection of grout in drilled holes or using vibrating beam method.	Not implementable because of the depth and extent required to control groundwater.	NOT Retained
	Sediment Control Features	Dikes and Berms		Grading the land surface to control surface water runoff and sediment mobilization.	Potentially implementable.	Retained
		Detention Basins		Basins or ponds used to allow sediment to settle out of storm water runoff.	Potentially implementable.	Retained

Technologies and/or process options screened out

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Source Control, Flow Control and Routing	Surface Controls	Grading		Grading the land surface to manage surface water infiltration and runoff.	Potentially implementable in conjunction with other technologies.	Retained
		Erosion Control and Protection		Use of riprap, vegetation, and geosynthetic fabrics to reduce erosion.	Potentially implementable.	Retained
		Vegetation		Application of soil and seeding with native plants to reduce infiltration, runoff, erosion.	Potentially implementable in conjunction with other technologies.	Retained
	Slope Stabilization	Slope Reduction		Reducing the grade of surface slopes of backfilled pits and ODAs.	Potentially implementable.	Retained
		Retaining Walls		Vertical walls of steel, concrete, bricks, wood, or rock to stabilize steep slopes.	Potentially implementable.	Retained
	Diversion	Open Channels		Engineered canals or ditches constructed to convey surface water.	Potentially implementable.	Retained
		Closed Conduits		Culverts or pipes installed below ground to manage and control surface water.	Potentially implementable.	Retained
Removal and Disposal	Excavation	Removal and Transport of Solid Material		Excavation and transport of overburden/soils or sediments using earthmoving equipment.	Potentially implementable in conjunction with other technologies.	Retained
	Collection	Extraction Wells		Pumping well(s) used to control gradients and flow directions and to extract contaminated groundwater.	Potentially implementable.	Retained
		Trenches		Excavated ditches or channels to intercept and manage groundwater.	Not implementable due to the depth of the Wells formation aquifer.	NOT Retained
	Solids Disposal	Onsite Disposal		Identification of an onsite location for disposal of overburden/soils or treatment residuals.	Potentially implementable.	Retained
		Onsite Consolidation		Consolidation and relocation of overburden materials or treatment residuals and backfill/disposal in mine pits.	Potentially implementable for nonhazardous materials.	Retained
		Offsite Disposal		Disposal of hazardous material in a landfill offsite.	Potentially implementable.	Retained
	Groundwater/ Surface Water Disposal	Injection		Disposal of treated water by injection into deep wells.	Not feasible to implement due to discharge of groundwater at creeks and springs.	NOT Retained
		Discharge to Onsite Treatment or Storage/Disposal Facility		Routing and discharge of impacted water to a treatment or storage/disposal facility onsite.	Potentially implementable in conjunction with treatment technologies.	Retained
		Transport to Offsite Treatment Facility		Transport of impacted water to a publicly owned treatment works (POTW) facility offsite.	Not implementable because there are no POTW facilities near the Site.	NOT Retained

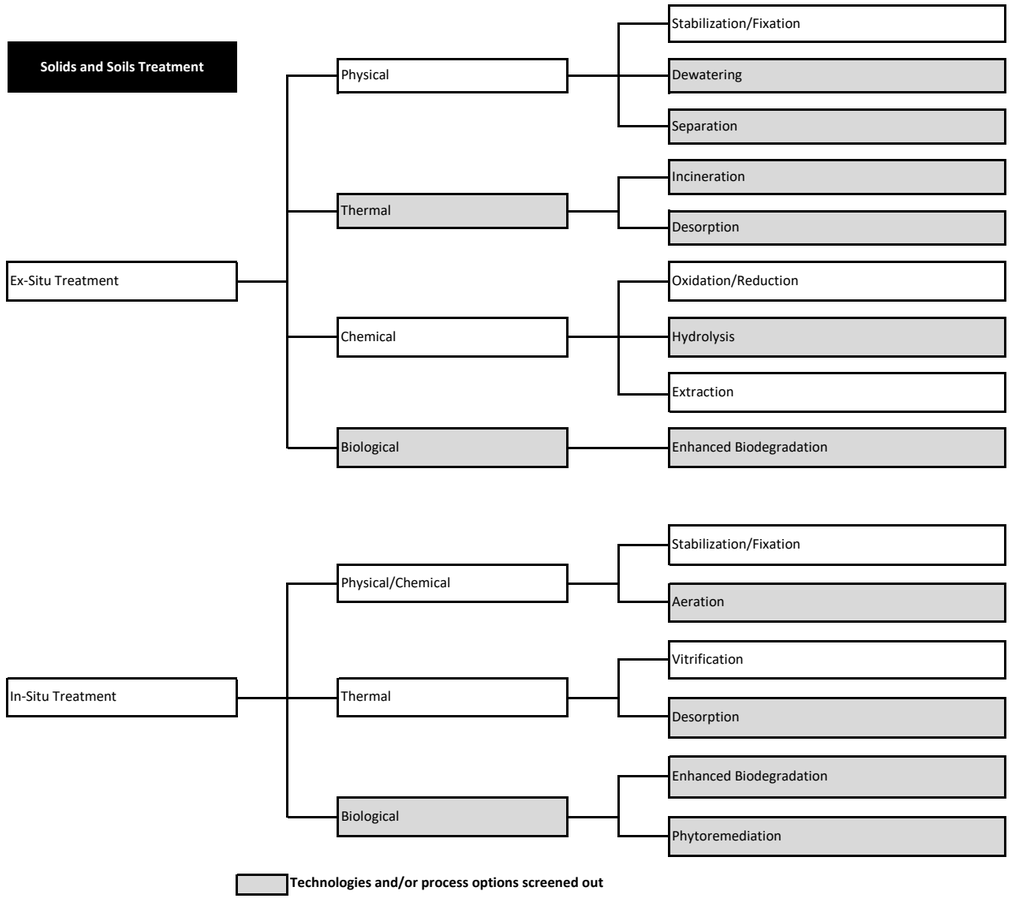
Technologies and/or process options screened out

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Groundwater and Surface Water Treatment						
Ex-Situ Treatment	Physical	Separation	Gravity Separation	Separation of solids from a liquid using settling tanks, basins or other devices.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Mechanical Separation	Separation of solids from a liquid using a mechanical device such as a belt press.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Media Filtration	Separation of solids from a liquid typically using a granular media filter.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Demineralization	Ultrafiltration/Reverse Osmosis	Physical treatment process in which pressurized water passes through a semipermeable membrane.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Ion Exchange	Cation or anion exchange resins used to remove ions from water.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Electrodialysis	An electric field used as the driving force for separating a liquid across a membrane.	Not implementable for inorganic constituents found in groundwater at the site.	NOT Retained
	Chemical	Adsorption	Activated Carbon	Granular media filled vessels used to remove dissolved constituents from groundwater or surface water.	Potentially implementable in conjunction with other treatment technologies.	Retained
			Metal Oxide	Vessels filled with zero-valent iron or activated alumina used primarily to remove arsenic.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Solvent Extraction		Separates constituents from a liquid by contact with another immiscible liquid.	Not applicable to inorganic constituents found in groundwater at the site.	NOT Retained
		Chemical Precipitation		Chemical process where dissolved ions/salts are precipitated in the form of insoluble salts.	Potentially implementable in conjunction with other treatment technologies.	Retained
		Oxidation/Reduction		Chemical reactions used to change contaminants to less toxic compounds.	Potentially implementable in conjunction with other treatment technologies.	Retained
	Biological	Biodegradation		Microorganisms used to degrade or reduce contaminants.	Potentially implementable.	Retained
	Thermal	Mechanical Evaporation		Water is mechanically heated to boiling and clean water is distilled off.	Not feasible due to the large water flow rates.	NOT Retained
		Wet Air Oxidation		Combustion reaction to break contaminated water and constituents down into base reaction products.	Not applicable to inorganic constituents found in groundwater at the site.	NOT Retained
In-Situ Treatment	Physical/Chemical	Chemical Injection		Chemical agents are injected into the impacted region of the aquifer to treat the groundwater.	Potentially hazardous byproducts, and complicated groundwater setting.	NOT Retained
	Biological	Biodegradation		Nutrients are injected into groundwater to encourage native microorganisms to metabolize contaminants.	Potentially implementable for inorganic constituents.	Retained
Monitored Natural Attenuation	In Conjunction with Above Remedial Technologies	None		Natural physical/biochemical processes to further reduce contamination in groundwater.	Potentially implementable in conjunction with other technologies.	Retained

Technologies and/or process options screened out

FIGURE 4-2. INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR TECHNICAL IMPLEMENTABILITY



GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	DESCRIPTION	SCREENING COMMENT	SCREENING RESULT
Solids and Soils Treatment	Ex-Situ Treatment	Physical	Stabilization/Fixation	Excavated solids slurried with stabilization/ fixation agents to reduce contaminant solubility and mobility.	Potentially implementable to immobilize small volumes of solids/soils during the cover process.	Retained
			Dewatering	Separation of liquids from solids by various methods.	Not applicable for large volumes of overburden material.	NOT Retained
			Separation	Soils are slurried, and passed through a gravity separation process to extract inorganics.	Site conditions not conducive to this technology.	NOT Retained
		Thermal	Incineration	Energy applied to solids to combust organic constituents.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
			Desorption	Volatile compounds are separated or recovered from a solid or liquid matrix.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
		Chemical	Oxidation/Reduction	Chemical reactions used to change contaminants to less toxic compounds.	Potentially implementable when used in conjunction with other process options.	Retained
			Hydrolysis	Contaminants react with hydrolyzing agents resulting in decomposition of the chemical compounds.	Not applicable for removing selenium from solids and soils at the site.	NOT Retained
			Extraction	Multistage, intense scrubbing circuit used to wash and separate contaminated solids.	Not a proven method for inorganics but potentially implementable with further research.	Retained
		Biological	Enhanced Biodegradation	Slurrying solids with nutrient additives for degradation of constituents by microbial activity.	Not applicable for inorganic constituents.	NOT Retained
	In-Situ Treatment	Physical/Chemical	Stabilization/Fixation	Machinery is used to directly inject stabilizing agents, such as cement, into the soil.	Potentially implementable to immobilize small volumes of solids/soils during the cover process.	Retained
			Aeration	Aeration of soils is typically achieved by soil vapor extraction systems.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
		Thermal	Vitrification	Solids or soils are electrically heated and fused into a stable, glass-like block.	Potentially implementable for small volumes of solids and soils.	Retained
			Desorption	Volatile compounds are separated or recovered from a solid or liquid matrix.	Not applicable to inorganic constituents in solids and soils at the site.	NOT Retained
		Biological	Enhanced Biodegradation	Nutrients are injected into soils to encourage native microorganisms to metabolize contaminants.	Not applicable for inorganic constituents.	NOT Retained
			Phytoremediation	Plants used to extract and concentrate organic constituents and metals/metalloids from soils.	Not applicable due to the presence of plant eating livestock and wildlife at the site.	NOT Retained

FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	SCREENING RESULT
No Further Action	None	None		Retained
Institutional and Access Controls				
Institutional Controls	Government Controls	Closure Orders, Land-Use Controls, Grazing Controls		Retained
	Proprietary Controls	Deed Restrictions		Retained
	Enforcement and Permit Tools	Administrative Orders, Consent Decrees		Retained
	Information Devices	Signs, Information Programs		Retained
Access Controls	Physical Barriers	Fences, Gates		Retained
Containment				
Containment	Engineered Covers	Soil Cover		NOT Retained
		Tailings Cover		Retained
		Chert/Limestone Cover		Retained
		Dinwoody Cover		Retained
		Geosynthetic Cover		Retained
	Sediment Control Features	Dikes, Berms		Retained
		Detention Basins		Retained

Technologies and/or Process Options Screened Out

FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	SCREENING RESULT
Source Control and Routing				
Source Control, Flow Control and Routing	Surface Controls	Grading		Retained
		Erosion Control and Protection		Retained
		Vegetation		Retained
	Slope Stabilization	Slope Reduction		Retained
		Retaining Walls		Retained
	Diversion	Open Channels		Retained
		Closed Conduits		Retained
Removal and Disposal				
Removal and Disposal	Excavation	Removal of Solid Material		Retained
	Collection	Extraction Wells		Retained
	Solids Disposal	Onsite Disposal		Retained
		Onsite Consolidation		Retained
		Offsite Disposal		Retained
	Groundwater/Surface Water Disposal	Discharge to Onsite Treatment or Storage/Disposal Facility		Retained

Technologies and/or Process Options Screened Out

FIGURE 4-3. EVALUATION OF PROCESS OPTIONS FOR EFFECTIVENESS, IMPLEMENTABILITY, AND RELATIVE COST

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	PROCESS OPTION	SCREENING RESULT
Groundwater and Surface Water Treatment				
Ex-Situ Treatment	Physical	Separation	Gravity Separation	Retained
			Mechanical Separation	Retained
			Media Filtration	Retained
		Demineralization	Ultrafiltration/Reverse Osmosis	Retained
			Ion Exchange	NOT Retained
	Chemical	Adsorption	Activated Carbon	NOT Retained
			Metal Oxide	NOT Retained
		Chemical Precipitation		Retained
		Oxidation/Reduction		Retained
	Biological	Biodegradation		Retained
In-Situ Treatment	Biological	Biodegradation		Retained
Monitored Natural Attenuation (MNA)	In Conjunction with Above Remedial Technologies	None		Retained
Solids and Soils Treatment				
Ex-Situ Treatment	Physical	Stabilization/Fixation		Retained
	Chemical	Extraction		NOT Retained
In-Situ Treatment	Physical	Stabilization/Fixation		Retained
	Thermal	Vitrification		NOT Retained

Technologies and/or Process Options Screened Out

APPENDIX A

Preliminary Remediation Goal for Soil

FINAL

Smoky Canyon Mine RI/FS

Preliminary Remediation Goal for Soil

December 2019

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No.	Title
1	Data Used in the Assessment
2	Linear Regression Plots
3	Detailed Statistical Analysis Output

LIST OF ACRONYMS

BW	Body Weight
C	Concentration
COPC	Chemical of Potential Concern
DQO	Data Quality Objectives
ECOC	Ecological Chemical of Concern
EcoSSL	Ecological Soil Screening Level
FS	Feasibility Study
HQ	Hazard Quotient
IR	Ingestion Rate
kg	Kilogram
kg/day	Kilogram per day
km^2	square kilometers
LOAEL	Lowest Observable Adverse Effect Levels
mg	milligrams
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NOAEL	No Observed Adverse Effect Level
ODA	Overburden Disposal Area
p	Probability
PRG	Preliminary Remediation Goal
R^2	Coefficient of Determination
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SSERA	Site-Specific Ecological Risk Assessment
SUF	Site Use Factor
TRV	Toxicity Reference Value
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This document provides the technical analyses used to develop a Preliminary Remediation Goal (PRG) for selenium in soils that is protective of wildlife receptor populations at the Smoky Canyon Mine (the Site). As part of the Feasibility Study (FS), the agencies have directed development of soil-based PRGs that are protective of wildlife receptor populations identified as having potentially unacceptable risks in the Final Site-Specific Ecological Risk Assessment (SSERA; Formation 2015). The SSERA concluded that selenium is the primary ecological chemical of concern (ECOC) driving risk estimates and the potential need for risk management decisions at the Site.

Elevated concentrations of selenium were measured primarily in Overburden Disposal Areas (ODAs) at the Site with either no cover (i.e., direct revegetation of overburden) or on reclaimed areas where a relatively thin layer of topsoil was used as a cover. Elevated concentrations of selenium in soils media corresponded with higher exposures and risks. Exposures and risks were considerably lower for northern Sage Valley, where no mining activities have occurred, as well as the Panel A Area 1 and Panel E ODAs, where previous reclamation activities resulted in lower selenium concentrations in surface soils, vegetation, and terrestrial prey tissues, resulting in relatively low population-level risk estimates.

The data and analyses provided in this document are intended to describe PRGs that are protective of the range of wildlife receptors evaluated in the SSERA and are appropriate for guiding risk management decisions. This document is organized as follows:

- Section 2 provides a summary of the SSERA conclusions and discusses the risks predicted for selenium and the other ECOCs at the Site.
- Section 3 presents the collocated soil and tissue data collected at the Site and evaluates the relationship of selenium concentrations in soil, vegetation, and prey tissue.
- Section 4 describes the PRG calculations.
- Section 5 present the conclusions of the PRG analysis.

2.0 SITE-SPECIFIC ECOLOGICAL RISK ASSESSMENT SUMMARY

The SSERA for the Site was submitted in December 2015 (Formation 2015). It assessed potential risks to populations for a range of ecological receptors associated with upland and riparian areas within the Site including northern Sage Valley. For terrestrial receptors, the SSERA concluded that selenium is the primary ECOC driving risk estimates and the potential need for risk management decisions at the Site. It also concluded that concentrations of cadmium, chromium, lead, manganese, molybdenum, vanadium, and zinc corresponded to exposures that exceeded the toxicity reference values (TRVs) at some locations concurrent with elevated selenium concentrations. However, elevated exposures for these ECOCs are restricted to small portions of the Site and do not present unacceptable risk to wildlife populations. Therefore, while individual receptors may experience exposures exceeding lowest observed adverse effect levels (LOAELs), effects to receptor populations from these chemicals was concluded to be low.

Copper was the only other ECOC extensively discussed in the conclusions of the SSERA. Elevated concentrations of copper detected in several small mammal samples were observed and resulted in exposure estimates that exceeded TRVs for both the coyote and northern harrier receptors. The concentrations observed showed no spatial relationship and no relationship with copper concentrations in soil/overburden on the reclaimed and riparian areas of the Site. Site-wide risks to both the coyote and northern harrier could not be ruled out, due to these copper concentrations in small mammal tissue. However, elevated copper concentrations in small mammal tissue samples are thought to be anomalous considering the relatively low copper concentrations in soil/overburden and other tissue samples from the same areas, from other southeast Idaho phosphate mine sites, and concentrations reported in the literature for copper-contaminated sites (Formation 2018). Copper contamination is not associated with phosphate mining and copper was not identified in the Smoky Canyon Mine Remedial Investigation (RI) at elevated concentrations in soil/overburden (Formation 2014).

In the upland portions of the Site, elevated concentrations of selenium were observed primarily on ODAs with either no cover (i.e., direct revegetation) or relatively thin topsoil-only covers. Elevated concentrations of selenium in soil/overburden corresponded with higher exposures and risks. Estimated exposures and risks were considerably lower for soils in northern Sage Valley and soil/overburden at Panel A Area 1 and Panel E. Estimated risks were lowest within the ODA areas with Dinwoody or topsoil soil over chert cover reclamation and highest on the ODAs with no cover. For areas of northern Sage Valley that are outside of the Pole Canyon Creek corridor, concentrations of ECOCs were relatively low and may reflect background concentrations.

3.0 SELENIUM IN EXPOSURE MEDIA

This section provides an analysis of Site-specific data to support the derivation of a PRG for selenium. The available data are described in Section 3.1 and the relationship between selenium concentrations in collocated soil and concentrations in tissue samples are described in Section 3.2.

3.1 Site-Specific Data

Data were collected under the Remedial Investigation/Feasibility Study (RI/FS) Sampling and Analysis Plan (SAP) (Formation 2010), and the investigation was guided by the Data Quality Objectives (DQOs), background information, and the SSERA Work Plan presented in the RI/FS Work Plan (Formation 2011). The data collected for the RI/FS were used to refine the preliminary characterization of the nature and extent, and fate and transport, of RI chemicals of potential concern (COPCs) in the environment and were used to support the SSERA. A detailed description of the investigations conducted under the RI, as well as data collected, and an evaluation of data quality, is provided in Section 2 of the Final RI Report (Formation 2014).

Surface soil/overburden, terrestrial vegetation, terrestrial invertebrate tissue, and small mammal (whole body) tissues were collected from a total of 58 locations at the Site. These locations included ODAs, undisturbed soils in northern Sage Valley, seep areas at the foot of ODAs, riparian areas, and the Hoopes Spring discharge area. Together these data provided collocated soil/overburden (source) and biological tissue selenium concentration data from across the Site and from both upland and riparian areas. The collocated data collected for all four media types at all locations are provided in Attachment 1.

For the purposes of this analysis, only those data collected from sampling locations from the reclaimed and un-reclaimed mining areas were used. Data collected from locations outside of the actual mined areas, including samples from seeps and riparian areas, were not included in the analysis, because, while they are valuable for assessing risk from exposure in non-mined areas, they are not directly applicable for determining the effects from selenium exposure on ODAs and for assessing the need for, and effectiveness of remedial actions. Because the SSERA concluded that population-level risks to all receptors in all locations outside of the mined area were low, using the data from the mined areas (42 of 58 locations) provides the most applicable dataset. The collocated data from upland sampling locations from the mined areas for surface soil/overburden, vegetation, terrestrial invertebrates, and small mammals are provided in Table 1.

3.2 Relationship between Soil and Tissue Selenium Concentrations

In order to calculate PRGs for terrestrial receptors, it is necessary to define the relationship between selenium concentrations in the source material (i.e. soil/overburden) and the exposure media (i.e. tissues ingested by terrestrial receptors).

The data collected from the 42 collocated upland sampling locations were first evaluated to determine if statistically significant relationships exist between soil/overburden concentrations and tissue concentrations. The data were evaluated using a series of linear regression analyses (NCSS 12 Statistical Software 2018). The results of the linear regression analyses included the calculation of the coefficient of determination (R^2) and a determination regarding the statistical significance of the relationship between the two variables (p). The R^2 value is a measure of the amount of variability in selenium concentrations measured in the tissue media (dependent variable) due to the variability in concentrations measured in the surface soil/overburden (independent variable). A perfect correlation between the two variables would be represented by an R^2 value equal to 1 and the closer the R^2 value is to 1, the more highly correlated the tissue media selenium concentration is to the surface soil/overburden selenium concentration.

As a first step, regressions between surface soil/overburden selenium concentrations and selenium concentrations in terrestrial vegetation, invertebrates, and small mammals were calculated (Table 2). Using untransformed data, only the relationship between soil/overburden selenium concentrations and vegetation selenium concentrations showed a significant correlation ($p < 0.1$) between the two variables. Terrestrial invertebrate and small mammal selenium concentrations were not correlated with the untransformed surface soil/overburden selenium concentrations. When the data were transformed using a standard natural logarithm transformation, all three variables were significantly correlated, and the R^2 ranged from 0.35 for small mammals to 0.65 for vegetation indicating a reasonable relationship between soil/overburden selenium concentrations and selenium concentrations in collocated tissue samples. The regression plots for the statistical analyses discussed in this section are provided in Attachment 2. The full results and outputs from the statistical analysis are provided in Attachment 3. The values for coefficients and variables in the regression analyses for natural logarithm transformed soil to terrestrial vegetation, invertebrates, and small mammals were selected for use in the PRG calculation and are provided in Table 3.

Based solely on the results of the regression analyses between soil/overburden concentrations and tissue concentrations, the use of a soil PRG results in some uncertainty due to the variability in the uptake of selenium from soil/overburden into tissues; however, the use of the R^2 values result in acceptable levels of uncertainty and would provide a better estimate of soil to tissue accumulation of selenium than would be expected if non-site-specific sources of bioaccumulation data are used (e.g. Ecological Soil Screening Level [EcoSSL] bioaccumulation models in United States Environmental Protection Agency (USEPA) guidance [USEPA 2005]).

4.0 PRG FOR SELENIUM IN SOIL

In this section, the regression models developed in Section 3 were used to estimate prey tissue selenium concentrations from soil selenium concentrations in order to estimate selenium exposure via SSERA exposure pathways. The exposure estimates were used to calculate PRGs using the SSERA TRVs.

4.1 Exposure Estimation

Quantification of exposure requires not only data on selenium concentrations in Site environmental media but also estimates of predicted ingestion rates and contact information for each receptor and pathway. All exposure factors for the upland terrestrial receptors evaluated in the SSERA such as body weights, ingestion rates of food, proportions of prey ingested, and home range used for each receptor were provided in detail in Section 2.7 and in Tables 2-14 (feeding habits) and 2-15 (exposure parameters) of the Final SSERA. The values from those tables were used in this document as shown in Table 4.

The exposure model provided in the SSERA was used to estimate exposure to a subset of SSERA receptors. The receptors were chosen to provide a range of feeding habits and home range sizes. The generic exposure equation is:

$$\text{Dose}_{\text{Total}} = (\text{SUF}) \times \frac{\left[\left(\text{C}_{\text{media}} \text{ x IR}_{\text{media}}\right) + \left(\text{C}_{\text{prey}}\right)\left(\text{IR}_{\text{prey}}\right)\right]}{\text{BW}}$$

Where:

$\text{Dose}_{\text{Total}}$= Daily dose resulting from ingestion of abiotic media and dietary items (milligrams chemical per kilogram body weight per day [mg chemical/kg BW/day]).

C_{media} = Concentration of chemical in abiotic media (mg/kg or milligrams per liter [mg/L]) during incidental ingestion of that media.

C_{prey} = Measured concentration of chemical in prey or forage types (mg/kg).

IR = Ingestion Rate (the amount of prey items, surface water, sediment, and soil ingested per day) (kilogram per day [kg/day], kg/kg BW/day).

BW = Body Weight of receptor species (kg).

SUF = Site Use Factor to account for the amount of time that the organism spends using the Site.

Water ingestion was a minor contributor to exposure and risk in the SSERA and is not discussed further in this analysis.

4.2 PRG Calculation

As defined in the SSERA, Hazard Quotients (HQs) are a standard approach identified in USEPA guidance (USEPA 1997) to make comparisons between the predicted exposure for a receptor and the exposure rate indicative of some level of toxicity to the receptor (TRV). Therefore, the HQ is simply a ratio of the estimated exposure concentration to the TRV where:

$$\mathrm{HQ} = \mathrm{Intake/TRV}$$

For selenium, the SSERA risk characterization used the geometric mean of the no observed adverse effect level (NOAEL) TRV presented in the EcoSSL document (USEPA 2007) as a less conservative and potentially more representative TRV for consideration in risk management decision making. Rationale for use of this TRV in the SSERA is described in Section 4.3 of the Final SSERA (Formation 2015).

The geometric mean NOAEL TRVs from the EcoSSL guidance were discussed in the SSERA and provide an estimate of the mean exposure rate across all of the sub-lethal growth and reproduction endpoints in the database across species and studies. As presented in the SSERA, the geometric mean NOAEL TRVs may provide risk managers with a better estimate of the average exposure rate across species that have been shown to have no effects, but because the TRV is higher than the lowest LOAEL, some effects are possible at or below the TRV. However, those effects are not expected to correspond to significant population-level effects. A full discussion of the underlying data used to calculate the geometric mean TRVs was provided in Section 4.3.4 of the SSERA and, as discussed in that document, the geometric mean NOAEL is still conservative; other factors including habitat and Site use are much more important determinants of whether ecologically meaningful adverse impacts on a population are expected.

Using the exposure parameters provided in Table 4, soil concentrations were back calculated for each of the receptors using the geometric mean TRVs that resulted in the estimated exposure being equal to the TRV resulting in a range of HQs.

The data provided in Table 4 also show that area use is an important consideration in PRG development, especially when considering animals with large home ranges. In the case of the small home range receptors such as the deer mouse and American robin receptors, home range size is small enough that entire sub-populations of the regional populations may reside entirely within the ODAs assessed at the Site.

For the large home range receptors, population-level exposure is correspondingly reduced. As shown in Table 2-17 of the Final SSERA, home ranges for individual coyotes (7,240 acres) and northern harriers (642.5 acres) are very large relative to the size of the mine panels. The home range for a mule deer herd was estimated at 31,424 acres. The largest of the mine panels assessed in the Final SSERA is 392 acres (Panel E) or approximately half of the home range for an individual northern harrier and approximately 1 percent of the range for mule deer. This

indicates that for large home range receptors, the mine panels represent habitat for only a portion of the activity for one or several individuals of the local populations and are not large enough to support populations or even sub-populations of these receptors for more than periodic feeding. As a result, a site use factor (SUF; home range/site area) was applied to the large home range receptors assuming the size of the Site is 1,250 acres representing the sum of the total acreage of overburden in the mine panels and their associated external ODAs.

While the home range of an individual northern harrier is smaller than the Site, the use of an SUF equal to 1 is overly-conservative for population level assessments. In northern harrier population studies conducted in sagebrush habitats in Utah and Idaho, nest density was estimated to be less than 0.1 per 10 square kilometers (km^2) (Smith and Murphy 1973, Howard et al. 1976), or less than 0.0004 nests per acre. These data suggest that while one or several northern harriers may utilize the Site for a portion of their feeding activities, population-level effects are highly unlikely due to the low population density of harriers.

Based on data collected from southwestern Idaho (Martin 1987), average home ranges for female (1.13 km^2; 280 acres) and male (15.7 km^2; 3,880 acres) birds ranged widely and utilized a number of different habitats. Female birds used sagebrush habitats (67.5 percent) much more heavily than male birds (17.7 percent) with male birds using riparian habitats (43.9 percent) more heavily. Neither male nor female birds heavily used abandoned field areas that most closely represent the Site with male and female birds using those habitats only 11.5 and 1.4 percent, respectively.

Nesting density is driven by prey abundance and nesting habitat. Harriers are ground nesters and prefer nesting in wet areas even in dry environments and do not generally nest in high densities unless prey abundance is high (Smith et al. 2011). Since the mine panels and ODAs are all smaller in area than the estimated home range and the habitat provided by the ODAs is not a preferred feeding ground, it is likely that individual birds may feed at the Site, but the food obtained from the Site makes up less than 100 percent of the individual bird's diet. The overall available habitat on the ODAs likely makes up a portion of several individual bird's habitats, but Site use by the local populations is likely to be limited relative to the large expanses of available higher quality habitat surrounding the Site even during breeding season. This indicates that for harrier, the Site represents habitat for only a portion of the activity of the local populations and is not large enough to support populations or even sub-populations of these receptors for more than periodic feeding. A SUF for the harrier equal to 0.1 was used as an estimate based on best professional judgement.

As indicated in Table 5, when the exposure equations are solved for an HQ equal to 1 using the geometric mean NOAEL TRVs, the soil concentrations are less than background concentration estimated for the Ballard Mine Site (MWH 2013) for all of the small home range receptors. This result indicates that the exposure model in conjunction with the geometric mean NOAEL TRV is overly conservative for use in PRG calculations. Table 5 also presents the exposure equations solved for a range of HQs using the same TRVs.

5.0 CONCLUSIONS

The SSERA characterized potential risks to populations of terrestrial ecological receptors inhabiting the Site, riparian areas associated with Site drainages and seeps, and in northern Sage Valley. The assessment concluded that selenium is the primary ECOC and drove the risk estimates and the potential need for risk management decisions at the Site. Other ECOCs identified in the terrestrial SSERA as a result of risk characterization included cadmium, copper, lead, vanadium, and zinc for both the upland and riparian receptors. Chromium, manganese, and molybdenum were identified as ECOCs for riparian receptors only.

For those ECOCs, the SSERA concluded that concentrations present at the Site corresponded to exposures that exceeded TRVs at some locations that represent small portions of the Site. Even if no remediation is completed in those locations, while individual small home range receptors may experience exposures exceeding the TRVs used in the SSERA for those ECOCs, no risks to populations were predicted in the SSERA. Risk management decisions for wildlife should, therefore, be based on the potential risk from selenium exposure.

A range of potential PRGs for selenium in soil were estimated corresponding to a range of HQs. For an HQ of 1, the PRG was 0.9 mg/kg in soil; below the soil background concentration identified for the Ballard Mine Site (6.67 mg/kg 95% UCL on the mean). This result indicates that the exposure model in conjunction with the geometric mean NOAEL TRV is overly conservative for use in PRG calculations. Consequently, other PRG values were calculated for a range of HQs (Table 5). This information will help inform the detailed analysis and ultimately the risk management decisions to be made by the agencies for the Smoky Canyon Mine.

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TABLE 1
Selenium Data from Upland Sampling Location Exposure Media

Sampling Location	Exposure Media (mg/kg)						
	Surface Soil	Terrestrial Vegetation				Terrestrial Invertebrate	Small Mammal[1]
		Forage	General Forage Sample Description	Additional Forb	Additional Grass		
APL-10	245.00	31.60	Forage			30.20	28.30
APL-13	6.00	17.50	Forage	10.00	3.36	20.20	23.07
APL-15	46.90	50.10	Forage			12.00	10.90
APL-16	1.20	4.08	Forage			9.07	14.89
APL-18	39.60	14.10	Forage	20.90	7.03	16.30	16.60
APL-19	4.10	0.37	Forage			11.10	2.60
APL-20	0.71	0.08	Grass			1.61	11.70
APL-21	5.10	0.43	Grass			2.36	2.08
APL-25	0.35	0.11	Grass			1.52	2.78
APL-26	3.60	0.62	Grass			1.97	2.11
APL-27	2.60	1.50	Grass			4.50	1.99
APL-29	0.66	0.03	Grass			1.32	0.89
DPL-16	45.60	13.60	Forage			34.60	31.10
DPL-18	4.50	2.02	Forage			8.77	7.80
DPL-20	5.80	12.20	Forage			24.50	36.80
DPL-21	6.80	14.90	Forage			26.00	30.40
DPL-23	9.20	29.50	Forage			53.80	36.80
DPL-25	7.40	24.80	Forage			62.30	53.42
DPL-26	10.80	7.74	Grass			32.10	33.30
DPL-27	3.60	28.30	Forage			50.10	54.40
DPL-29	18.10	8.81	Grass			26.60	23.35
DPL-32	42.90	9.15	Forage			16.20	19.07
DPL-33	1.90	5.33	Forage			8.45	6.08
DPL-34	4.00	11.80	Forage			29.20	48.30
EPL-11	0.46	0.09	Grass			5.32	4.05
EPL-12	1.50	0.35	Forage			2.27	2.99
EPL-14	1.80	0.34	Grass			1.68	1.84
EPL-15	6.80	1.11	Forage			3.42	2.97
EPL-18	1.40	0.77	Forage			4.41	3.21
EPL-19	0.67	0.33	Forage			1.31	2.94
EPL-21	0.94	0.33	Forage			7.08	1.52
EPL-22	0.18	0.07	Forage			1.09	1.39
EPL-25	0.21	0.30	Forage			0.97	3.93
EPL-26	0.54	0.23	Forage			1.11	1.28
EPL-27	0.07	0.07	Forage			1.07	1.31
EPL-28	0.08	0.04	Forage			0.45	1.55
PCO-05	8.40	3.71	Grass			20.50	30.10
PCO-06	2.00	8.70	Browse/Forage			29.30	101.9
PCO-07	1.10	7.02	Forage			18.60	54.45
PCO-10	39.20	29.00	Forage	38.10	20.50	27.70	23.90
PCO-12	34.70	6.36	Forage	10.20	1.49	13.60	14.60
PCO-14	5.50	16.00	Forage	29.30	7.65	30.00	36.67

Notes:
mg/kg - milligrams per kilogram
[1]- Small mammal concentrations are averages of concentrations in all animals collected from the site.

TABLE 2
Linear Regression R^2 Value Summary

Soil vs. Media[1]	Untransformed	ln Transformed
Terrestrial Vegetation	0.32	**0.65**
Terrestrial Invertebrate	0.07	**0.55**
Small Mammal	0.01	**0.35**

Notes:

Bold indicates the model selected for PRG calculation.

[1] - The soil concentration at sampling location APL-10 was determined to be an outlier. R^2 values presented do not include data from APL-10.

TABLE 3
Linear Equations Selected for Analysis

	Slope (m)	Slope S.E.	Intercept (B)	Intercept S.E.
Soil to Vegetation	1.0254	0.12	-0.4733	0.24
Soil to Invertebrate	0.5966	0.09	1.3793	0.17
Soil to Small Mammal	0.4734	0.1	1.6437	0.21

Note:

Slope and intercept data for the models selected in Table 2.

Linear Equation:

$$\ln X = m(\ln Y) + B$$

TABLE 4
Receptor Exposure Parameters

Receptor	Percent of Diet			Food Ingestion Rate (mg/kg BW/day)	Soil Ingestion Rate (mg/kg BW/day)	Home Range (acres)	Site Use Factor
	Vegetation	Invertebrate	Small Mammal				
Deer Mouse	54.5%	45.5%	0%	0.21	0.0032	0.23	1
Eastern Cottontail	100%	0%	0%	0.06	0.0015	5.96	1
Northern Bobwhite	85.6%	14.4%	0%	0.19	0.0019	28.61	1
American Robin	50%	50%	0%	0.21	0.0027	0.395	1
Mule Deer	100%	0%	0%	0.04	0.0003	31424	0.04
Coyote	4%	6%	90%	0.033	0.0009	7240	0.17
Northern Harrier	0%	2.5%	97.5%	0.10	0.0007	642.5	0.1

Note:

mg/kg BW/day - milligram per kilogram body weight per day

Northern Harrier site use factor is based on professional judgement as discussed in Section 4.

All other site use factors calculated using Home Range/1250 acres.

TABLE 5
Back Calculated Soil Selenium Concentrations at a Range of Hazard Quotients

Receptor	Estimate Food Concentration (mg/kg)			Food Ingestion Rate (mg/kgBW/day)	Proportion of Diet			Soil Ingestion Rate (mg/kg BW/day)	Exposure Rate (mg/kg BW/day)					Site Use Factor	TRV (mg/kg BW/day)	Soil Concentration (mg/kg)
	Vegetation	Invertebrate	Small Mammal		Vegetation	Invertebrate	Small Mammal		Vegetation	Invertebrate	Small Mammal	Soil	Total			
Hazard Quotient = 1																
Deer Mouse	0.6	3.8	5.0	0.21	54.5%	45.5%	0%	0.0032	0.067	0.367	0	0.003	0.437	1	0.437	0.9
Eastern Cottontail	7.0	16.3	15.8	0.06	100%	0%	0%	0.0015	0.421	0	0	0.016	0.437	1	0.437	11
American Robin	0.9	4.9	6.1	0.21	50%	50%	0%	0.0027	0.093	0.513	0	0.004	0.610	1	0.610	1.4
Northern Bobwhite	2.3	8.5	9.4	0.19	85.6%	14.4%	0%	0.0019	0.372	0.232	0	0.007	0.610	1	0.610	3.6
Mule Deer	270.3	136.0	85.4	0.04	100%	0%	0%	0.0003	10.813	0	0	0.112	0.437	0.04	0.437	373
Coyote	156.5	99.0	66.4	0.033	4%	6%	90%	0.0009	0.207	0.196	1.971	0.197	0.437	0.17	0.437	219
Northern Harrier	121.9	85.6	59.1	0.10	0%	2.5%	97.5%	0.0007	0	0.214	5.766	0.120	0.610	0.1	0.610	172
Hazard Quotient = 5																
Deer Mouse	6.2	15.1	14.9	0.21	54.5%	45.5%	0%	0.0032	0.710	1.445	0	0.030	2.185	1	0.437	9.4
Eastern Cottontail	35.1	41.5	33.3	0.06	100%	0%	0%	0.0015	2.108	0	0	0.077	2.185	1	0.437	51
American Robin	9.4	19.3	18.1	0.21	50%	50%	0%	0.0027	0.988	2.024	0	0.038	3.050	1	0.610	14
Northern Bobwhite	14.4	24.7	22.0	0.19	85.6%	14.4%	0%	0.0019	2.335	0.674	0	0.041	3.050	1	0.610	21
Mule Deer	1352.2	347.0	179.6	0.04	100%	0%	0%	0.0003	54.087	0	0	0.538	2.185	0.04	0.437	1794
Coyote	2142.6	453.6	222.1	0.033	4%	6%	90%	0.0009	2.828	0.898	6.597	2.530	2.185	0.17	0.437	2811
Northern Harrier	3219.9	574.8	268.1	0.10	0%	2.5%	97.5%	0.0007	0	1.437	26.135	2.928	3.050	0.1	0.610	4182
Hazard Quotient = 7.5																
Deer Mouse	10.8	20.9	19.3	0.21	54.5%	45.5%	0%	0.0032	1.233	1.993	0	0.052	3.278	1	0.437	16
Eastern Cottontail	52.7	52.5	40.2	0.06	100%	0%	0%	0.0015	3.164	0	0	0.114	3.277	1	0.437	76
American Robin	16.4	26.6	23.4	0.21	50%	50%	0%	0.0027	1.717	2.792	0	0.065	4.575	1	0.610	24
Northern Bobwhite	22.4	31.9	27.0	0.19	85.6%	14.4%	0%	0.0019	3.639	0.873	0	0.062	4.575	1	0.610	33
Mule Deer	2028.4	439.3	216.6	0.04	100%	0%	0%	0.0003	81.138	0	0	0.800	3.277	0.04	0.437	2665
Coyote	3797.9	632.8	289.3	0.033	4%	6%	90%	0.0009	5.013	1.253	8.592	4.422	3.278	0.17	0.437	4913
Northern Harrier	6955.7	899.9	382.5	0.10	0%	2.5%	97.5%	0.0007	0	2.250	37.296	6.205	4.575	0.1	0.610	8864
Hazard Quotient = 10																
Deer Mouse	15.8	26.0	23.0	0.21	54.5%	45.5%	0%	0.0032	1.806	2.489	0	0.075	4.370	1	0.437	23
Eastern Cottontail	70.3	62.1	45.9	0.06	100%	0%	0%	0.0015	4.219	0	0	0.151	4.370	1	0.437	100
American Robin	24.0	33.2	27.9	0.21	50%	50%	0%	0.0027	2.517	3.488	0	0.095	6.100	1	0.610	35
Northern Bobwhite	30.6	38.3	31.2	0.19	85.6%	14.4%	0%	0.0019	4.969	1.047	0	0.085	6.100	1	0.610	45
Mule Deer	2704.8	519.4	247.3	0.04	100%	0%	0%	0.0003	108.192	0	0	1.059	4.370	0.04	0.437	3528
Coyote	5602.1	793.4	346.1	0.033	4%	6%	90%	0.0009	7.395	1.571	10.281	6.460	4.370	0.17	0.437	7177
Northern Harrier	11782.1	1222.8	487.9	0.10	0%	2.5%	97.5%	0.0007	0	3.057	47.569	10.374	6.100	0.1	0.610	14820
Hazard Quotient = 20																
Deer Mouse	38.4	43.7	34.7	0.21	54.5%	45.5%	0%	0.0032	4.390	4.172	0	0.178	8.740	1	0.437	56
Eastern Cottontail	140.7	93.0	63.2	0.06	100%	0%	0%	0.0015	8.444	0	0	0.296	8.740	1	0.437	198
American Robin	58.3	55.7	42.1	0.21	50%	50%	0%	0.0027	6.124	5.851	0	0.226	12.200	1	0.610	84
Northern Bobwhite	64.0	58.8	43.9	0.19	85.6%	14.4%	0%	0.0019	10.416	1.610	0	0.174	12.200	1	0.610	92
Mule Deer	5410.5	777.5	340.6	0.04	100%	0%	0%	0.0003	216.419	0	0	2.081	8.740	0.04	0.437	6938
Coyote	13601.4	1329.3	521.3	0.033	4%	6%	90%	0.0009	17.954	2.632	15.484	15.342	8.740	0.17	0.437	17047
Northern Harrier	38929.4	2451.0	847.1	0.10	0%	2.5%	97.5%	0.0007	0	6.127	82.597	33.276	12.200	0.1	0.610	47537

ATTACHMENT 1

Data Used in the Assessment

Attachment 1
Collocated Soil and Tissue Samples
2010 Smoky Canyon Mine RI Dataset

Type	Location	ECOC	Surface Soil		Terrestrial Vegetation		Terrestrial Invertebrate		Small Mammal	
			As Measured	ln Transformed	As Measured	ln Transformed	As Measured	ln Transformed	As Measured	ln Transformed
Upland	APL-10	Selenium	245	5.50	31.6	3.45	30.2	3.41	28.3	3.34
Upland	APL-13	Selenium	6	1.79	17.5	2.86	20.2	3.01	23.1	3.14
Upland	APL-15	Selenium	46.9	3.85	50.1	3.91	12	2.48	10.9	2.39
Upland	APL-16	Selenium	1.2	0.18	4.08	1.41	9.07	2.20	14.9	2.70
Upland	APL-18	Selenium	39.6	3.68	14.1	2.65	16.3	2.79	16.6	2.81
Upland	APL-19	Selenium	4.1	1.41	0.37	-0.99	11.1	2.41	2.6	0.96
Upland	APL-20	Selenium	0.71	-0.34	0.08	-2.53	1.61	0.48	11.7	2.46
Upland	APL-21	Selenium	5.1	1.63	0.43	-0.84	2.36	0.86	2.1	0.73
Upland	APL-25	Selenium	0.35	-1.05	0.11	-2.21	1.52	0.42	2.8	1.02
Upland	APL-26	Selenium	3.6	1.28	0.62	-0.48	1.97	0.68	2.1	0.75
Upland	APL-27	Selenium	2.6	0.96	1.5	0.41	4.5	1.50	2.0	0.69
Upland	APL-29	Selenium	0.66	-0.42	0.03	-3.51	1.32	0.28	0.9	-0.12
Upland	DPL-16	Selenium	45.6	3.82	13.6	2.61	34.6	3.54	31.1	3.44
Upland	DPL-18	Selenium	4.5	1.50	2.02	0.70	8.77	2.17	7.8	2.05
Upland	DPL-20	Selenium	5.8	1.76	12.2	2.50	24.5	3.20	36.8	3.61
Upland	DPL-21	Selenium	6.8	1.92	14.9	2.70	26	3.26	30.4	3.41
Upland	DPL-23	Selenium	9.2	2.22	29.5	3.38	53.8	3.99	36.8	3.61
Upland	DPL-25	Selenium	7.4	2.00	24.8	3.21	62.3	4.13	53.4	3.98
Upland	DPL-26	Selenium	10.8	2.38	7.74	2.05	32.1	3.47	33.3	3.51
Upland	DPL-27	Selenium	3.6	1.28	28.3	3.34	50.1	3.91	54.4	4.00
Upland	DPL-29	Selenium	18.1	2.90	8.81	2.18	26.6	3.28	23.4	3.15
Upland	DPL-32	Selenium	42.9	3.76	9.15	2.21	16.2	2.79	19.1	2.95
Upland	DPL-33	Selenium	1.9	0.64	5.33	1.67	8.45	2.13	6.1	1.81
Upland	DPL-34	Selenium	4	1.39	11.8	2.47	29.2	3.37	48.3	3.88
Upland	EPL-11	Selenium	0.46	-0.78	0.09	-2.41	5.32	1.67	4.1	1.40
Upland	EPL-12	Selenium	1.5	0.41	0.35	-1.05	2.27	0.82	3.0	1.09
Upland	EPL-14	Selenium	1.8	0.59	0.34	-1.08	1.68	0.52	1.8	0.61
Upland	EPL-15	Selenium	6.8	1.92	1.11	0.10	3.42	1.23	3.0	1.09
Upland	EPL-18	Selenium	1.4	0.34	0.77	-0.26	4.41	1.48	3.2	1.17
Upland	EPL-19	Selenium	0.67	-0.40	0.33	-1.11	1.31	0.27	2.9	1.08
Upland	EPL-21	Selenium	0.94	-0.06	0.33	-1.11	7.08	1.96	1.5	0.42
Upland	EPL-22	Selenium	0.18	-1.71	0.07	-2.66	1.09	0.09	1.4	0.33
Upland	EPL-25	Selenium	0.21	-1.56	0.3	-1.20	0.97	-0.03	3.9	1.37
Upland	EPL-26	Selenium	0.54	-0.62	0.23	-1.47	1.11	0.10	1.3	0.24
Upland	EPL-27	Selenium	0.073	-2.62	0.07	-2.66	1.07	0.07	1.3	0.27
Upland	EPL-28	Selenium	0.077	-2.56	0.04	-3.22	0.45	-0.80	1.6	0.44
Upland	PCO-05	Selenium	8.4	2.13	3.71	1.31	20.5	3.02	30.1	3.40
Upland	PCO-06	Selenium	2	0.69	8.7	2.16	29.3	3.38	101.9	4.62
Upland	PCO-07	Selenium	1.1	0.10	7.02	1.95	18.6	2.92	54.5	4.00
Upland	PCO-10	Selenium	39.2	3.67	29	3.37	27.7	3.32	23.9	3.17
Upland	PCO-12	Selenium	34.7	3.55	6.36	1.85	13.6	2.61	14.6	2.68
Upland	PCO-14	Selenium	5.5	1.70	16	2.77	30	3.40	36.7	3.60
Sage Valley	SV-22	Selenium	0.31	-1.17	0.03	-3.51	0.94	-0.06	1.9	0.65
Sage Valley	SV-23	Selenium	0.36	-1.02	0.2	-1.61	5.58	1.72	1.9	0.65
Sage Valley	SV-25	Selenium	0.28	-1.27	0.03	-3.51	1.22	0.20	0.9	-0.08
Sage Valley	SV-27	Selenium	0.47	-0.76	4.34	1.47	12.1	2.49	3.1	1.13
Sage Valley	SV-28	Selenium	0.27	-1.31	0.41	-0.89	8.57	2.15	1.9	0.66
Sage Valley	SV-29	Selenium	0.24	-1.43	0.03	-3.51	2.37	0.86	2.6	0.97
Riparian	DS-7	Selenium	87.5	4.47	34.6	3.54	86.1	4.46	29.3	3.38
Riparian	ES-3	Selenium	1.2	0.18	0.17	-1.77	1.84	0.61	1.9	0.62
Riparian	ES-4	Selenium	98.7	4.59	149	5.00	193	5.26	95.5	4.56
Riparian	HS-3	Selenium	4.7	1.55	0.28	-1.27	6.75	1.91	10.2	2.32
Riparian	HS-CC1	Selenium	8.4	2.13	0.5	-0.69	3.6	1.28	4.6	1.53
Riparian	HS-CC2	Selenium	1.6	0.47	0.35	-1.05	6.3	1.84	4.6	1.53
Riparian	LP-PD	Selenium	0.56	-0.58	42	3.74	9.85	2.29	12.9	2.56
Riparian	LS	Selenium	0.55	-0.60	0.18	-1.71	1.98	0.68	1.7	0.55
Riparian	LSm	Selenium	0.55	-0.60	0.09	-2.41	1.38	0.32	0.6	-0.48
Riparian	LSS	Selenium	10.4	2.34	0.84	-0.17	5.22	1.65	3.1	1.13

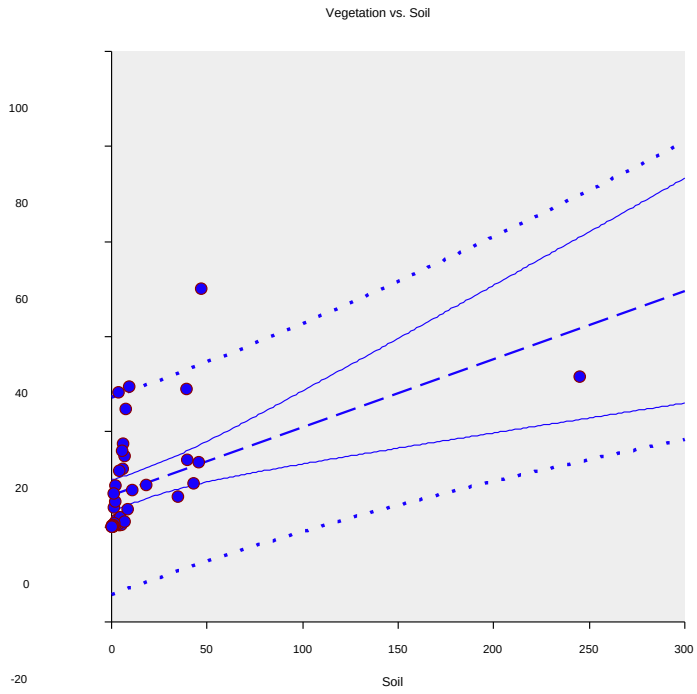
All units presented in mg/kg DW

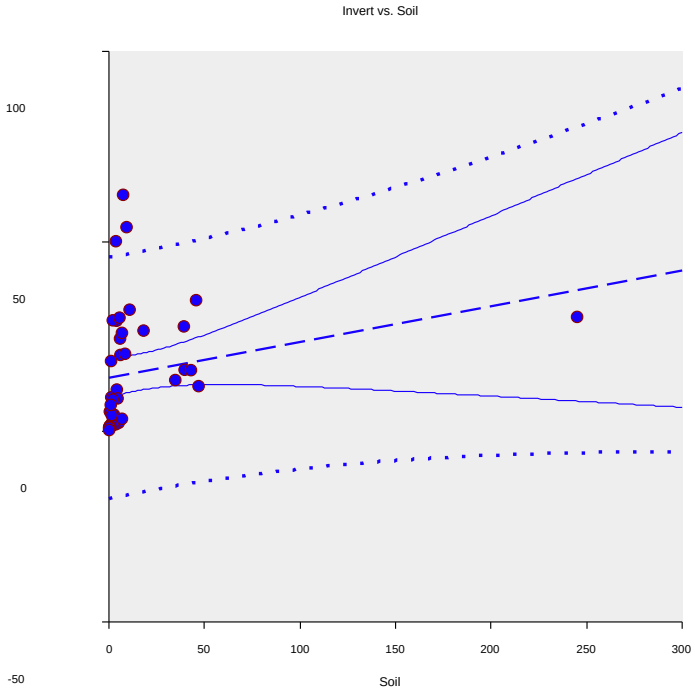
ATTACHMENT 2

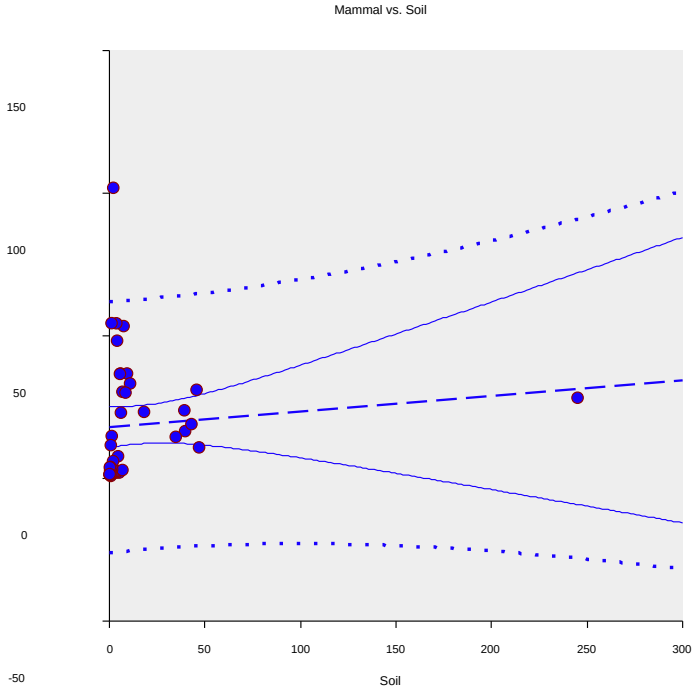
Linear Regression Plots

Attachment 2 – Linear Regression Plots

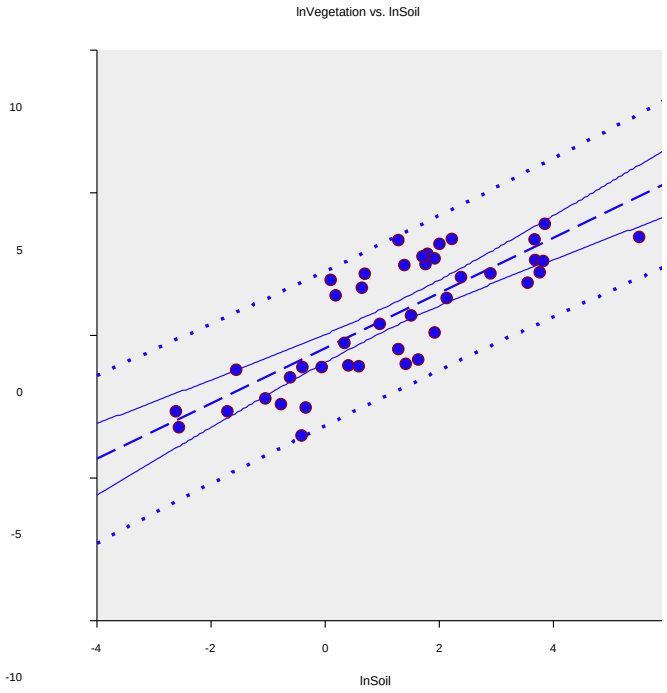
Figure A2-1 – Soil to media regressions. No transformation. All data.

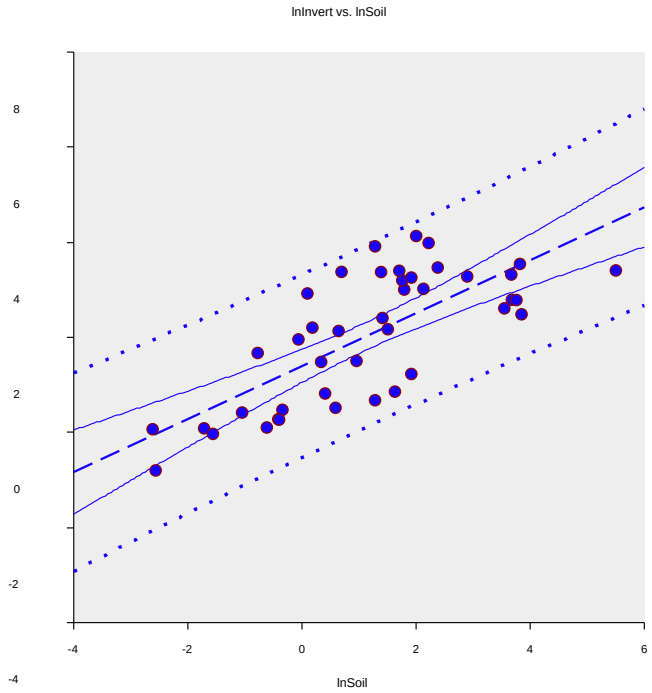


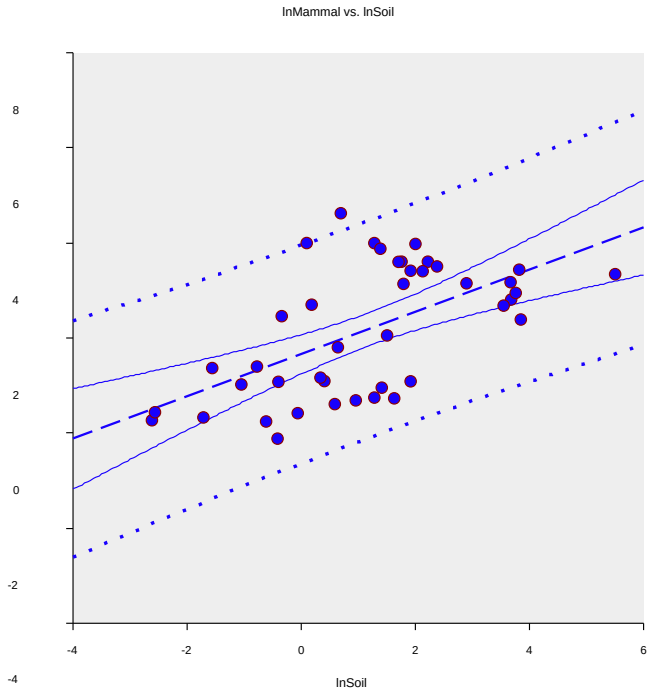




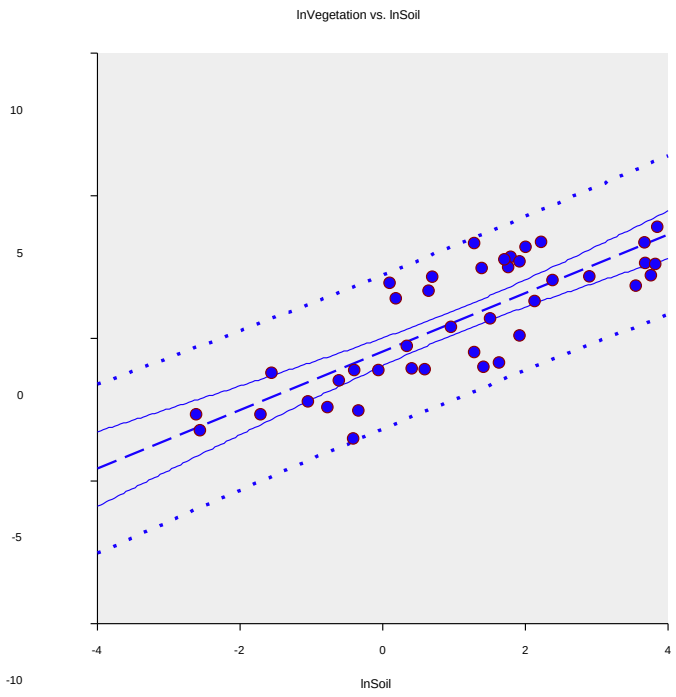
Attachment 2 – Linear Regression Plots
Figure A2-2 – Soil to media regressions. ln transformation. All data.

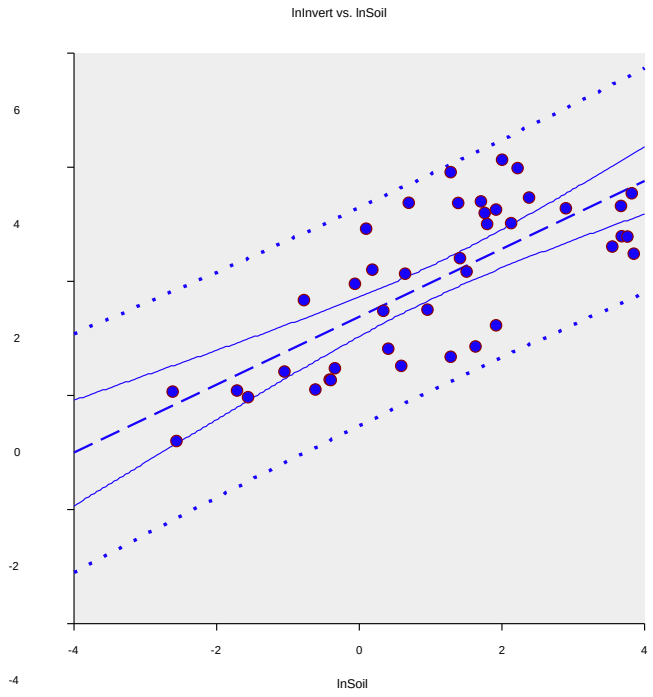






Attachment 2 – Linear Regression Plots
Figure A2-3 – Soil to media regressions. ln transformation. Outlier APL-10 removed





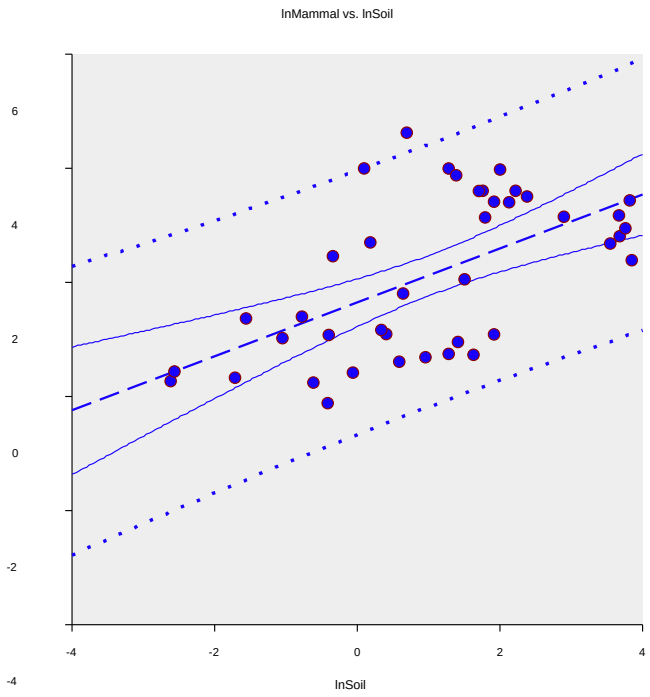
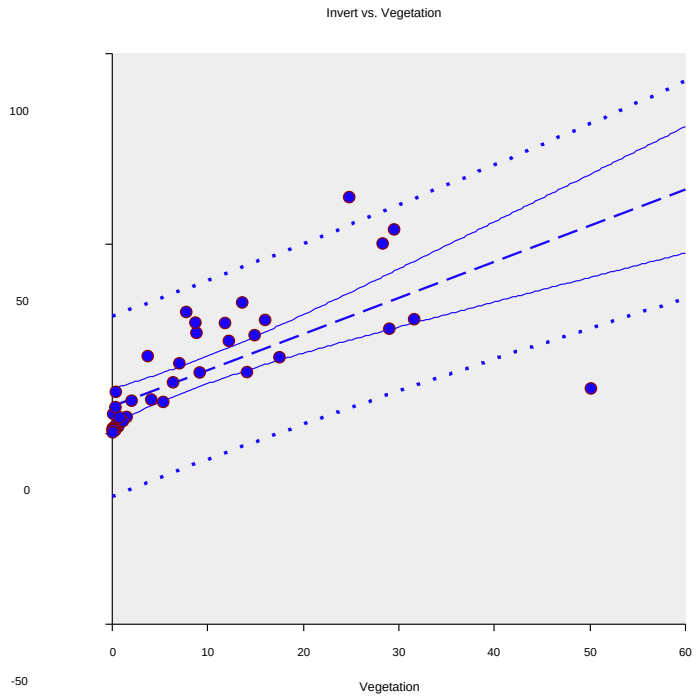


Figure A2-4 – Vegetation to media regressions. No transformation. All data.



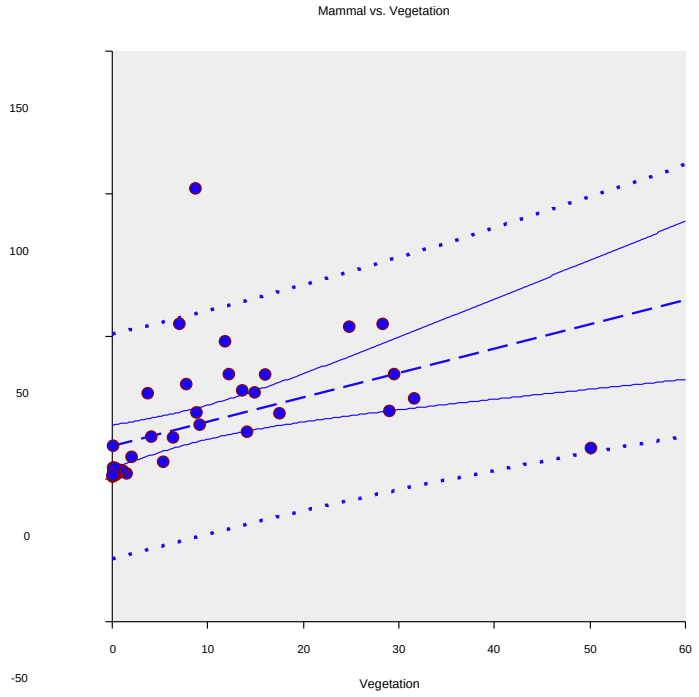
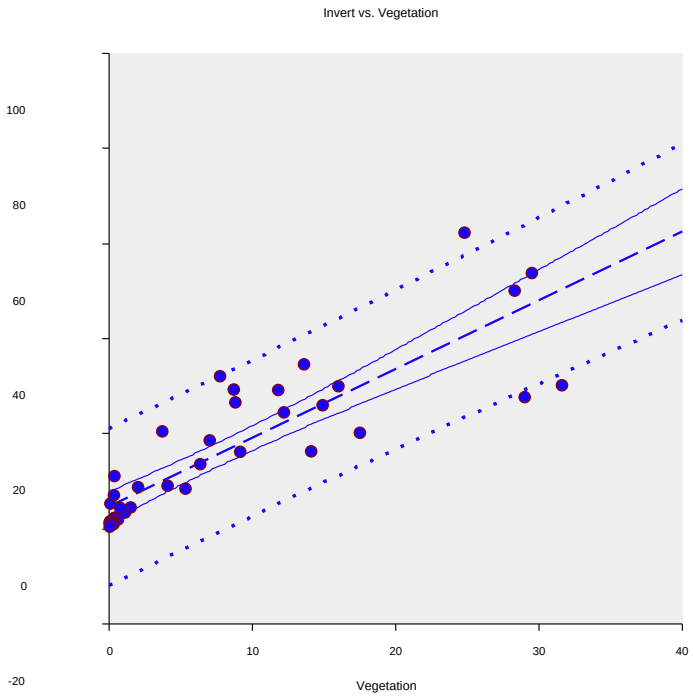


Figure A2-5 – Vegetation to media regressions. No transformation. Data from APL-15 removed.



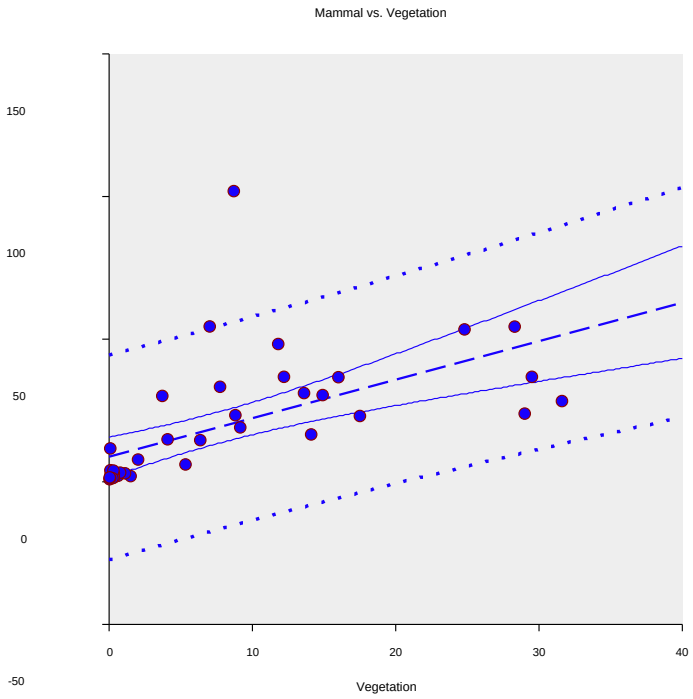
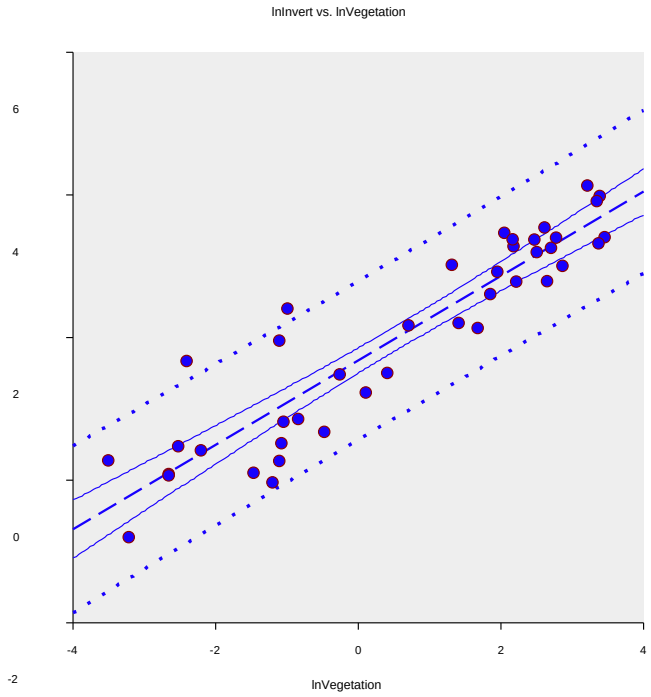


Figure A2-6 – Vegetation to media regressions. ln transformation. Data from APL-15 removed.



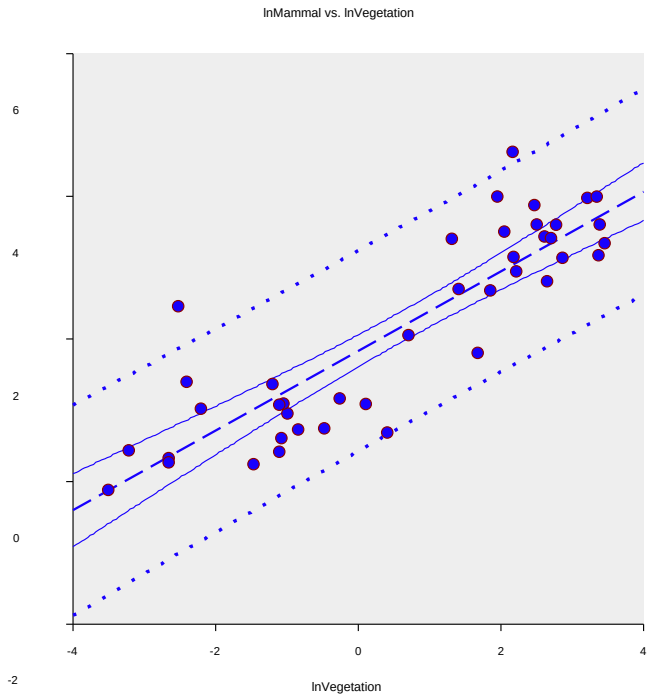
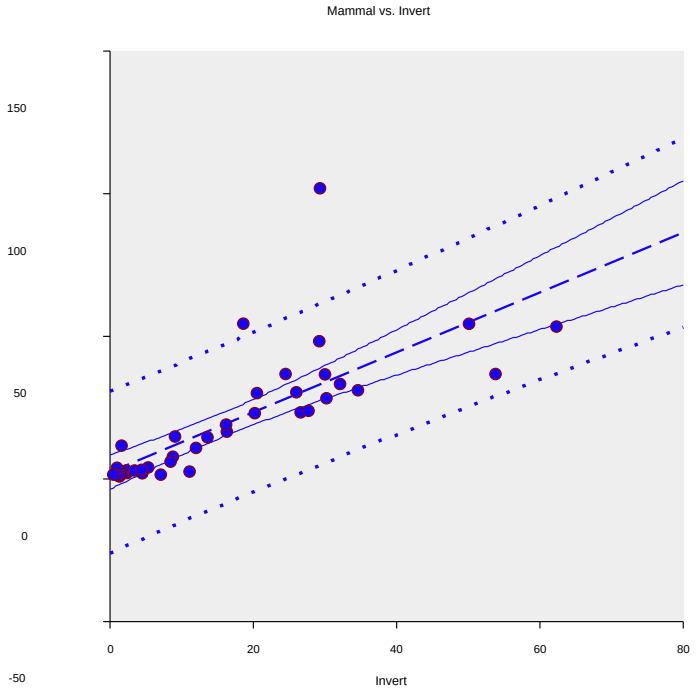


Figure A2-7 – Invertebrate to Small Mammal Regressions. No transformation.

All Data



PCO-06 Removed

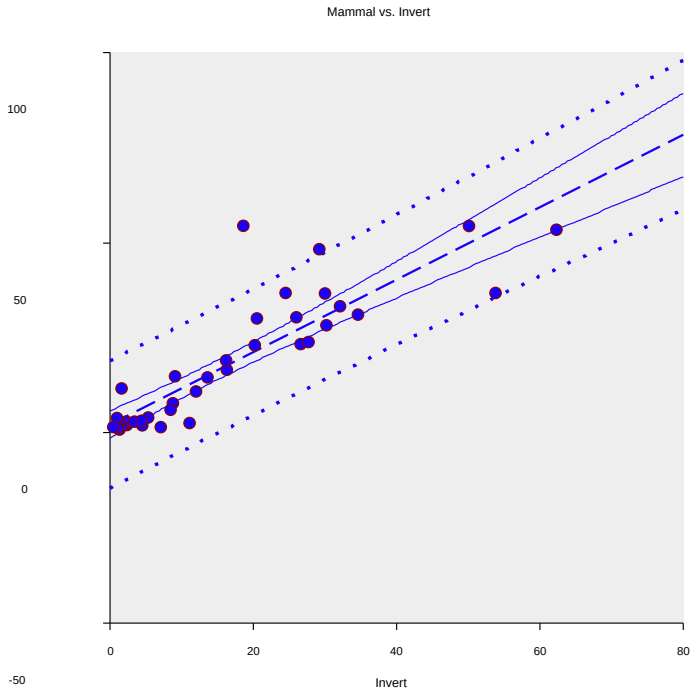
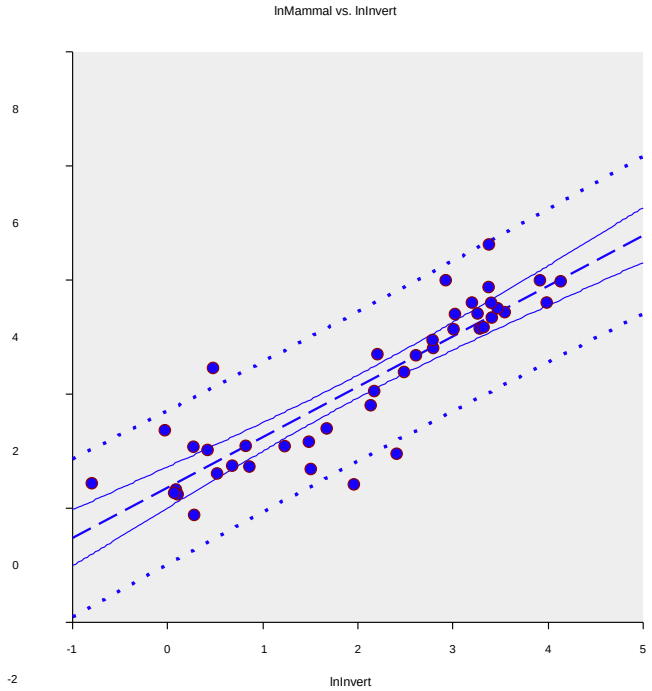
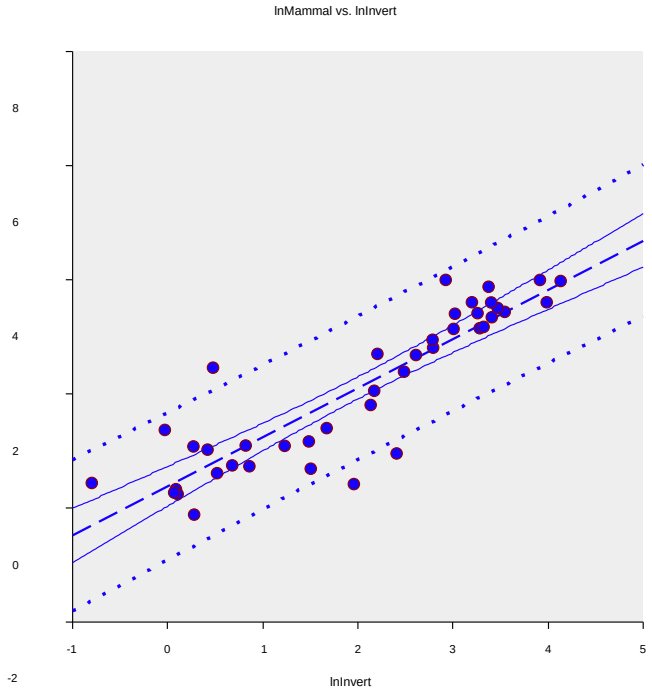


Figure A2-7 – Invertebrate to Small Mammal Regressions. ln transformation.

All Data



PCO-06 Removed



Attachment 3

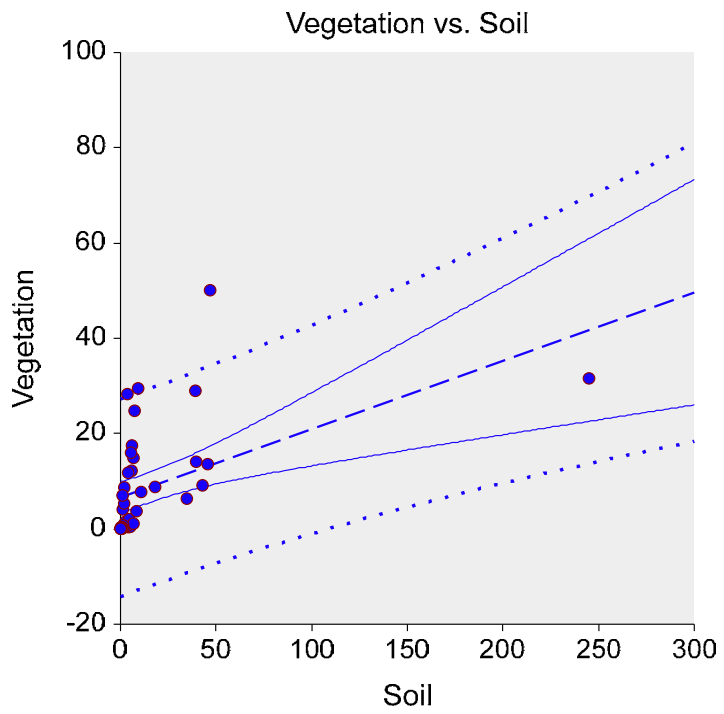
Detailed Statistical Analysis Output

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
No Transformation - All Data

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Vegetation	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	6.5243	Rows Prediction Only	0
Slope	0.1438	Sum of Frequencies	42
R-Squared	0.2384	Sum of Weights	42.0000
Correlation	0.4882	Coefficient of Variation	1.1717
Mean Square Error	102.838	Square Root of MSE	10.14091

Linear Regression Report

Y = Vegetation X = Soil

Summary Statement

The equation of the straight line relating Vegetation and Soil is estimated as: Vegetation = (6.5243) + (0.1438) Soil using the 42 observations in this dataset. The y-intercept, the estimated value of Vegetation when Soil is zero, is 6.5243 with a standard error of 1.6766. The slope, the estimated change in Vegetation per unit change in Soil, is 0.1438 with a standard error of 0.0407. The value of R-Squared, the proportion of the variation in Vegetation that can be accounted for by variation in Soil, is 0.2384. The correlation between Vegetation and Soil is 0.4882.

A significance test that the slope is zero resulted in a t-value of 3.5383. The significance level of this t-test is 0.0010. Since 0.0010 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.1438. The lower limit of the 95% confidence interval for the slope is 0.0617 and the upper limit is 0.2260. The estimated intercept is 6.5243. The lower limit of the 95% confidence interval for the intercept is 3.1358 and the upper limit is 9.9128.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Vegetation	Soil
Count	42	42
Mean	8.6545	14.8088
Standard Deviation	11.4775	38.9564
Minimum	0.0300	0.0730
Maximum	50.1000	245.0000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	6.5243	0.1438
Lower 95% Confidence Limit	3.1358	0.0617
Upper 95% Confidence Limit	9.9128	0.2260
Standard Error	1.6766	0.0407
Standardized Coefficient	0.0000	0.4882
T Value	3.8914	3.5383
Prob Level (T Test)	0.0004	0.0010
Prob Level (Randomization Test N =1000)		0.0230
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.9669	0.9322
Regression of Y on X	6.5243	0.1438
Inverse Regression from X on Y	-0.2817	0.6034
Orthogonal Regression of Y and X	6.3770	0.1538

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(6.52431707491952) + (0.143847264101774) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	6.5243	0.9000	4.2059	10.6549
Bootstrap Mean	5.6838	0.9500	3.7490	11.1089
Bias (BM - OV)	-0.8405	0.9900	2.2603	11.8750
Bias Corrected	7.3648			
Standard Error	1.9467			
Slope				
Original Value	0.1438	0.9000	-0.3289	0.1784
Bootstrap Mean	0.2467	0.9500	-0.4009	0.1816
Bias (BM - OV)	0.1029	0.9900	-0.5492	0.1879
Bias Corrected	0.0410			
Standard Error	0.1770			
Correlation				
Original Value	0.4882	0.9000	0.2523	0.5958
Bootstrap Mean	0.5417	0.9500	0.2140	0.6399
Bias (BM - OV)	0.0535	0.9900	0.1334	0.7317
Bias Corrected	0.4347			
Standard Error	0.1028			
R-Squared				
Original Value	0.2384	0.9000	0.0000	0.3318
Bootstrap Mean	0.3040	0.9500	0.0000	0.3635
Bias (BM - OV)	0.0657	0.9900	0.0000	0.4168
Bias Corrected	0.1727			
Standard Error	0.1143			
Standard Error of Estimate				
Original Value	10.1409	0.9000	7.8812	13.6683
Bootstrap Mean	9.4319	0.9500	7.2856	14.2522
Bias (BM - OV)	-0.7090	0.9900	6.2544	15.3438
Bias Corrected	10.8499			
Standard Error	1.7485			
Orthogonal Intercept				
Original Value	6.3770	0.9000	4.1176	12.1301
Bootstrap Mean	4.9210	0.9500	3.6674	12.5278
Bias (BM - OV)	-1.4560	0.9900	2.2308	13.4133
Bias Corrected	7.8330			
Standard Error	2.5743			
Orthogonal Slope				
Original Value	0.1538	0.9000	-0.6008	0.1949
Bootstrap Mean	0.3314	0.9500	-0.7078	0.1984
Bias (BM - OV)	0.1777	0.9900	-0.9945	0.2049
Bias Corrected	-0.0239			
Standard Error	0.2986			

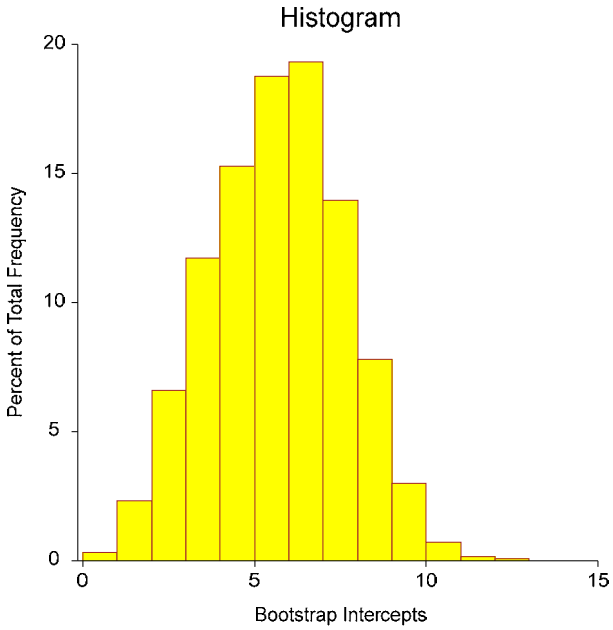
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

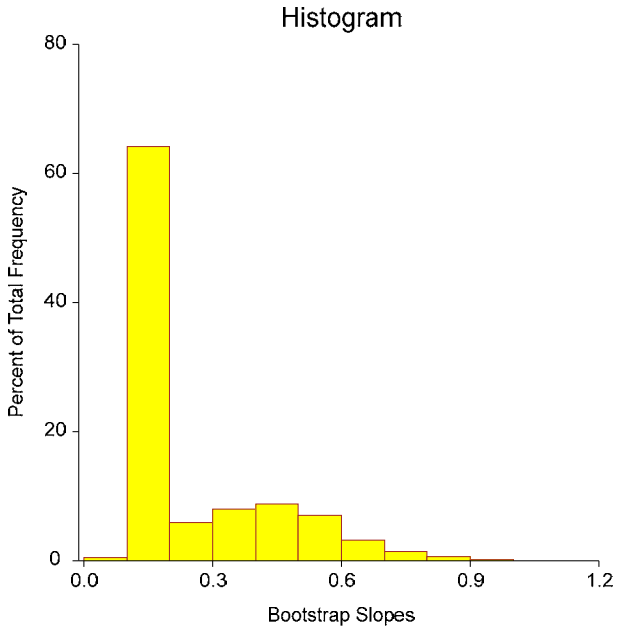
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

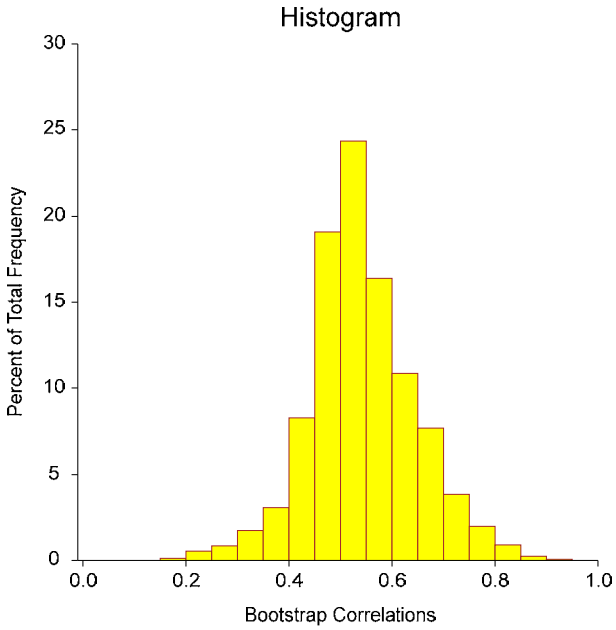
Linear Regression Report

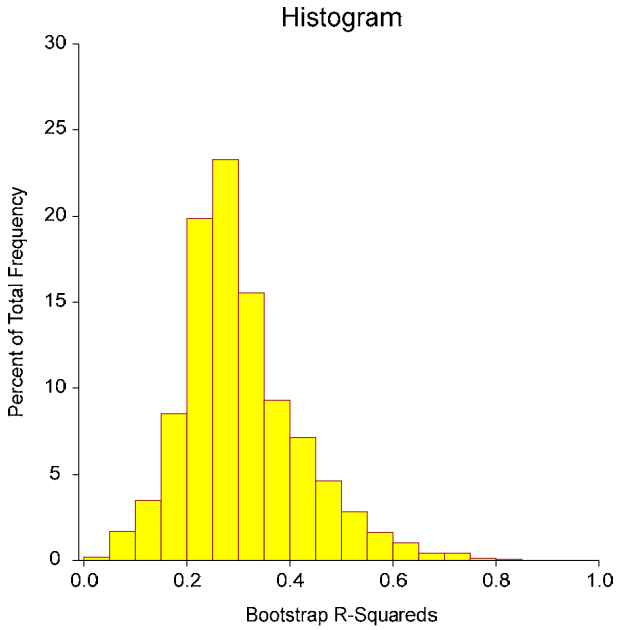
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Histograms Section



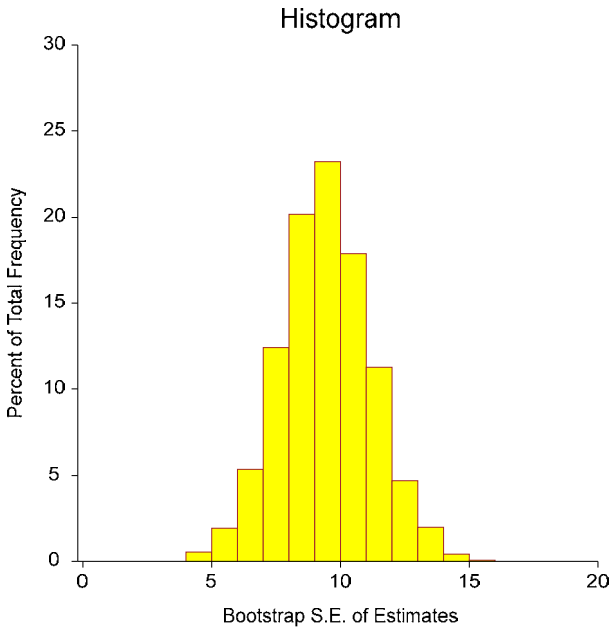


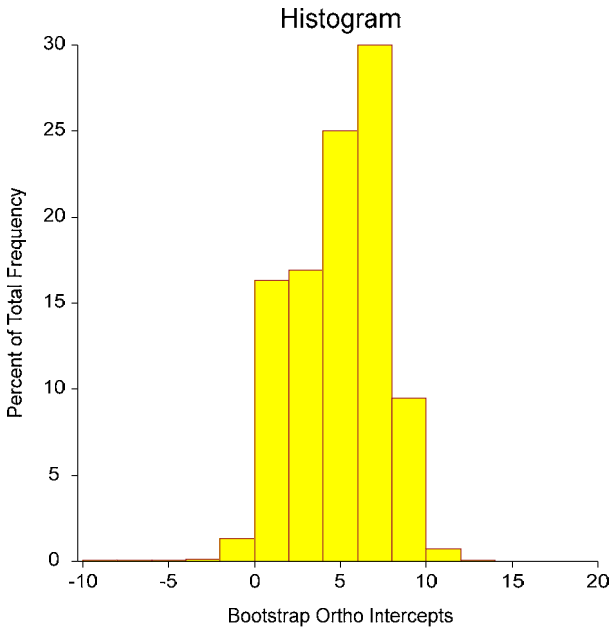


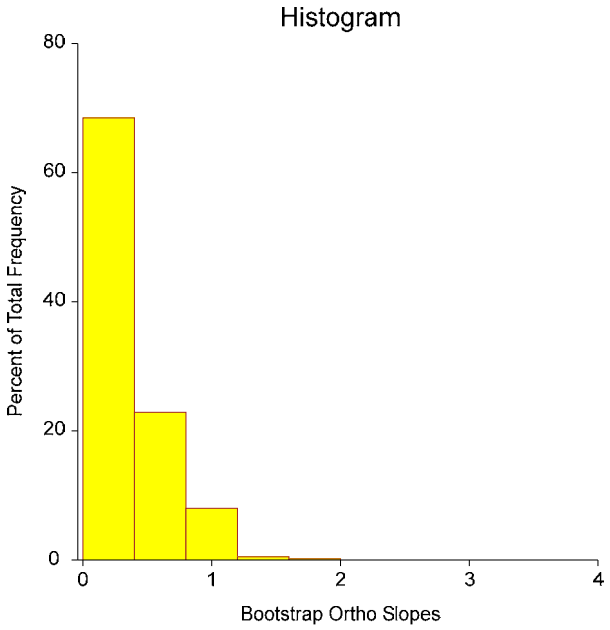


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.4882	0.2384	0.8324
Lower 95% Conf. Limit (r dist'n)	0.2135		
Upper 95% Conf. Limit (r dist'n)	0.6850		
Lower 95% Conf. Limit (Fisher's z)	0.2164		0.7074
Upper 95% Conf. Limit (Fisher's z)	0.6898		0.9069
Adjusted (Rbar)		0.2193	
T-Value for H0: Rho = 0	3.5383	3.5383	9.4999
Prob Level for H0: Rho = 0	0.0010	0.0010	0.0000
Prob Level (Randomization Test N =1000)	0.0230		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	3145.833	3145.833			
Slope	1	1287.493	1287.493	12.5196	0.0010	0.9322
Error	40	4113.519	102.838			
Lack of Fit	38	3635.346	95.667	0.4001	0.9044	
Pure Error	2	478.1732	239.0866			
Adj. Total	41	5401.012	131.732			
Total	42	8546.845				

s = Square Root(102.838) = 10.14091

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	621.97	363.49	0.02733403	-0.0002380009
1	621.97	71432.3	14333.27	-0.0002380009	1.607157E-05
2 (Y'Y)			8546.845		
Determinant		2613310			3.826565E-07

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	2.810977	-0.02447553
1	-0.02447553	0.001652768

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7444	0.000000	No
Anderson Darling	4.0292	0.000000	No
D'Agostino Skewness	4.1670	0.000031	No
D'Agostino Kurtosis	2.9193	0.003509	No
D'Agostino Omnibus	25.8856	0.000002	No
Constant Residual Variance?			
Modified Levene Test	6.8059	0.012716	No
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.4001	0.904432	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

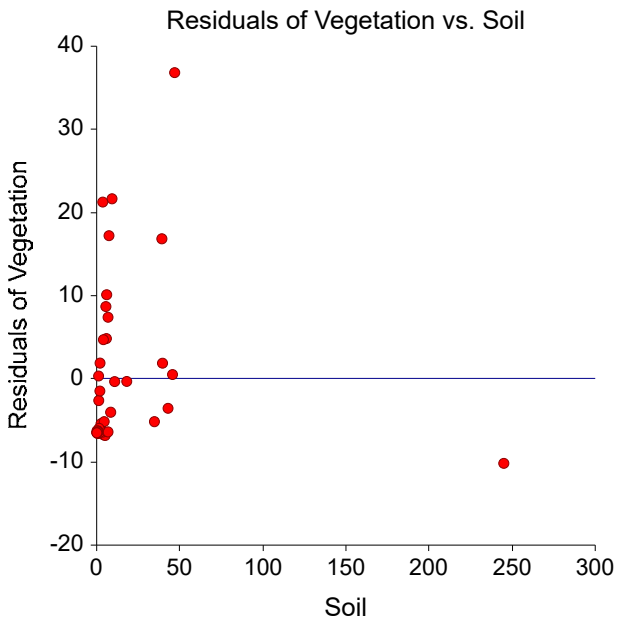
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

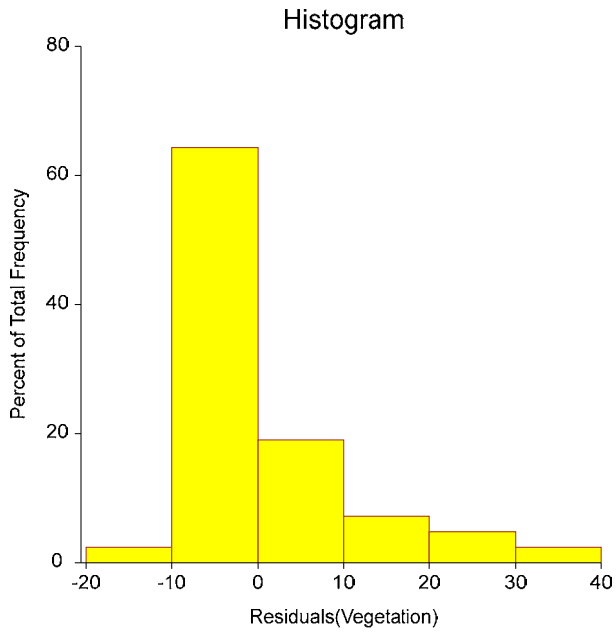
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

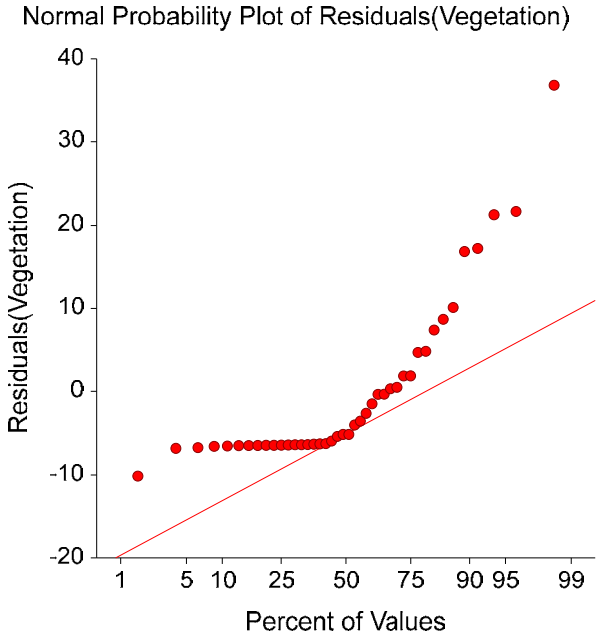
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Original Data Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual
10	245.0000	31.6000	41.7669	-10.1669
11	6.0000	17.5000	7.3874	10.1126
12	46.9000	50.1000	13.2708	36.8292
13	1.2000	4.0800	6.6969	-2.6169
14	39.6000	14.1000	12.2207	1.8793
15	4.1000	0.3700	7.1141	-6.7441
16	0.7100	0.0800	6.6264	-6.5464
17	5.1000	0.4300	7.2579	-6.8279
18	0.3500	0.1100	6.5747	-6.4647
19	3.6000	0.6200	7.0422	-6.4222
20	2.6000	1.5000	6.8983	-5.3983
21	0.6600	0.0300	6.6193	-6.5893
22	45.6000	13.6000	13.0838	0.5162
23	4.5000	2.0200	7.1716	-5.1516
24	5.8000	12.2000	7.3586	4.8414
25	6.8000	14.9000	7.5025	7.3975
26	9.2000	29.5000	7.8477	21.6523
27	7.4000	24.8000	7.5888	17.2112
28	10.8000	7.7400	8.0779	-0.3379
29	3.6000	28.3000	7.0422	21.2578
30	18.1000	8.8100	9.1280	-0.3180
31	42.9000	9.1500	12.6954	-3.5454
32	1.9000	5.3300	6.7976	-1.4676
33	4.0000	11.8000	7.0997	4.7003
34	0.4600	0.0900	6.5905	-6.5005
35	1.5000	0.3500	6.7401	-6.3901
36	1.8000	0.3400	6.7832	-6.4432
37	6.8000	1.1100	7.5025	-6.3925
38	1.4000	0.7700	6.7257	-5.9557
39	0.6700	0.3300	6.6207	-6.2907
40	0.9400	0.3300	6.6595	-6.3295
41	0.1800	0.0700	6.5502	-6.4802
42	0.2100	0.3000	6.5545	-6.2545
43	0.5400	0.2300	6.6020	-6.3720
44	0.0730	0.0700	6.5348	-6.4648
45	0.0770	0.0400	6.5354	-6.4954
46	8.4000	3.7100	7.7326	-4.0226
47	2.0000	8.7000	6.8120	1.8880
48	1.1000	7.0200	6.6825	0.3375
49	39.2000	29.0000	12.1631	16.8369
50	34.7000	6.3600	11.5158	-5.1558
51	5.5000	16.0000	7.3155	8.6845

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	245.0000	31.6000	41.7669	9.4882	22.5906	60.9432
11	6.0000	17.5000	7.3874	1.6052	4.1431	10.6317
12	46.9000	50.1000	13.2708	2.0373	9.1532	17.3883
13	1.2000	4.0800	6.6969	1.6597	3.3425	10.0513
14	39.6000	14.1000	12.2207	1.8613	8.4589	15.9824
15	4.1000	0.3700	7.1141	1.6242	3.8314	10.3967
16	0.7100	0.0800	6.6264	1.6664	3.2584	9.9945
17	5.1000	0.4300	7.2579	1.6138	3.9963	10.5195
18	0.3500	0.1100	6.5747	1.6715	3.1964	9.9530
19	3.6000	0.6200	7.0422	1.6298	3.7483	10.3361
20	2.6000	1.5000	6.8983	1.6416	3.5805	10.2161
21	0.6600	0.0300	6.6193	1.6671	3.2498	9.9887
22	45.6000	13.6000	13.0838	2.0039	9.0338	17.1337
23	4.5000	2.0200	7.1716	1.6199	3.8976	10.4456
24	5.8000	12.2000	7.3586	1.6071	4.1106	10.6066
25	6.8000	14.9000	7.5025	1.5983	4.2722	10.7327
26	9.2000	29.5000	7.8477	1.5813	4.6518	11.0436
27	7.4000	24.8000	7.5888	1.5935	4.3682	10.8094
28	10.8000	7.7400	8.0779	1.5732	4.8982	11.2575
29	3.6000	28.3000	7.0422	1.6298	3.7483	10.3361
30	18.1000	8.8100	9.1280	1.5705	5.9539	12.3020
31	42.9000	9.1500	12.6954	1.9372	8.7801	16.6106
32	1.9000	5.3300	6.7976	1.6504	3.4620	10.1333
33	4.0000	11.8000	7.0997	1.6253	3.8148	10.3846
34	0.4600	0.0900	6.5905	1.6700	3.2153	9.9656
35	1.5000	0.3500	6.7401	1.6557	3.3938	10.0863
36	1.8000	0.3400	6.7832	1.6517	3.4450	10.1215
37	6.8000	1.1100	7.5025	1.5983	4.2722	10.7327
38	1.4000	0.7700	6.7257	1.6570	3.3768	10.0746
39	0.6700	0.3300	6.6207	1.6670	3.2515	9.9898
40	0.9400	0.3300	6.6595	1.6633	3.2980	10.0211
41	0.1800	0.0700	6.5502	1.6740	3.1670	9.9335
42	0.2100	0.3000	6.5545	1.6736	3.1722	9.9369
43	0.5400	0.2300	6.6020	1.6688	3.2291	9.9748
44	0.0730	0.0700	6.5348	1.6755	3.1484	9.9212
45	0.0770	0.0400	6.5354	1.6755	3.1491	9.9217
46	8.4000	3.7100	7.7326	1.5863	4.5266	10.9387
47	2.0000	8.7000	6.8120	1.6491	3.4790	10.1451
48	1.1000	7.0200	6.6825	1.6611	3.3254	10.0397
49	39.2000	29.0000	12.1631	1.8525	8.4191	15.9072
50	34.7000	6.3600	11.5158	1.7614	7.9559	15.0757
51	5.5000	16.0000	7.3155	1.6099	4.0618	10.5692

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	245.0000	31.6000	41.7669	13.8875	13.6992	69.8346
11	6.0000	17.5000	7.3874	10.2672	-13.3633	28.1381
12	46.9000	50.1000	13.2708	10.3435	-7.6343	34.1758
13	1.2000	4.0800	6.6969	10.2758	-14.0713	27.4652
14	39.6000	14.1000	12.2207	10.3103	-8.6172	33.0586
15	4.1000	0.3700	7.1141	10.2702	-13.6427	27.8708
16	0.7100	0.0800	6.6264	10.2769	-14.1440	27.3969
17	5.1000	0.4300	7.2579	10.2685	-13.4955	28.0114
18	0.3500	0.1100	6.5747	10.2777	-14.1974	27.3468
19	3.6000	0.6200	7.0422	10.2710	-13.7164	27.8007
20	2.6000	1.5000	6.8983	10.2729	-13.8640	27.6607
21	0.6600	0.0300	6.6193	10.2770	-14.1514	27.3899
22	45.6000	13.6000	13.0838	10.3370	-7.8081	33.9756
23	4.5000	2.0200	7.1716	10.2695	-13.5838	27.9270
24	5.8000	12.2000	7.3586	10.2675	-13.3927	28.1099
25	6.8000	14.9000	7.5025	10.2661	-13.2461	28.2510
26	9.2000	29.5000	7.8477	10.2635	-12.8955	28.5909
27	7.4000	24.8000	7.5888	10.2653	-13.1582	28.3358
28	10.8000	7.7400	8.0779	10.2622	-12.6628	28.8186
29	3.6000	28.3000	7.0422	10.2710	-13.7164	27.8007
30	18.1000	8.8100	9.1280	10.2618	-11.6119	29.8678
31	42.9000	9.1500	12.6954	10.3243	-8.1708	33.5615
32	1.9000	5.3300	6.7976	10.2743	-13.9676	27.5628
33	4.0000	11.8000	7.0997	10.2703	-13.6574	27.8568
34	0.4600	0.0900	6.5905	10.2775	-14.1811	27.3621
35	1.5000	0.3500	6.7401	10.2752	-14.0268	27.5070
36	1.8000	0.3400	6.7832	10.2745	-13.9824	27.5489
37	6.8000	1.1100	7.5025	10.2661	-13.2461	28.2510
38	1.4000	0.7700	6.7257	10.2754	-14.0416	27.4930
39	0.6700	0.3300	6.6207	10.2770	-14.1499	27.3913
40	0.9400	0.3300	6.6595	10.2764	-14.1098	27.4289
41	0.1800	0.0700	6.5502	10.2781	-14.2227	27.3231
42	0.2100	0.3000	6.5545	10.2781	-14.2182	27.3273
43	0.5400	0.2300	6.6020	10.2773	-14.1692	27.3732
44	0.0730	0.0700	6.5348	10.2784	-14.2386	27.3082
45	0.0770	0.0400	6.5354	10.2784	-14.2380	27.3088
46	8.4000	3.7100	7.7326	10.2642	-13.0121	28.4774
47	2.0000	8.7000	6.8120	10.2741	-13.9528	27.5768
48	1.1000	7.0200	6.6825	10.2760	-14.0861	27.4512
49	39.2000	29.0000	12.1631	10.3087	-8.6716	32.9978
50	34.7000	6.3600	11.5158	10.2927	-9.2866	32.3182
51	5.5000	16.0000	7.3155	10.2679	-13.4367	28.0677

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	245.0000	31.6000	41.7669	9.4882	14.7598	68.7740
11	6.0000	17.5000	7.3874	1.6052	2.8183	11.9565
12	46.9000	50.1000	13.2708	2.0373	7.4718	19.0697
13	1.2000	4.0800	6.6969	1.6597	1.9728	11.4211
14	39.6000	14.1000	12.2207	1.8613	6.9228	17.5186
15	4.1000	0.3700	7.1141	1.6242	2.4909	11.7372
16	0.7100	0.0800	6.6264	1.6664	1.8831	11.3698
17	5.1000	0.4300	7.2579	1.6138	2.6645	11.8514
18	0.3500	0.1100	6.5747	1.6715	1.8168	11.3325
19	3.6000	0.6200	7.0422	1.6298	2.4032	11.6812
20	2.6000	1.5000	6.8983	1.6416	2.2256	11.5710
21	0.6600	0.0300	6.6193	1.6671	1.8739	11.3646
22	45.6000	13.6000	13.0838	2.0039	7.3799	18.7876
23	4.5000	2.0200	7.1716	1.6199	2.5607	11.7826
24	5.8000	12.2000	7.3586	1.6071	2.7843	11.9330
25	6.8000	14.9000	7.5025	1.5983	2.9531	12.0519
26	9.2000	29.5000	7.8477	1.5813	3.3467	12.3487
27	7.4000	24.8000	7.5888	1.5935	3.0530	12.1245
28	10.8000	7.7400	8.0779	1.5732	3.5998	12.5559
29	3.6000	28.3000	7.0422	1.6298	2.4032	11.6812
30	18.1000	8.8100	9.1280	1.5705	4.6577	13.5982
31	42.9000	9.1500	12.6954	1.9372	7.1813	18.2094
32	1.9000	5.3300	6.7976	1.6504	2.0998	11.4954
33	4.0000	11.8000	7.0997	1.6253	2.4734	11.7260
34	0.4600	0.0900	6.5905	1.6700	1.8371	11.3439
35	1.5000	0.3500	6.7401	1.6557	2.0274	11.4528
36	1.8000	0.3400	6.7832	1.6517	2.0818	11.4847
37	6.8000	1.1100	7.5025	1.5983	2.9531	12.0519
38	1.4000	0.7700	6.7257	1.6570	2.0092	11.4422
39	0.6700	0.3300	6.6207	1.6670	1.8757	11.3657
40	0.9400	0.3300	6.6595	1.6633	1.9252	11.3938
41	0.1800	0.0700	6.5502	1.6740	1.7854	11.3150
42	0.2100	0.3000	6.5545	1.6736	1.7909	11.3181
43	0.5400	0.2300	6.6020	1.6688	1.8518	11.3522
44	0.0730	0.0700	6.5348	1.6755	1.7656	11.3041
45	0.0770	0.0400	6.5354	1.6755	1.7663	11.3045
46	8.4000	3.7100	7.7326	1.5863	3.2173	12.2479
47	2.0000	8.7000	6.8120	1.6491	2.1179	11.5061
48	1.1000	7.0200	6.6825	1.6611	1.9545	11.4106
49	39.2000	29.0000	12.1631	1.8525	6.8901	17.4361
50	34.7000	6.3600	11.5158	1.7614	6.5022	16.5294
51	5.5000	16.0000	7.3155	1.6099	2.7331	11.8979

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	245.0000	31.6000	41.7669	-10.1669	-2.8403	32.1737
11	6.0000	17.5000	7.3874	10.1126	1.0099	57.7863
12	46.9000	50.1000	13.2708	36.8292	3.7073	73.5115
13	1.2000	4.0800	6.6969	-2.6169	-0.2616	64.1405
14	39.6000	14.1000	12.2207	1.8793	0.1885	13.3286
15	4.1000	0.3700	7.1141	-6.7441	-0.6737	1822.7273
16	0.7100	0.0800	6.6264	-6.5464	-0.6544	8183.0608
17	5.1000	0.4300	7.2579	-6.8279	-0.6820	1587.8926
18	0.3500	0.1100	6.5747	-6.4647	-0.6463	5876.9669
19	3.6000	0.6200	7.0422	-6.4222	-0.6416	1035.8334
20	2.6000	1.5000	6.8983	-5.3983	-0.5394	359.8880
21	0.6600	0.0300	6.6193	-6.5893	-0.6587	21964.1876
22	45.6000	13.6000	13.0838	0.5162	0.0519	3.7959
23	4.5000	2.0200	7.1716	-5.1516	-0.5146	255.0312
24	5.8000	12.2000	7.3586	4.8414	0.4835	39.6834
25	6.8000	14.9000	7.5025	7.3975	0.7387	49.6478
26	9.2000	29.5000	7.8477	21.6523	2.1616	73.3976
27	7.4000	24.8000	7.5888	17.2112	1.7186	69.4001
28	10.8000	7.7400	8.0779	-0.3379	-0.0337	4.3652
29	3.6000	28.3000	7.0422	21.2578	2.1239	75.1160
30	18.1000	8.8100	9.1280	-0.3180	-0.0317	3.6090
31	42.9000	9.1500	12.6954	-3.5454	-0.3562	38.7472
32	1.9000	5.3300	6.7976	-1.4676	-0.1467	27.5352
33	4.0000	11.8000	7.0997	4.7003	0.4696	39.8330
34	0.4600	0.0900	6.5905	-6.5005	-0.6499	7222.7631
35	1.5000	0.3500	6.7401	-6.3901	-0.6387	1825.7394
36	1.8000	0.3400	6.7832	-6.4432	-0.6440	1895.0712
37	6.8000	1.1100	7.5025	-6.3925	-0.6383	575.8990
38	1.4000	0.7700	6.7257	-5.9557	-0.5953	773.4680
39	0.6700	0.3300	6.6207	-6.2907	-0.6289	1906.2711
40	0.9400	0.3300	6.6595	-6.3295	-0.6327	1918.0405
41	0.1800	0.0700	6.5502	-6.4802	-0.6479	9257.4423
42	0.2100	0.3000	6.5545	-6.2545	-0.6253	2084.8417
43	0.5400	0.2300	6.6020	-6.3720	-0.6370	2770.4324
44	0.0730	0.0700	6.5348	-6.4648	-0.6464	9235.4542
45	0.0770	0.0400	6.5354	-6.4954	-0.6494	16238.4833
46	8.4000	3.7100	7.7326	-4.0226	-0.4016	108.4268
47	2.0000	8.7000	6.8120	1.8880	0.1887	21.7010
48	1.1000	7.0200	6.6825	0.3375	0.0337	4.8070
49	39.2000	29.0000	12.1631	16.8369	1.6887	58.0582
50	34.7000	6.3600	11.5158	-5.1558	-0.5163	81.0663
51	5.5000	16.0000	7.3155	8.6845	0.8674	54.2783

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	245.0000	-10.1669	**-3.1390	0.8754	*28.3424	84.2019
11	6.0000	10.1126	1.0102	0.0251	0.0131	102.7853
12	46.9000	36.8292	*4.5184	0.0404	0.2890	69.2328
13	1.2000	-2.6169	-0.2585	0.0268	0.0009	105.2944
14	39.6000	1.8793	0.1862	0.0337	0.0006	105.3811
15	4.1000	-6.7441	-0.6691	0.0257	0.0060	104.2779
16	0.7100	-6.5464	-0.6497	0.0270	0.0059	104.3455
17	5.1000	-6.8279	-0.6774	0.0253	0.0060	104.2484
18	0.3500	-6.4647	-0.6416	0.0272	0.0058	104.3733
19	3.6000	-6.4222	-0.6368	0.0258	0.0055	104.3893
20	2.6000	-5.3983	-0.5346	0.0262	0.0039	104.7075
21	0.6600	-6.5893	-0.6540	0.0270	0.0060	104.3306
22	45.6000	0.5162	0.0513	0.0390	0.0001	105.4677
23	4.5000	-5.1516	-0.5098	0.0255	0.0035	104.7765
24	5.8000	4.8414	0.4788	0.0251	0.0030	104.8584
25	6.8000	7.3975	0.7344	0.0248	0.0070	104.0359
26	9.2000	21.6523	*2.2712	0.0243	0.0582	93.1542
27	7.4000	17.2112	1.7633	0.0247	0.0374	97.6870
28	10.8000	-0.3379	-0.0333	0.0241	0.0000	105.4719
29	3.6000	21.2578	*2.2264	0.0258	0.0598	93.5806
30	18.1000	-0.3180	-0.0313	0.0240	0.0000	105.4722
31	42.9000	-3.5454	-0.3522	0.0365	0.0024	105.1403
32	1.9000	-1.4676	-0.1449	0.0265	0.0003	105.4181
33	4.0000	4.7003	0.4649	0.0257	0.0029	104.8934
34	0.4600	-6.5005	-0.6451	0.0271	0.0059	104.3612
35	1.5000	-6.3901	-0.6339	0.0267	0.0056	104.3992
36	1.8000	-6.4432	-0.6392	0.0265	0.0057	104.3813
37	6.8000	-6.3925	-0.6335	0.0248	0.0052	104.4004
38	1.4000	-5.9557	-0.5904	0.0267	0.0049	104.5404
39	0.6700	-6.2907	-0.6241	0.0270	0.0055	104.4320
40	0.9400	-6.3295	-0.6279	0.0269	0.0055	104.4192
41	0.1800	-6.4802	-0.6431	0.0272	0.0059	104.3679
42	0.2100	-6.2545	-0.6205	0.0272	0.0055	104.4437
43	0.5400	-6.3720	-0.6322	0.0271	0.0056	104.4048
44	0.0730	-6.4648	-0.6416	0.0273	0.0059	104.3731
45	0.0770	-6.4954	-0.6447	0.0273	0.0059	104.3627
46	8.4000	-4.0226	-0.3974	0.0245	0.0020	105.0495
47	2.0000	1.8880	0.1864	0.0264	0.0005	105.3810
48	1.1000	0.3375	0.0333	0.0268	0.0000	105.4719
49	39.2000	16.8369	1.7303	0.0334	0.0492	97.9552
50	34.7000	-5.1558	-0.5115	0.0302	0.0041	104.7720
51	5.5000	8.6845	0.8646	0.0252	0.0097	103.4910

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	* -3.1390	-8.3205	** 28.3424	* 5.3809	1.6662	-8.2066
11	1.0102	0.1619	0.0131	1.0246	0.1603	-0.0361
12	* 4.5184	0.9266	0.2890	0.4723	0.4512	0.5934
13	-0.2585	-0.0429	0.0009	1.0772	-0.0429	0.0143
14	0.1862	0.0348	0.0006	1.0867	0.0205	0.0188
15	-0.6691	-0.1086	0.0060	1.0553	-0.1081	0.0291
16	-0.6497	-0.1082	0.0059	1.0581	-0.1082	0.0372
17	-0.6774	-0.1092	0.0060	1.0543	-0.1084	0.0267
18	-0.6416	-0.1072	0.0058	1.0589	-0.1072	0.0377
19	-0.6368	-0.1037	0.0055	1.0577	-0.1033	0.0290
20	-0.5346	-0.0877	0.0039	1.0646	-0.0875	0.0265
21	-0.6540	-0.1090	0.0060	1.0578	-0.1090	0.0376
22	0.0513	0.0103	0.0001	1.0945	0.0052	0.0065
23	-0.5098	-0.0825	0.0035	1.0652	-0.0820	0.0213
24	0.4788	0.0769	0.0030	1.0665	0.0761	-0.0175
25	0.7344	0.1172	0.0070	1.0495	0.1157	-0.0239
26	* 2.2712	0.3585	0.0582	0.8410	0.3497	-0.0517
27	1.7633	0.2806	0.0374	0.9252	0.2762	-0.0530
28	-0.0333	-0.0052	0.0000	1.0778	-0.0050	0.0005
29	* 2.2264	0.3625	0.0598	0.8500	0.3613	-0.1014
30	-0.0313	-0.0049	0.0000	1.0777	-0.0044	-0.0004
31	-0.3522	-0.0686	0.0024	1.0849	-0.0372	-0.0404
32	-0.1449	-0.0239	0.0003	1.0794	-0.0239	0.0076
33	0.4649	0.0755	0.0029	1.0678	0.0752	-0.0204
34	-0.6451	-0.1077	0.0059	1.0585	-0.1077	0.0376
35	-0.6339	-0.1049	0.0056	1.0588	-0.1048	0.0343
36	-0.6392	-0.1055	0.0057	1.0583	-0.1054	0.0338
37	-0.6335	-0.1011	0.0052	1.0569	-0.0998	0.0206
38	-0.5904	-0.0978	0.0049	1.0617	-0.0977	0.0322
39	-0.6241	-0.1040	0.0055	1.0599	-0.1040	0.0359
40	-0.6279	-0.1044	0.0055	1.0595	-0.1044	0.0354
41	-0.6431	-0.1076	0.0059	1.0588	-0.1076	0.0382
42	-0.6205	-0.1038	0.0055	1.0604	-0.1038	0.0368
43	-0.6322	-0.1055	0.0056	1.0594	-0.1055	0.0367
44	-0.6416	-0.1075	0.0059	1.0590	-0.1075	0.0384
45	-0.6447	-0.1080	0.0059	1.0588	-0.1080	0.0386
46	-0.3974	-0.0629	0.0020	1.0696	-0.0617	0.0103
47	0.1864	0.0307	0.0005	1.0786	0.0307	-0.0097
48	0.0333	0.0055	0.0000	1.0809	0.0055	-0.0019
49	1.7303	0.3215	0.0492	0.9386	0.1917	0.1721
50	-0.5115	-0.0902	0.0041	1.0703	-0.0599	-0.0414
51	0.8646	0.1390	0.0097	1.0389	0.1379	-0.0327

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
10	245.0000	-10.1669	||||.....	-2.8403	|||||||||||....	* -3.1390	|||||||||.....
11	6.0000	10.1126	||||.....	1.0099	|||.....	1.0102	|||.....
12	46.9000	36.8292	|||||||||||||||	3.7073	|||||||||||||||	* 4.5184	|||||||||||||||
13	1.2000	-2.6169	|.....	-0.2616	|.....	-0.2585	|.....
14	39.6000	1.8793	|.....	0.1885	|.....	0.1862	|.....
15	4.1000	-6.7441	||.....	-0.6737	||.....	-0.6691	||.....
16	0.7100	-6.5464	||.....	-0.6544	||.....	-0.6497	||.....
17	5.1000	-6.8279	||.....	-0.6820	||.....	-0.6774	||.....
18	0.3500	-6.4647	||.....	-0.6463	||.....	-0.6416	||.....
19	3.6000	-6.4222	||.....	-0.6416	||.....	-0.6368	||.....
20	2.6000	-5.3983	||.....	-0.5394	||.....	-0.5346	|.....
21	0.6600	-6.5893	||.....	-0.6587	||.....	-0.6540	||.....
22	45.6000	0.5162	|.....	0.0519	|.....	0.0513	|.....
23	4.5000	-5.1516	|.....	-0.5146	|.....	-0.5098	|.....
24	5.8000	4.8414	|.....	0.4835	|.....	0.4788	|.....
25	6.8000	7.3975	||.....	0.7387	||.....	0.7344	||.....
26	9.2000	21.6523	|||||||.....	2.1616	|||||||.....	* 2.2712	|||||||.....
27	7.4000	17.2112	||||||.....	1.7186	||||||.....	1.7633	|||||.....
28	10.8000	-0.3379	|.....	-0.0337	|.....	-0.0333	|.....
29	3.6000	21.2578	|||||||.....	2.1239	|||||||.....	* 2.2264	|||||||.....
30	18.1000	-0.3180	|.....	-0.0317	|.....	-0.0313	|.....
31	42.9000	-3.5454	|.....	-0.3562	|.....	-0.3522	|.....
32	1.9000	-1.4676	|.....	-0.1467	|.....	-0.1449	|.....
33	4.0000	4.7003	|.....	0.4696	|.....	0.4649	|.....
34	0.4600	-6.5005	||.....	-0.6499	||.....	-0.6451	||.....
35	1.5000	-6.3901	||.....	-0.6387	||.....	-0.6339	||.....
36	1.8000	-6.4432	||.....	-0.6440	||.....	-0.6392	||.....
37	6.8000	-6.3925	||.....	-0.6383	||.....	-0.6335	||.....
38	1.4000	-5.9557	||.....	-0.5953	||.....	-0.5904	|.....
39	0.6700	-6.2907	||.....	-0.6289	||.....	-0.6241	|.....
40	0.9400	-6.3295	||.....	-0.6327	||.....	-0.6279	|.....
41	0.1800	-6.4802	||.....	-0.6479	||.....	-0.6431	||.....
42	0.2100	-6.2545	||.....	-0.6253	||.....	-0.6205	|.....
43	0.5400	-6.3720	||.....	-0.6370	||.....	-0.6322	||.....
44	0.0730	-6.4648	||.....	-0.6464	||.....	-0.6416	||.....
45	0.0770	-6.4954	||.....	-0.6494	||.....	-0.6447	||.....
46	8.4000	-4.0226	|.....	-0.4016	|.....	-0.3974	|.....
47	2.0000	1.8880	|.....	0.1887	|.....	0.1864	|.....
48	1.1000	0.3375	|.....	0.0337	|.....	0.0333	|.....
49	39.2000	16.8369	||||||.....	1.6887	||||||.....	1.7303	|||||.....
50	34.7000	-5.1558	|.....	-0.5163	|.....	-0.5115	|.....
51	5.5000	8.6845	|||.....	0.8674	|||.....	0.8646	||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	245.0000	-8.3205	|||||||||||||||	** 28.3424	|||||||||||||||	-8.2066	|||||||||||||||
11	6.0000	0.1619	|.....	0.0131	|.....	-0.0361	|.....
12	46.9000	0.9266	|.....	0.2890	|.....	0.5934	|.....
13	1.2000	-0.0429	|.....	0.0009	|.....	0.0143	|.....
14	39.6000	0.0348	|.....	0.0006	|.....	0.0188	|.....
15	4.1000	-0.1086	|.....	0.0060	|.....	0.0291	|.....
16	0.7100	-0.1082	|.....	0.0059	|.....	0.0372	|.....
17	5.1000	-0.1092	|.....	0.0060	|.....	0.0267	|.....
18	0.3500	-0.1072	|.....	0.0058	|.....	0.0377	|.....
19	3.6000	-0.1037	|.....	0.0055	|.....	0.0290	|.....
20	2.6000	-0.0877	|.....	0.0039	|.....	0.0265	|.....
21	0.6600	-0.1090	|.....	0.0060	|.....	0.0376	|.....
22	45.6000	0.0103	|.....	0.0001	|.....	0.0065	|.....
23	4.5000	-0.0825	|.....	0.0035	|.....	0.0213	|.....
24	5.8000	0.0769	|.....	0.0030	|.....	-0.0175	|.....
25	6.8000	0.1172	|.....	0.0070	|.....	-0.0239	|.....
26	9.2000	0.3585	|.....	0.0582	|.....	-0.0517	|.....
27	7.4000	0.2806	|.....	0.0374	|.....	-0.0530	|.....
28	10.8000	-0.0052	|.....	0.0000	|.....	0.0005	|.....
29	3.6000	0.3625	|.....	0.0598	|.....	-0.1014	|.....
30	18.1000	-0.0049	|.....	0.0000	|.....	-0.0004	|.....
31	42.9000	-0.0686	|.....	0.0024	|.....	-0.0404	|.....
32	1.9000	-0.0239	|.....	0.0003	|.....	0.0076	|.....
33	4.0000	0.0755	|.....	0.0029	|.....	-0.0204	|.....
34	0.4600	-0.1077	|.....	0.0059	|.....	0.0376	|.....
35	1.5000	-0.1049	|.....	0.0056	|.....	0.0343	|.....
36	1.8000	-0.1055	|.....	0.0057	|.....	0.0338	|.....
37	6.8000	-0.1011	|.....	0.0052	|.....	0.0206	|.....
38	1.4000	-0.0978	|.....	0.0049	|.....	0.0322	|.....
39	0.6700	-0.1040	|.....	0.0055	|.....	0.0359	|.....
40	0.9400	-0.1044	|.....	0.0055	|.....	0.0354	|.....
41	0.1800	-0.1076	|.....	0.0059	|.....	0.0382	|.....
42	0.2100	-0.1038	|.....	0.0055	|.....	0.0368	|.....
43	0.5400	-0.1055	|.....	0.0056	|.....	0.0367	|.....
44	0.0730	-0.1075	|.....	0.0059	|.....	0.0384	|.....
45	0.0770	-0.1080	|.....	0.0059	|.....	0.0386	|.....
46	8.4000	-0.0629	|.....	0.0020	|.....	0.0103	|.....
47	2.0000	0.0307	|.....	0.0005	|.....	-0.0097	|.....
48	1.1000	0.0055	|.....	0.0000	|.....	-0.0019	|.....
49	39.2000	0.3215	|.....	0.0492	|.....	0.1721	|.....
50	34.7000	-0.0902	|.....	0.0041	|.....	-0.0414	|.....
51	5.5000	0.1390	|.....	0.0097	|.....	-0.0327	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	245.0000	* -3.1390	|||||||||.....	** 28.3424	||||||||||||||	0.8754	||||||||||||||
11	6.0000	1.0102	|||.....	0.0131	|.....	0.0251	|.....
12	46.9000	* 4.5184	||||||||||||||	0.2890	|.....	0.0404	|.....
13	1.2000	-0.2585	|.....	0.0009	|.....	0.0268	|.....
14	39.6000	0.1862	|.....	0.0006	|.....	0.0337	|.....
15	4.1000	-0.6691	||.....	0.0060	|.....	0.0257	|.....
16	0.7100	-0.6497	||.....	0.0059	|.....	0.0270	|.....
17	5.1000	-0.6774	||.....	0.0060	|.....	0.0253	|.....
18	0.3500	-0.6416	||.....	0.0058	|.....	0.0272	|.....
19	3.6000	-0.6368	||.....	0.0055	|.....	0.0258	|.....
20	2.6000	-0.5346	|.....	0.0039	|.....	0.0262	|.....
21	0.6600	-0.6540	||.....	0.0060	|.....	0.0270	|.....
22	45.6000	0.0513	|.....	0.0001	|.....	0.0390	|.....
23	4.5000	-0.5098	|.....	0.0035	|.....	0.0255	|.....
24	5.8000	0.4788	|.....	0.0030	|.....	0.0251	|.....
25	6.8000	0.7344	||.....	0.0070	|.....	0.0248	|.....
26	9.2000	* 2.2712	|||||||.....	0.0582	|.....	0.0243	|.....
27	7.4000	1.7633	|||||.....	0.0374	|.....	0.0247	|.....
28	10.8000	-0.0333	|.....	0.0000	|.....	0.0241	|.....
29	3.6000	* 2.2264	|||||||.....	0.0598	|.....	0.0258	|.....
30	18.1000	-0.0313	|.....	0.0000	|.....	0.0240	|.....
31	42.9000	-0.3522	|.....	0.0024	|.....	0.0365	|.....
32	1.9000	-0.1449	|.....	0.0003	|.....	0.0265	|.....
33	4.0000	0.4649	|.....	0.0029	|.....	0.0257	|.....
34	0.4600	-0.6451	||.....	0.0059	|.....	0.0271	|.....
35	1.5000	-0.6339	||.....	0.0056	|.....	0.0267	|.....
36	1.8000	-0.6392	||.....	0.0057	|.....	0.0265	|.....
37	6.8000	-0.6335	||.....	0.0052	|.....	0.0248	|.....
38	1.4000	-0.5904	|.....	0.0049	|.....	0.0267	|.....
39	0.6700	-0.6241	|.....	0.0055	|.....	0.0270	|.....
40	0.9400	-0.6279	|.....	0.0055	|.....	0.0269	|.....
41	0.1800	-0.6431	||.....	0.0059	|.....	0.0272	|.....
42	0.2100	-0.6205	|.....	0.0055	|.....	0.0272	|.....
43	0.5400	-0.6322	||.....	0.0056	|.....	0.0271	|.....
44	0.0730	-0.6416	||.....	0.0059	|.....	0.0273	|.....
45	0.0770	-0.6447	||.....	0.0059	|.....	0.0273	|.....
46	8.4000	-0.3974	|.....	0.0020	|.....	0.0245	|.....
47	2.0000	0.1864	|.....	0.0005	|.....	0.0264	|.....
48	1.1000	0.0333	|.....	0.0000	|.....	0.0268	|.....
49	39.2000	1.7303	|||||.....	0.0492	|.....	0.0334	|.....
50	34.7000	-0.5115	|.....	0.0041	|.....	0.0302	|.....
51	5.5000	0.8646	||.....	0.0097	|.....	0.0252	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Means

Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	31.6000	245.0000	174.3216	70.6784	113.7048	389.4324
11	17.5000	6.0000	76.3010	-70.3010	47.4677	164.6916
12	50.1000	46.9000	302.9302	-256.0302	196.7216	688.1951
13	4.0800	1.2000	-16.9924	18.1924	-70.3974	5.6118
14	14.1000	39.6000	52.6648	-13.0648	29.1941	112.8003
15	0.3700	4.1000	-42.7837	46.8837	-126.3656	-14.9823
16	0.0800	0.7100	-44.7997	45.5097	-130.8624	-16.4701
17	0.4300	5.1000	-42.3666	47.4666	-125.4367	-14.6729
18	0.1100	0.3500	-44.5912	44.9412	-130.3967	-16.3167
19	0.6200	3.6000	-41.0457	44.6457	-122.4988	-13.6899
20	1.5000	2.6000	-34.9281	37.5281	-108.9695	-9.0589
21	0.0300	0.6600	-45.1473	45.8073	-131.6388	-16.7255
22	13.6000	45.6000	49.1889	-3.5889	26.2524	105.4237
23	2.0200	4.5000	-31.3132	35.8132	-101.0454	-6.2518
24	12.2000	5.8000	39.4563	-33.6563	17.4204	85.3642
25	14.9000	6.8000	58.2262	-51.4262	33.7284	124.7754
26	29.5000	9.2000	159.7228	-150.5228	104.1545	355.6456
27	24.8000	7.4000	127.0492	-119.6492	82.5472	280.2602
28	7.7400	10.8000	8.4512	2.3488	-21.9494	32.6942
29	28.3000	3.6000	151.3806	-147.7806	98.6732	336.3628
30	8.8100	18.1000	15.8897	2.2103	-10.3875	43.2136
31	9.1500	42.9000	18.2533	24.6467	-7.0223	46.8649
32	5.3300	1.9000	-8.3027	10.2027	-52.6816	13.6919
33	11.8000	4.0000	36.6756	-32.6756	14.6902	79.8398
34	0.0900	0.4600	-44.7302	45.1902	-130.7071	-16.4190
35	0.3500	1.5000	-42.9227	44.4227	-126.6753	-15.0852
36	0.3400	1.8000	-42.9922	44.7922	-126.8302	-15.1367
37	1.1100	6.8000	-37.6393	44.4393	-114.9485	-11.1282
38	0.7700	1.4000	-40.0030	41.4030	-120.1833	-12.9099
39	0.3300	0.6700	-43.0618	43.7318	-126.9851	-15.1882
40	0.3300	0.9400	-43.0618	44.0018	-126.9851	-15.1882
41	0.0700	0.1800	-44.8692	45.0492	-131.0176	-16.5212
42	0.3000	0.2100	-43.2703	43.4803	-127.4500	-15.3425
43	0.2300	0.5400	-43.7569	44.2969	-128.5350	-15.7020
44	0.0700	0.0730	-44.8692	44.9422	-131.0176	-16.5212
45	0.0400	0.0770	-45.0778	45.1548	-131.4835	-16.6745
46	3.7100	8.4000	-19.5646	27.9646	-75.7921	3.3709
47	8.7000	2.0000	15.1250	-13.1250	-11.5081	42.0642
48	7.0200	1.1000	3.4459	-2.3459	-30.5214	26.4078
49	29.0000	39.2000	156.2469	-117.0469	101.8730	347.6087
50	6.3600	34.7000	-1.1423	35.8423	-38.8722	21.1383
51	16.0000	5.5000	65.8732	-60.3732	39.6932	141.5110

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Individuals

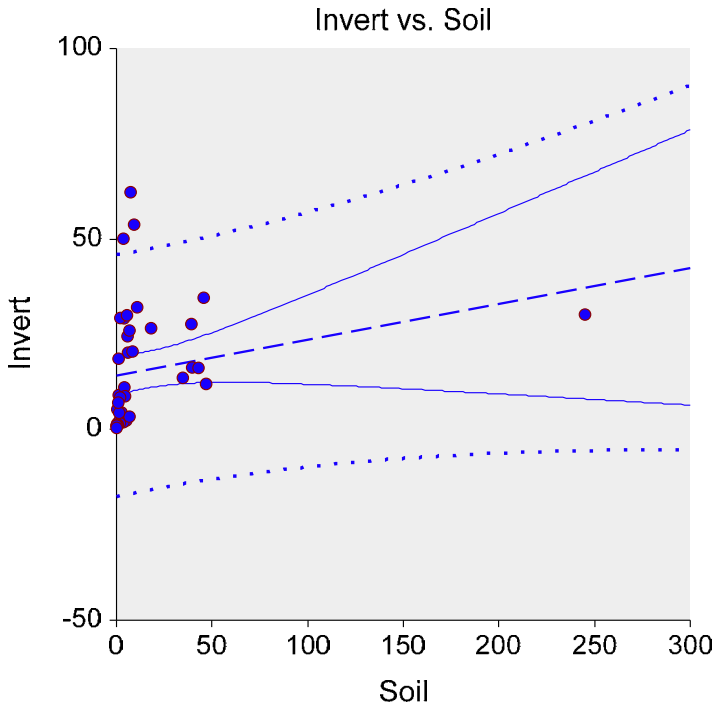
Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	31.6000	245.0000	174.3216	70.6784	29.8968	473.2404
11	17.5000	6.0000	76.3010	-70.3010	-77.1343	289.2936
12	50.1000	46.9000	302.9302	-256.0302	141.5953	743.3214
13	4.0800	1.2000	-16.9924	18.1924	-210.0901	145.3045
14	14.1000	39.6000	52.6648	-13.0648	-107.5511	249.5455
15	0.3700	4.1000	-42.7837	46.8837	-252.9746	111.6268
16	0.0800	0.7100	-44.7997	45.5097	-256.4322	109.0997
17	0.4300	5.1000	-42.3666	47.4666	-252.2612	112.1515
18	0.1100	0.3500	-44.5912	44.9412	-256.0738	109.3604
19	0.6200	3.6000	-41.0457	44.6457	-250.0059	113.8173
20	1.5000	2.6000	-34.9281	37.5281	-239.6451	121.6167
21	0.0300	0.6600	-45.1473	45.8073	-257.0298	108.6655
22	13.6000	45.6000	49.1889	-3.5889	-112.2041	243.8802
23	2.0200	4.5000	-31.3132	35.8132	-233.5887	126.2915
24	12.2000	5.8000	39.4563	-33.6563	-125.4864	228.2710
25	14.9000	6.8000	58.2262	-51.4262	-100.2039	258.7077
26	29.5000	9.2000	159.7228	-150.5228	15.5547	444.2454
27	24.8000	7.4000	127.0492	-119.6492	-18.3576	381.1651
28	7.7400	10.8000	8.4512	2.3488	-170.3503	181.0951
29	28.3000	3.6000	151.3806	-147.7806	7.1467	427.8893
30	8.8100	18.1000	15.8897	2.2103	-159.2293	192.0555
31	9.1500	42.9000	18.2533	24.6467	-155.7430	195.5856
32	5.3300	1.9000	-8.3027	10.2027	-196.2244	157.2348
33	11.8000	4.0000	36.6756	-32.6756	-129.3507	223.8807
34	0.0900	0.4600	-44.7302	45.1902	-256.3127	109.1866
35	0.3500	1.5000	-42.9227	44.4227	-253.2126	111.4520
36	0.3400	1.8000	-42.9922	44.7922	-253.3316	111.3647
37	1.1100	6.8000	-37.6393	44.4393	-244.2196	118.1429
38	0.7700	1.4000	-40.0030	41.4030	-248.2301	115.1369
39	0.3300	0.6700	-43.0618	43.7318	-253.4507	111.2773
40	0.3300	0.9400	-43.0618	44.0018	-253.4507	111.2773
41	0.0700	0.1800	-44.8692	45.0492	-256.5517	109.0128
42	0.3000	0.2100	-43.2703	43.4803	-253.8079	111.0154
43	0.2300	0.5400	-43.7569	44.2969	-254.6420	110.4050
44	0.0700	0.0730	-44.8692	44.9422	-256.5517	109.0128
45	0.0400	0.0770	-45.0778	45.1548	-256.9103	108.7523
46	3.7100	8.4000	-19.5646	27.9646	-214.2518	141.8307
47	8.7000	2.0000	15.1250	-13.1250	-160.3622	190.9183
48	7.0200	1.1000	3.4459	-2.3459	-177.9608	173.8472
49	29.0000	39.2000	156.2469	-117.0469	12.0709	437.4108
50	6.3600	34.7000	-1.1423	35.8423	-185.0268	167.2930
51	16.0000	5.5000	65.8732	-60.3732	-90.2948	271.4991

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Invert	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	14.1891	Rows Prediction Only	0
Slope	0.0944	Sum of Frequencies	42
R-Squared	0.0547	Sum of Weights	42.0000
Correlation	0.2339	Coefficient of Variation	0.9926
Mean Square Error	239.3676	Square Root of MSE	15.47151

Linear Regression Report

Y = Invert X = Soil

Summary Statement

The equation of the straight line relating Invert and Soil is estimated as: Invert = (14.1891) + (0.0944) Soil using the 42 observations in this dataset. The y-intercept, the estimated value of Invert when Soil is zero, is 14.1891 with a standard error of 2.5579. The slope, the estimated change in Invert per unit change in Soil, is 0.0944 with a standard error of 0.0620. The value of R-Squared, the proportion of the variation in Invert that can be accounted for by variation in Soil, is 0.0547. The correlation between Invert and Soil is 0.2339.

A significance test that the slope is zero resulted in a t-value of 1.5218. The significance level of this t-test is 0.1359. Since 0.1359 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.0944. The lower limit of the 95% confidence interval for the slope is -0.0310 and the upper limit is 0.2197. The estimated intercept is 14.1891. The lower limit of the 95% confidence interval for the intercept is 9.0194 and the upper limit is 19.3588.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Invert	Soil
Count	42	42
Mean	15.5869	14.8088
Standard Deviation	15.7178	38.9564
Minimum	0.4500	0.0730
Maximum	62.3000	245.0000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	14.1891	0.0944
Lower 95% Confidence Limit	9.0194	-0.0310
Upper 95% Confidence Limit	19.3588	0.2197
Standard Error	2.5579	0.0620
Standardized Coefficient	0.0000	0.2339
T Value	5.5472	1.5218
Prob Level (T Test)	0.0000	0.1359
Prob Level (Randomization Test N =1000)		0.0870
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9997	0.3178
Regression of Y on X	14.1891	0.0944
Inverse Regression from X on Y	-9.9533	1.7247
Orthogonal Regression of Y and X	13.9380	0.1113

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(14.189108423285) + (0.094389514320674) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	14.1891	0.9000	10.2603	19.3685
Bootstrap Mean	13.5020	0.9500	9.2935	20.1572
Bias (BM - OV)	-0.6871	0.9900	7.6668	21.5859
Bias Corrected	14.8762			
Standard Error	2.7484			
Slope				
Original Value	0.0944	0.9000	-0.2901	0.1262
Bootstrap Mean	0.1789	0.9500	-0.3580	0.1328
Bias (BM - OV)	0.0845	0.9900	-0.5696	0.1446
Bias Corrected	0.0098			
Standard Error	0.1676			
Correlation				
Original Value	0.2339	0.9000	0.0246	0.3238
Bootstrap Mean	0.2753	0.9500	-0.0146	0.3463
Bias (BM - OV)	0.0413	0.9900	-0.1116	0.4062
Bias Corrected	0.1926			
Standard Error	0.0919			
R-Squared				
Original Value	0.0547	0.9000	0.0000	0.0887
Bootstrap Mean	0.0842	0.9500	0.0000	0.0947
Bias (BM - OV)	0.0295	0.9900	0.0000	0.1057
Bias Corrected	0.0252			
Standard Error	0.0572			
Standard Error of Estimate				
Original Value	15.4715	0.9000	12.4162	19.8191
Bootstrap Mean	14.9287	0.9500	11.8193	20.7918
Bias (BM - OV)	-0.5428	0.9900	10.7722	22.0233
Bias Corrected	16.0143			
Standard Error	2.2517			
Orthogonal Intercept				
Original Value	13.9380	0.9000	10.2526	38.5495
Bootstrap Mean	8.4207	0.9500	9.3014	45.7171
Bias (BM - OV)	-5.5174	0.9900	7.4926	69.3039
Bias Corrected	19.4554			
Standard Error	12.2169			
Orthogonal Slope				
Original Value	0.1113	0.9000	-3.3587	0.1523
Bootstrap Mean	0.7950	0.9500	-4.6302	0.1585
Bias (BM - OV)	0.6836	0.9900	-7.0595	0.1724
Bias Corrected	-0.5723			
Standard Error	1.4976			

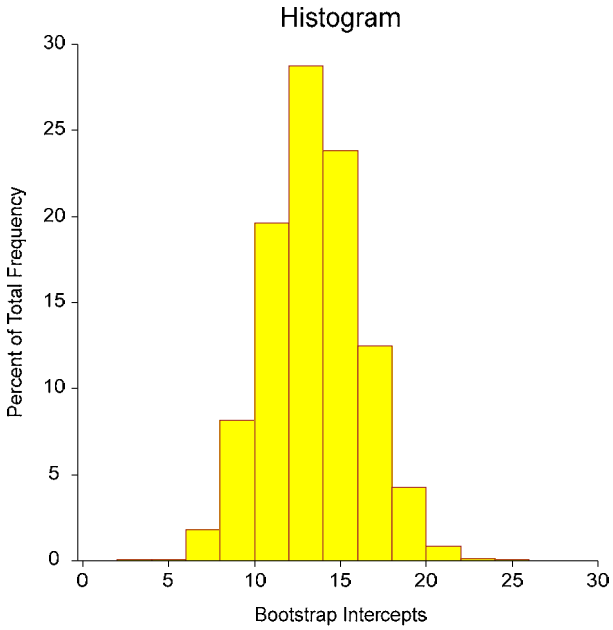
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

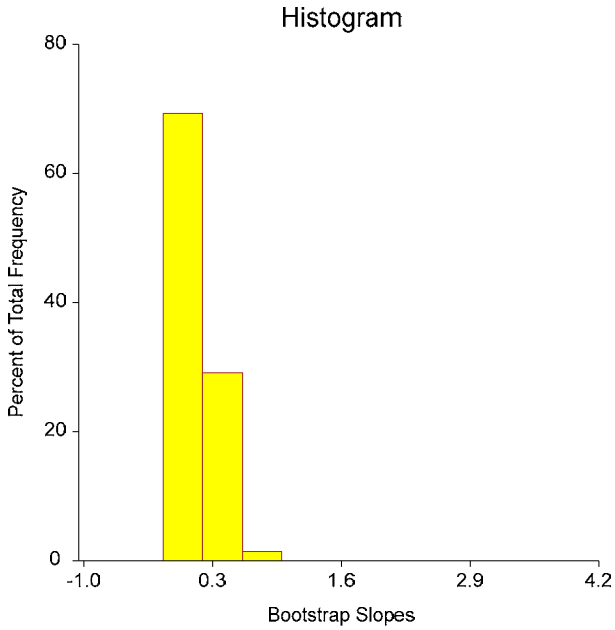
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

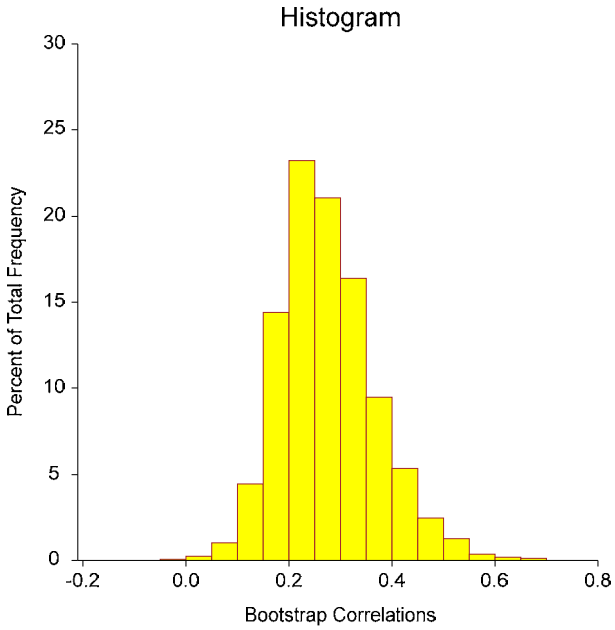
Linear Regression Report

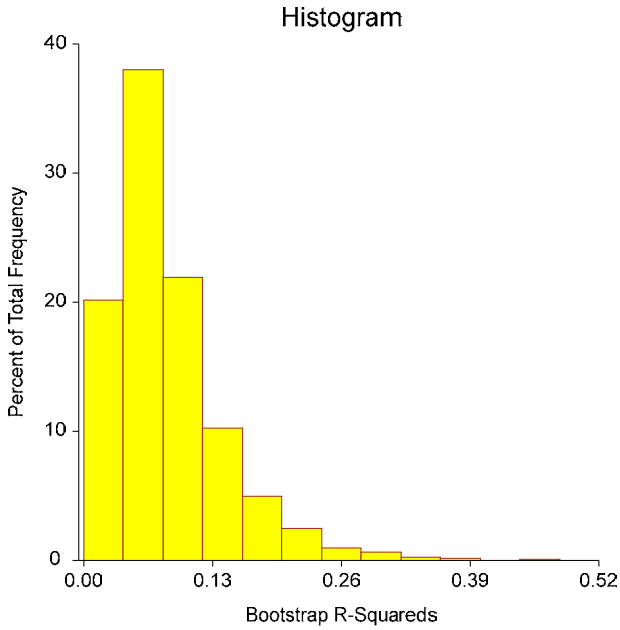
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Histograms Section



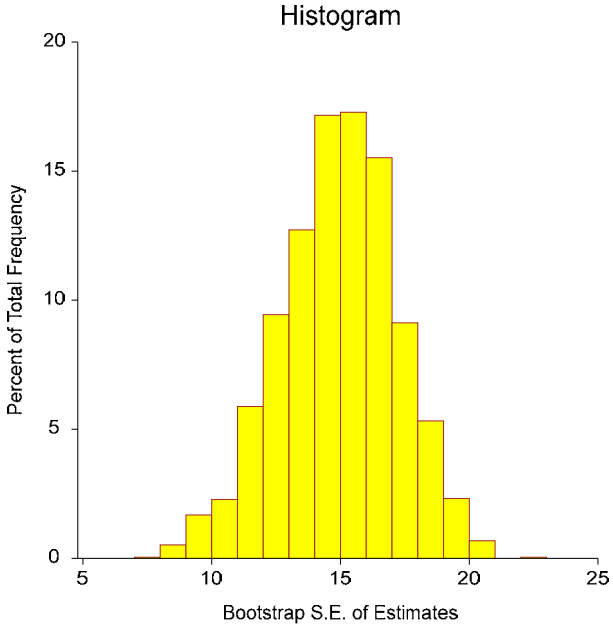


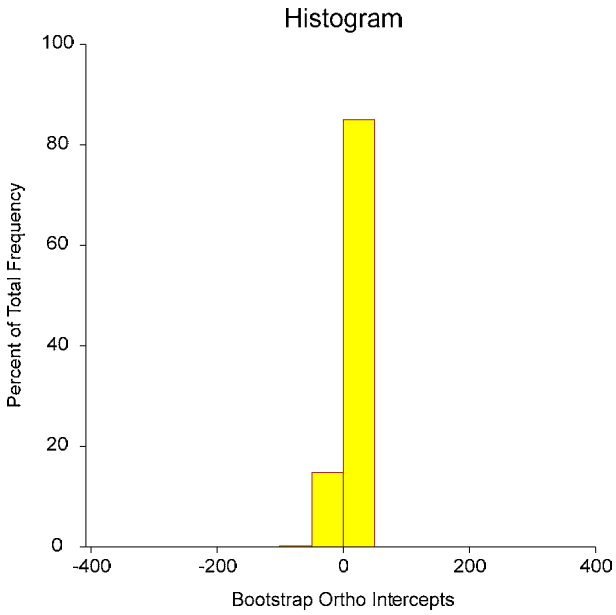


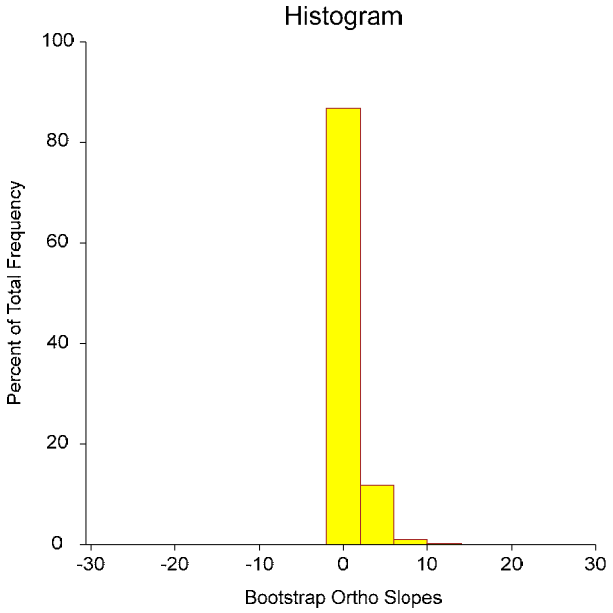


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.2339	0.0547	0.7539
Lower 95% Conf. Limit (r dist'n)	-0.0749		
Upper 95% Conf. Limit (r dist'n)	0.4975		
Lower 95% Conf. Limit (Fisher's z)	-0.0753		0.5837
Upper 95% Conf. Limit (Fisher's z)	0.5022		0.8606
Adjusted (Rbar)		0.0311	
T-Value for H0: Rho = 0	1.5218	1.5218	7.2572
Prob Level for H0: Rho = 0	0.1359	0.1359	0.0000
Prob Level (Randomization Test N =1000)	0.0870		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	10203.97	10203.97			
Slope	1	554.3564	554.3564	2.3159	0.1359	0.3178
Error	40	9574.705	239.3676			
Lack of Fit	38	8161.529	214.7771	0.3040	0.9519	
Pure Error	2	1413.177	706.5883			
Adj. Total	41	10129.06	247.0503			
Total	42	20333.03				

s = Square Root(239.3676) = 15.47151

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	621.97	654.65	0.02733403	-0.0002380009
1	621.97	71432.3	15567.66	-0.0002380009	1.607157E-05
2 (Y'Y)			20333.03		
Determinant		2613310			3.826565E-07

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	6.542883	-0.05696971
1	-0.05696971	0.003847015

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.8181	0.000011	No
Anderson Darling	2.4864	0.000003	No
D'Agostino Skewness	3.4092	0.000651	No
D'Agostino Kurtosis	1.9508	0.051081	No
D'Agostino Omnibus	15.4285	0.000446	No
Constant Residual Variance?			
Modified Levene Test	2.5980	0.114865	No
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.3040	0.951886	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

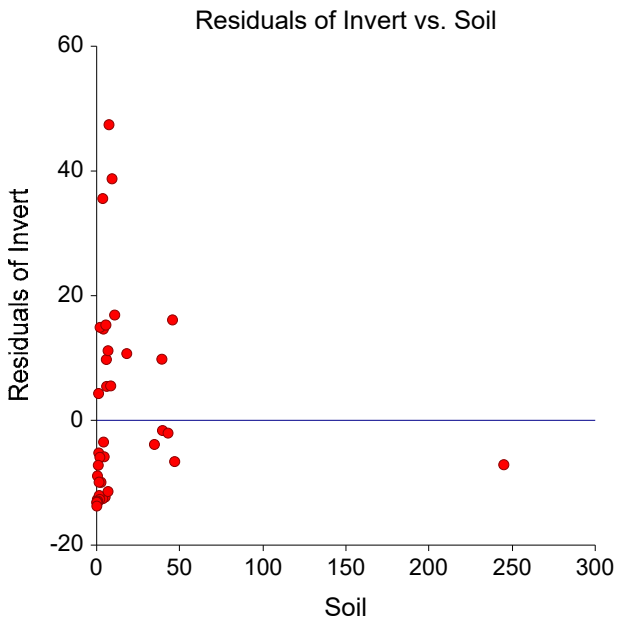
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

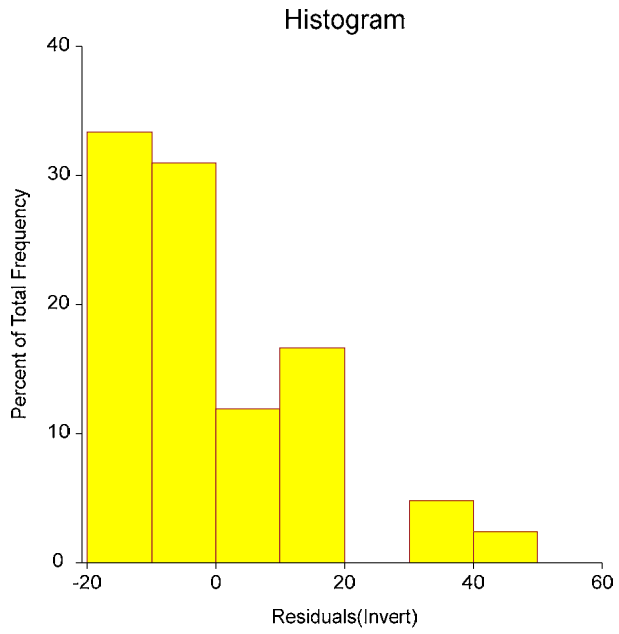
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

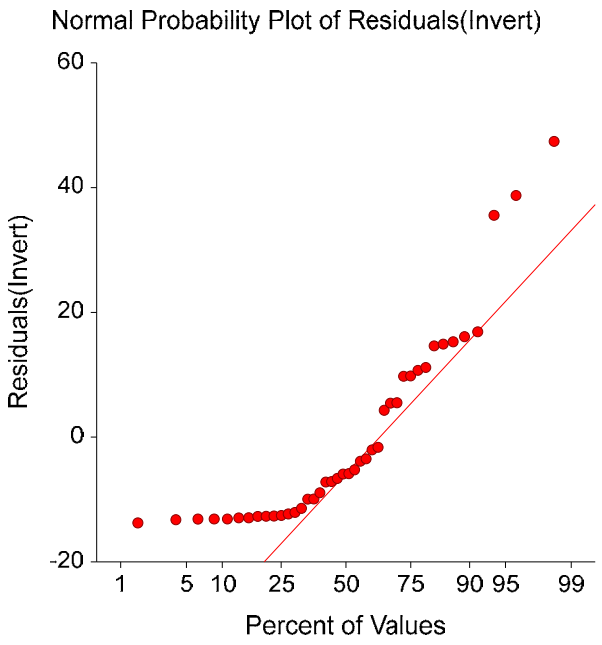
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Original Data Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual
10	245.0000	30.2000	37.3145	-7.1145
11	6.0000	20.2000	14.7554	5.4446
12	46.9000	12.0000	18.6160	-6.6160
13	1.2000	9.0700	14.3024	-5.2324
14	39.6000	16.3000	17.9269	-1.6269
15	4.1000	11.1000	14.5761	-3.4761
16	0.7100	1.6100	14.2561	-12.6461
17	5.1000	2.3600	14.6705	-12.3105
18	0.3500	1.5200	14.2221	-12.7021
19	3.6000	1.9700	14.5289	-12.5589
20	2.6000	4.5000	14.4345	-9.9345
21	0.6600	1.3200	14.2514	-12.9314
22	45.6000	34.6000	18.4933	16.1067
23	4.5000	8.7700	14.6139	-5.8439
24	5.8000	24.5000	14.7366	9.7634
25	6.8000	26.0000	14.8310	11.1690
26	9.2000	53.8000	15.0575	38.7425
27	7.4000	62.3000	14.8876	47.4124
28	10.8000	32.1000	15.2085	16.8915
29	3.6000	50.1000	14.5289	35.5711
30	18.1000	26.6000	15.8976	10.7024
31	42.9000	16.2000	18.2384	-2.0384
32	1.9000	8.4500	14.3684	-5.9184
33	4.0000	29.2000	14.5667	14.6333
34	0.4600	5.3200	14.2325	-8.9125
35	1.5000	2.2700	14.3307	-12.0607
36	1.8000	1.6800	14.3590	-12.6790
37	6.8000	3.4200	14.8310	-11.4110
38	1.4000	4.4100	14.3213	-9.9113
39	0.6700	1.3100	14.2523	-12.9423
40	0.9400	7.0800	14.2778	-7.1978
41	0.1800	1.0900	14.2061	-13.1161
42	0.2100	0.9700	14.2089	-13.2389
43	0.5400	1.1100	14.2401	-13.1301
44	0.0730	1.0700	14.1960	-13.1260
45	0.0770	0.4500	14.1964	-13.7464
46	8.4000	20.5000	14.9820	5.5180
47	2.0000	29.3000	14.3779	14.9221
48	1.1000	18.6000	14.2929	4.3071
49	39.2000	27.7000	17.8892	9.8108
50	34.7000	13.6000	17.4644	-3.8644
51	5.5000	30.0000	14.7083	15.2917

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	245.0000	30.2000	37.3145	14.4757	8.0581	66.5709
11	6.0000	20.2000	14.7554	2.4490	9.8058	19.7051
12	46.9000	12.0000	18.6160	3.1082	12.3340	24.8979
13	1.2000	9.0700	14.3024	2.5321	9.1847	19.4200
14	39.6000	16.3000	17.9269	2.8397	12.1878	23.6661
15	4.1000	11.1000	14.5761	2.4780	9.5679	19.5843
16	0.7100	1.6100	14.2561	2.5424	9.1177	19.3946
17	5.1000	2.3600	14.6705	2.4621	9.6944	19.6466
18	0.3500	1.5200	14.2221	2.5502	9.0680	19.3763
19	3.6000	1.9700	14.5289	2.4865	9.5036	19.5543
20	2.6000	4.5000	14.4345	2.5045	9.3727	19.4964
21	0.6600	1.3200	14.2514	2.5435	9.1108	19.3920
22	45.6000	34.6000	18.4933	3.0572	12.3144	24.6721
23	4.5000	8.7700	14.6139	2.4714	9.6189	19.6088
24	5.8000	24.5000	14.7366	2.4518	9.7812	19.6919
25	6.8000	26.0000	14.8310	2.4384	9.9027	19.7592
26	9.2000	53.8000	15.0575	2.4125	10.1816	19.9334
27	7.4000	62.3000	14.8876	2.4311	9.9741	19.8011
28	10.8000	32.1000	15.2085	2.4002	10.3575	20.0595
29	3.6000	50.1000	14.5289	2.4865	9.5036	19.5543
30	18.1000	26.6000	15.8976	2.3960	11.0550	20.7401
31	42.9000	16.2000	18.2384	2.9555	12.2651	24.2117
32	1.9000	8.4500	14.3684	2.5180	9.2794	19.4575
33	4.0000	29.2000	14.5667	2.4797	9.5551	19.5782
34	0.4600	5.3200	14.2325	2.5478	9.0832	19.3818
35	1.5000	2.2700	14.3307	2.5260	9.2255	19.4359
36	1.8000	1.6800	14.3590	2.5200	9.2660	19.4521
37	6.8000	3.4200	14.8310	2.4384	9.9027	19.7592
38	1.4000	4.4100	14.3213	2.5280	9.2119	19.4306
39	0.6700	1.3100	14.2523	2.5433	9.1122	19.3925
40	0.9400	7.0800	14.2778	2.5376	9.1492	19.4064
41	0.1800	1.0900	14.2061	2.5539	9.0444	19.3678
42	0.2100	0.9700	14.2089	2.5533	9.0486	19.3693
43	0.5400	1.1100	14.2401	2.5461	9.0943	19.3859
44	0.0730	1.0700	14.1960	2.5563	9.0296	19.3624
45	0.0770	0.4500	14.1964	2.5562	9.0301	19.3626
46	8.4000	20.5000	14.9820	2.4202	10.0906	19.8733
47	2.0000	29.3000	14.3779	2.5160	9.2928	19.4630
48	1.1000	18.6000	14.2929	2.5342	9.1711	19.4148
49	39.2000	27.7000	17.8892	2.8263	12.1770	23.6013
50	34.7000	13.6000	17.4644	2.6873	12.0333	22.8956
51	5.5000	30.0000	14.7083	2.4561	9.7442	19.6723

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	245.0000	30.2000	37.3145	21.1876	-5.5071	80.1362
11	6.0000	20.2000	14.7554	15.6641	-16.9030	46.4139
12	46.9000	12.0000	18.6160	15.7806	-13.2779	50.5098
13	1.2000	9.0700	14.3024	15.6774	-17.3827	45.9875
14	39.6000	16.3000	17.9269	15.7299	-13.8645	49.7183
15	4.1000	11.1000	14.5761	15.6687	-17.0915	46.2437
16	0.7100	1.6100	14.2561	15.6790	-17.4323	45.9446
17	5.1000	2.3600	14.6705	15.6662	-16.9921	46.3330
18	0.3500	1.5200	14.2221	15.6803	-17.4689	45.9132
19	3.6000	1.9700	14.5289	15.6700	-17.1414	46.1992
20	2.6000	4.5000	14.4345	15.6729	-17.2416	46.1107
21	0.6600	1.3200	14.2514	15.6792	-17.4374	45.9402
22	45.6000	34.6000	18.4933	15.7707	-13.3805	50.3670
23	4.5000	8.7700	14.6139	15.6677	-17.0517	46.2794
24	5.8000	24.5000	14.7366	15.6646	-16.9227	46.3959
25	6.8000	26.0000	14.8310	15.6625	-16.8241	46.4860
26	9.2000	53.8000	15.0575	15.6585	-16.5895	46.7045
27	7.4000	62.3000	14.8876	15.6614	-16.7652	46.5404
28	10.8000	32.1000	15.2085	15.6566	-16.4346	46.8517
29	3.6000	50.1000	14.5289	15.6700	-17.1414	46.1992
30	18.1000	26.6000	15.8976	15.6559	-15.7443	47.5394
31	42.9000	16.2000	18.2384	15.7513	-13.5961	50.0729
32	1.9000	8.4500	14.3684	15.6751	-17.3121	46.0490
33	4.0000	29.2000	14.5667	15.6690	-17.1015	46.2348
34	0.4600	5.3200	14.2325	15.6799	-17.4577	45.9228
35	1.5000	2.2700	14.3307	15.6764	-17.3524	46.0138
36	1.8000	1.6800	14.3590	15.6754	-17.3221	46.0402
37	6.8000	3.4200	14.8310	15.6625	-16.8241	46.4860
38	1.4000	4.4100	14.3213	15.6767	-17.3625	46.0050
39	0.6700	1.3100	14.2523	15.6792	-17.4364	45.9411
40	0.9400	7.0800	14.2778	15.6782	-17.4090	45.9647
41	0.1800	1.0900	14.2061	15.6809	-17.4862	45.8983
42	0.2100	0.9700	14.2089	15.6808	-17.4831	45.9010
43	0.5400	1.1100	14.2401	15.6796	-17.4496	45.9297
44	0.0730	1.0700	14.1960	15.6813	-17.4970	45.8890
45	0.0770	0.4500	14.1964	15.6813	-17.4966	45.8894
46	8.4000	20.5000	14.9820	15.6597	-16.6674	46.6313
47	2.0000	29.3000	14.3779	15.6748	-17.3020	46.0578
48	1.1000	18.6000	14.2929	15.6777	-17.3928	45.9787
49	39.2000	27.7000	17.8892	15.7275	-13.8974	49.6757
50	34.7000	13.6000	17.4644	15.7032	-14.2728	49.2017
51	5.5000	30.0000	14.7083	15.6653	-16.9524	46.3689

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	245.0000	30.2000	37.3145	14.4757	-3.8890	78.5180
11	6.0000	20.2000	14.7554	2.4490	7.7845	21.7264
12	46.9000	12.0000	18.6160	3.1082	9.7687	27.4632
13	1.2000	9.0700	14.3024	2.5321	7.0949	21.5098
14	39.6000	16.3000	17.9269	2.8397	9.8442	26.0097
15	4.1000	11.1000	14.5761	2.4780	7.5228	21.6294
16	0.7100	1.6100	14.2561	2.5424	7.0194	21.4929
17	5.1000	2.3600	14.6705	2.4621	7.6624	21.6786
18	0.3500	1.5200	14.2221	2.5502	6.9633	21.4810
19	3.6000	1.9700	14.5289	2.4865	7.4514	21.6064
20	2.6000	4.5000	14.4345	2.5045	7.3056	21.5634
21	0.6600	1.3200	14.2514	2.5435	7.0116	21.4912
22	45.6000	34.6000	18.4933	3.0572	9.7912	27.1953
23	4.5000	8.7700	14.6139	2.4714	7.5791	21.6486
24	5.8000	24.5000	14.7366	2.4518	7.7577	21.7154
25	6.8000	26.0000	14.8310	2.4384	7.8902	21.7717
26	9.2000	53.8000	15.0575	2.4125	8.1905	21.9245
27	7.4000	62.3000	14.8876	2.4311	7.9676	21.8076
28	10.8000	32.1000	15.2085	2.4002	8.3765	22.0405
29	3.6000	50.1000	14.5289	2.4865	7.4514	21.6064
30	18.1000	26.6000	15.8976	2.3960	9.0775	22.7176
31	42.9000	16.2000	18.2384	2.9555	9.8259	26.6509
32	1.9000	8.4500	14.3684	2.5180	7.2012	21.5357
33	4.0000	29.2000	14.5667	2.4797	7.5086	21.6247
34	0.4600	5.3200	14.2325	2.5478	6.9805	21.4846
35	1.5000	2.2700	14.3307	2.5260	7.1407	21.5207
36	1.8000	1.6800	14.3590	2.5200	7.1862	21.5319
37	6.8000	3.4200	14.8310	2.4384	7.8902	21.7717
38	1.4000	4.4100	14.3213	2.5280	7.1255	21.5170
39	0.6700	1.3100	14.2523	2.5433	7.0132	21.4915
40	0.9400	7.0800	14.2778	2.5376	7.0549	21.5007
41	0.1800	1.0900	14.2061	2.5539	6.9366	21.4756
42	0.2100	0.9700	14.2089	2.5533	6.9413	21.4765
43	0.5400	1.1100	14.2401	2.5461	6.9929	21.4872
44	0.0730	1.0700	14.1960	2.5563	6.9198	21.4722
45	0.0770	0.4500	14.1964	2.5562	6.9204	21.4723
46	8.4000	20.5000	14.9820	2.4202	8.0932	21.8708
47	2.0000	29.3000	14.3779	2.5160	7.2163	21.5395
48	1.1000	18.6000	14.2929	2.5342	7.0796	21.5063
49	39.2000	27.7000	17.8892	2.8263	9.8444	25.9339
50	34.7000	13.6000	17.4644	2.6873	9.8154	25.1134
51	5.5000	30.0000	14.7083	2.4561	7.7171	21.6994

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	245.0000	30.2000	37.3145	-7.1145	-1.3028	23.5581
11	6.0000	20.2000	14.7554	5.4446	0.3564	26.9532
12	46.9000	12.0000	18.6160	-6.6160	-0.4365	55.1331
13	1.2000	9.0700	14.3024	-5.2324	-0.3428	57.6888
14	39.6000	16.3000	17.9269	-1.6269	-0.1070	9.9812
15	4.1000	11.1000	14.5761	-3.4761	-0.2276	31.3163
16	0.7100	1.6100	14.2561	-12.6461	-0.8286	785.4736
17	5.1000	2.3600	14.6705	-12.3105	-0.8060	521.6311
18	0.3500	1.5200	14.2221	-12.7021	-0.8324	835.6674
19	3.6000	1.9700	14.5289	-12.5589	-0.8224	637.5082
20	2.6000	4.5000	14.4345	-9.9345	-0.6507	220.7671
21	0.6600	1.3200	14.2514	-12.9314	-0.8473	979.6519
22	45.6000	34.6000	18.4933	16.1067	1.0620	46.5512
23	4.5000	8.7700	14.6139	-5.8439	-0.3826	66.6347
24	5.8000	24.5000	14.7366	9.7634	0.6391	39.8507
25	6.8000	26.0000	14.8310	11.1690	0.7310	42.9579
26	9.2000	53.8000	15.0575	38.7425	2.5351	72.0121
27	7.4000	62.3000	14.8876	47.4124	3.1030	76.1034
28	10.8000	32.1000	15.2085	16.8915	1.1052	52.6214
29	3.6000	50.1000	14.5289	35.5711	2.3294	71.0002
30	18.1000	26.6000	15.8976	10.7024	0.7002	40.2347
31	42.9000	16.2000	18.2384	-2.0384	-0.1342	12.5828
32	1.9000	8.4500	14.3684	-5.9184	-0.3877	70.0408
33	4.0000	29.2000	14.5667	14.6333	0.9582	50.1142
34	0.4600	5.3200	14.2325	-8.9125	-0.5840	167.5287
35	1.5000	2.2700	14.3307	-12.0607	-0.7901	531.3080
36	1.8000	1.6800	14.3590	-12.6790	-0.8306	754.7029
37	6.8000	3.4200	14.8310	-11.4110	-0.7469	333.6537
38	1.4000	4.4100	14.3213	-9.9113	-0.6493	224.7450
39	0.6700	1.3100	14.2523	-12.9423	-0.8481	987.9656
40	0.9400	7.0800	14.2778	-7.1978	-0.4716	101.6643
41	0.1800	1.0900	14.2061	-13.1161	-0.8595	1203.3118
42	0.2100	0.9700	14.2089	-13.2389	-0.8676	1364.8382
43	0.5400	1.1100	14.2401	-13.1301	-0.8604	1182.8900
44	0.0730	1.0700	14.1960	-13.1260	-0.8602	1226.7289
45	0.0770	0.4500	14.1964	-13.7464	-0.9009	3054.7503
46	8.4000	20.5000	14.9820	5.5180	0.3611	26.9172
47	2.0000	29.3000	14.3779	14.9221	0.9775	50.9287
48	1.1000	18.6000	14.2929	4.3071	0.2822	23.1563
49	39.2000	27.7000	17.8892	9.8108	0.6450	35.4181
50	34.7000	13.6000	17.4644	-3.8644	-0.2536	28.4149
51	5.5000	30.0000	14.7083	15.2917	1.0011	50.9725

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	245.0000	-7.1145	*-1.3146	0.8754	*5.9627	235.0882
11	6.0000	5.4446	0.3525	0.0251	0.0016	244.7256
12	46.9000	-6.6160	-0.4321	0.0404	0.0040	244.3357
13	1.2000	-5.2324	-0.3390	0.0268	0.0016	244.7839
14	39.6000	-1.6269	-0.1056	0.0337	0.0002	245.4350
15	4.1000	-3.4761	-0.2249	0.0257	0.0007	245.1873
16	0.7100	-12.6461	-0.8253	0.0270	0.0095	241.2908
17	5.1000	-12.3105	-0.8024	0.0253	0.0084	241.5184
18	0.3500	-12.7021	-0.8291	0.0272	0.0097	241.2527
19	3.6000	-12.5589	-0.8190	0.0258	0.0090	241.3538
20	2.6000	-9.9345	-0.6459	0.0262	0.0057	242.9065
21	0.6600	-12.9314	-0.8443	0.0270	0.0100	241.0984
22	45.6000	16.1067	1.0637	0.0390	0.0229	238.5830
23	4.5000	-5.8439	-0.3785	0.0255	0.0019	244.6067
24	5.8000	9.7634	0.6343	0.0251	0.0053	242.9981
25	6.8000	11.1690	0.7267	0.0248	0.0068	242.2251
26	9.2000	38.7425	*2.7324	0.0243	0.0801	206.0594
27	7.4000	47.4124	*3.5163	0.0247	0.1219	186.4066
28	10.8000	16.8915	1.1083	0.0241	0.0151	238.0089
29	3.6000	35.5711	*2.4740	0.0258	0.0719	212.2014
30	18.1000	10.7024	0.6957	0.0240	0.0060	242.4961
31	42.9000	-2.0384	-0.1326	0.0365	0.0003	245.3947
32	1.9000	-5.9184	-0.3836	0.0265	0.0020	244.5827
33	4.0000	14.6333	0.9572	0.0257	0.0121	239.8699
34	0.4600	-8.9125	-0.5792	0.0271	0.0048	243.4117
35	1.5000	-12.0607	-0.7864	0.0267	0.0085	241.6734
36	1.8000	-12.6790	-0.8273	0.0265	0.0094	241.2709
37	6.8000	-11.4110	-0.7427	0.0248	0.0071	242.0815
38	1.4000	-9.9113	-0.6446	0.0267	0.0058	242.9174
39	0.6700	-12.9423	-0.8450	0.0270	0.0100	241.0910
40	0.9400	-7.1978	-0.4670	0.0269	0.0031	244.1401
41	0.1800	-13.1161	-0.8567	0.0272	0.0103	240.9706
42	0.2100	-13.2389	-0.8649	0.0272	0.0105	240.8854
43	0.5400	-13.1301	-0.8575	0.0271	0.0103	240.9617
44	0.0730	-13.1260	-0.8574	0.0273	0.0104	240.9635
45	0.0770	-13.7464	-0.8987	0.0273	0.0114	240.5241
46	8.4000	5.5180	0.3571	0.0245	0.0016	244.7049
47	2.0000	14.9221	0.9769	0.0264	0.0130	239.6407
48	1.1000	4.3071	0.2789	0.0268	0.0011	245.0165
49	39.2000	9.8108	0.6402	0.0334	0.0072	242.9521
50	34.7000	-3.8644	-0.2506	0.0302	0.0010	245.1104
51	5.5000	15.2917	1.0011	0.0252	0.0130	239.3544

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-1.3146	-3.4846	** 5.9627	* 7.7419	0.6978	-3.4369
11	0.3525	0.0565	0.0016	1.0721	0.0559	-0.0126
12	-0.4321	-0.0886	0.0040	1.0858	-0.0431	-0.0567
13	-0.3390	-0.0562	0.0016	1.0746	-0.0562	0.0187
14	-0.1056	-0.0197	0.0002	1.0880	-0.0116	-0.0107
15	-0.2249	-0.0365	0.0007	1.0768	-0.0363	0.0098
16	-0.8253	-0.1375	0.0095	1.0443	-0.1375	0.0473
17	-0.8024	-0.1293	0.0084	1.0445	-0.1284	0.0316
18	-0.8291	-0.1386	0.0097	1.0442	-0.1386	0.0487
19	-0.8190	-0.1334	0.0090	1.0436	-0.1329	0.0373
20	-0.6459	-0.1060	0.0057	1.0575	-0.1058	0.0320
21	-0.8443	-0.1407	0.0100	1.0427	-0.1407	0.0486
22	1.0637	0.2144	0.0229	1.0338	0.1082	0.1339
23	-0.3785	-0.0613	0.0019	1.0716	-0.0609	0.0158
24	0.6343	0.1018	0.0053	1.0571	0.1009	-0.0232
25	0.7267	0.1160	0.0068	1.0501	0.1145	-0.0236
26	* 2.7324	0.4313	0.0801	0.7595	0.4207	-0.0622
27	* 3.5163	0.5595	0.1219	0.6218	0.5507	-0.1058
28	1.1083	0.1740	0.0151	1.0131	0.1680	-0.0180
29	* 2.4740	0.4028	0.0719	0.8067	0.4014	-0.1126
30	0.6957	0.1091	0.0060	1.0515	0.0981	0.0093
31	-0.1326	-0.0258	0.0003	1.0908	-0.0140	-0.0152
32	-0.3836	-0.0633	0.0020	1.0725	-0.0632	0.0201
33	0.9572	0.1554	0.0121	1.0307	0.1547	-0.0420
34	-0.5792	-0.0967	0.0048	1.0629	-0.0967	0.0338
35	-0.7864	-0.1301	0.0085	1.0473	-0.1301	0.0425
36	-0.8273	-0.1366	0.0094	1.0437	-0.1365	0.0437
37	-0.7427	-0.1185	0.0071	1.0489	-0.1170	0.0241
38	-0.6446	-0.1068	0.0058	1.0581	-0.1067	0.0351
39	-0.8450	-0.1408	0.0100	1.0426	-0.1408	0.0486
40	-0.4670	-0.0776	0.0031	1.0690	-0.0776	0.0263
41	-0.8567	-0.1434	0.0103	1.0418	-0.1434	0.0509
42	-0.8649	-0.1447	0.0105	1.0411	-0.1447	0.0513
43	-0.8575	-0.1431	0.0103	1.0416	-0.1431	0.0497
44	-0.8574	-0.1436	0.0104	1.0418	-0.1436	0.0514
45	-0.8987	-0.1506	0.0114	1.0380	-0.1506	0.0538
46	0.3571	0.0566	0.0016	1.0713	0.0554	-0.0093
47	0.9769	0.1610	0.0130	1.0295	0.1608	-0.0508
48	0.2789	0.0463	0.0011	1.0766	0.0463	-0.0155
49	0.6402	0.1190	0.0072	1.0657	0.0709	0.0637
50	-0.2506	-0.0442	0.0010	1.0812	-0.0294	-0.0203
51	1.0011	0.1610	0.0130	1.0257	0.1596	-0.0378

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
10	245.0000	-7.1145	|.....	-1.3028	|||||.....	-1.3146	|||||.....
11	6.0000	5.4446	|.....	0.3564	|.....	0.3525	|.....
12	46.9000	-6.6160	|.....	-0.4365	|.....	-0.4321	|.....
13	1.2000	-5.2324	|.....	-0.3428	|.....	-0.3390	|.....
14	39.6000	-1.6269	|.....	-0.1070	|.....	-0.1056	|.....
15	4.1000	-3.4761	|.....	-0.2276	|.....	-0.2249	|.....
16	0.7100	-12.6461	|||.....	-0.8286	|||.....	-0.8253	|||.....
17	5.1000	-12.3105	|||.....	-0.8060	|||.....	-0.8024	|||.....
18	0.3500	-12.7021	|||.....	-0.8324	|||.....	-0.8291	|||.....
19	3.6000	-12.5589	|||.....	-0.8224	|||.....	-0.8190	|||.....
20	2.6000	-9.9345	||.....	-0.6507	||.....	-0.6459	||.....
21	0.6600	-12.9314	|||.....	-0.8473	|||.....	-0.8443	|||.....
22	45.6000	16.1067	||||.....	1.0620	||||.....	1.0637	||||.....
23	4.5000	-5.8439	|.....	-0.3826	|.....	-0.3785	|.....
24	5.8000	9.7634	||.....	0.6391	||.....	0.6343	||.....
25	6.8000	11.1690	|||.....	0.7310	|||.....	0.7267	||.....
26	9.2000	38.7425	|||||||||||...	2.5351	|||||||||||...	* 2.7324	||||||||||....
27	7.4000	47.4124	||||||||||||||	3.1030	||||||||||||||	* 3.5163	||||||||||||||
28	10.8000	16.8915	|||||.....	1.1052	||||.....	1.1083	||||.....
29	3.6000	35.5711	||||||||||....	2.3294	||||||||||....	* 2.4740	|||||||||.....
30	18.1000	10.7024	||.....	0.7002	||.....	0.6957	||.....
31	42.9000	-2.0384	|.....	-0.1342	|.....	-0.1326	|.....
32	1.9000	-5.9184	|.....	-0.3877	|.....	-0.3836	|.....
33	4.0000	14.6333	||||.....	0.9582	||||.....	0.9572	|||.....
34	0.4600	-8.9125	||.....	-0.5840	||.....	-0.5792	||.....
35	1.5000	-12.0607	|||.....	-0.7901	|||.....	-0.7864	||.....
36	1.8000	-12.6790	|||.....	-0.8306	|||.....	-0.8273	|||.....
37	6.8000	-11.4110	|||.....	-0.7469	|||.....	-0.7427	||.....
38	1.4000	-9.9113	||.....	-0.6493	||.....	-0.6446	||.....
39	0.6700	-12.9423	|||.....	-0.8481	|||.....	-0.8450	|||.....
40	0.9400	-7.1978	|.....	-0.4716	|.....	-0.4670	|.....
41	0.1800	-13.1161	|||.....	-0.8595	|||.....	-0.8567	|||.....
42	0.2100	-13.2389	|||.....	-0.8676	|||.....	-0.8649	|||.....
43	0.5400	-13.1301	|||.....	-0.8604	|||.....	-0.8575	|||.....
44	0.0730	-13.1260	|||.....	-0.8602	|||.....	-0.8574	|||.....
45	0.0770	-13.7464	|||.....	-0.9009	|||.....	-0.8987	|||.....
46	8.4000	5.5180	|.....	0.3611	|.....	0.3571	|.....
47	2.0000	14.9221	||||.....	0.9775	||||.....	0.9769	|||.....
48	1.1000	4.3071	|.....	0.2822	|.....	0.2789	|.....
49	39.2000	9.8108	||.....	0.6450	||.....	0.6402	||.....
50	34.7000	-3.8644	|.....	-0.2536	|.....	-0.2506	|.....
51	5.5000	15.2917	||||.....	1.0011	||||.....	1.0011	|||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	245.0000	-3.4846	|||||||||||||||	** 5.9627	|||||||||||||||	-3.4369	|||||||||||||||
11	6.0000	0.0565	|.....	0.0016	|.....	-0.0126	|.....
12	46.9000	-0.0886	|.....	0.0040	|.....	-0.0567	|.....
13	1.2000	-0.0562	|.....	0.0016	|.....	0.0187	|.....
14	39.6000	-0.0197	|.....	0.0002	|.....	-0.0107	|.....
15	4.1000	-0.0365	|.....	0.0007	|.....	0.0098	|.....
16	0.7100	-0.1375	|.....	0.0095	|.....	0.0473	|.....
17	5.1000	-0.1293	|.....	0.0084	|.....	0.0316	|.....
18	0.3500	-0.1386	|.....	0.0097	|.....	0.0487	|.....
19	3.6000	-0.1334	|.....	0.0090	|.....	0.0373	|.....
20	2.6000	-0.1060	|.....	0.0057	|.....	0.0320	|.....
21	0.6600	-0.1407	|.....	0.0100	|.....	0.0486	|.....
22	45.6000	0.2144	|.....	0.0229	|.....	0.1339	|.....
23	4.5000	-0.0613	|.....	0.0019	|.....	0.0158	|.....
24	5.8000	0.1018	|.....	0.0053	|.....	-0.0232	|.....
25	6.8000	0.1160	|.....	0.0068	|.....	-0.0236	|.....
26	9.2000	0.4313	|.....	0.0801	|.....	-0.0622	|.....
27	7.4000	0.5595	||.....	0.1219	|.....	-0.1058	|.....
28	10.8000	0.1740	|.....	0.0151	|.....	-0.0180	|.....
29	3.6000	0.4028	|.....	0.0719	|.....	-0.1126	|.....
30	18.1000	0.1091	|.....	0.0060	|.....	0.0093	|.....
31	42.9000	-0.0258	|.....	0.0003	|.....	-0.0152	|.....
32	1.9000	-0.0633	|.....	0.0020	|.....	0.0201	|.....
33	4.0000	0.1554	|.....	0.0121	|.....	-0.0420	|.....
34	0.4600	-0.0967	|.....	0.0048	|.....	0.0338	|.....
35	1.5000	-0.1301	|.....	0.0085	|.....	0.0425	|.....
36	1.8000	-0.1366	|.....	0.0094	|.....	0.0437	|.....
37	6.8000	-0.1185	|.....	0.0071	|.....	0.0241	|.....
38	1.4000	-0.1068	|.....	0.0058	|.....	0.0351	|.....
39	0.6700	-0.1408	|.....	0.0100	|.....	0.0486	|.....
40	0.9400	-0.0776	|.....	0.0031	|.....	0.0263	|.....
41	0.1800	-0.1434	|.....	0.0103	|.....	0.0509	|.....
42	0.2100	-0.1447	|.....	0.0105	|.....	0.0513	|.....
43	0.5400	-0.1431	|.....	0.0103	|.....	0.0497	|.....
44	0.0730	-0.1436	|.....	0.0104	|.....	0.0514	|.....
45	0.0770	-0.1506	|.....	0.0114	|.....	0.0538	|.....
46	8.4000	0.0566	|.....	0.0016	|.....	-0.0093	|.....
47	2.0000	0.1610	|.....	0.0130	|.....	-0.0508	|.....
48	1.1000	0.0463	|.....	0.0011	|.....	-0.0155	|.....
49	39.2000	0.1190	|.....	0.0072	|.....	0.0637	|.....
50	34.7000	-0.0442	|.....	0.0010	|.....	-0.0203	|.....
51	5.5000	0.1610	|.....	0.0130	|.....	-0.0378	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	245.0000	-1.3146	|||||.....	** 5.9627	||||||||||||||	0.8754	||||||||||||||
11	6.0000	0.3525	|.....	0.0016	|.....	0.0251	|.....
12	46.9000	-0.4321	|.....	0.0040	|.....	0.0404	|.....
13	1.2000	-0.3390	|.....	0.0016	|.....	0.0268	|.....
14	39.6000	-0.1056	|.....	0.0002	|.....	0.0337	|.....
15	4.1000	-0.2249	|.....	0.0007	|.....	0.0257	|.....
16	0.7100	-0.8253	|||.....	0.0095	|.....	0.0270	|.....
17	5.1000	-0.8024	|||.....	0.0084	|.....	0.0253	|.....
18	0.3500	-0.8291	|||.....	0.0097	|.....	0.0272	|.....
19	3.6000	-0.8190	|||.....	0.0090	|.....	0.0258	|.....
20	2.6000	-0.6459	||.....	0.0057	|.....	0.0262	|.....
21	0.6600	-0.8443	|||.....	0.0100	|.....	0.0270	|.....
22	45.6000	1.0637	||||.....	0.0229	|.....	0.0390	|.....
23	4.5000	-0.3785	|.....	0.0019	|.....	0.0255	|.....
24	5.8000	0.6343	||.....	0.0053	|.....	0.0251	|.....
25	6.8000	0.7267	||.....	0.0068	|.....	0.0248	|.....
26	9.2000	* 2.7324	||||||||||....	0.0801	|.....	0.0243	|.....
27	7.4000	* 3.5163	||||||||||||||	0.1219	|.....	0.0247	|.....
28	10.8000	1.1083	||||.....	0.0151	|.....	0.0241	|.....
29	3.6000	* 2.4740	|||||||||.....	0.0719	|.....	0.0258	|.....
30	18.1000	0.6957	||.....	0.0060	|.....	0.0240	|.....
31	42.9000	-0.1326	|.....	0.0003	|.....	0.0365	|.....
32	1.9000	-0.3836	|.....	0.0020	|.....	0.0265	|.....
33	4.0000	0.9572	|||.....	0.0121	|.....	0.0257	|.....
34	0.4600	-0.5792	||.....	0.0048	|.....	0.0271	|.....
35	1.5000	-0.7864	||.....	0.0085	|.....	0.0267	|.....
36	1.8000	-0.8273	|||.....	0.0094	|.....	0.0265	|.....
37	6.8000	-0.7427	||.....	0.0071	|.....	0.0248	|.....
38	1.4000	-0.6446	||.....	0.0058	|.....	0.0267	|.....
39	0.6700	-0.8450	|||.....	0.0100	|.....	0.0270	|.....
40	0.9400	-0.4670	|.....	0.0031	|.....	0.0269	|.....
41	0.1800	-0.8567	|||.....	0.0103	|.....	0.0272	|.....
42	0.2100	-0.8649	|||.....	0.0105	|.....	0.0272	|.....
43	0.5400	-0.8575	|||.....	0.0103	|.....	0.0271	|.....
44	0.0730	-0.8574	|||.....	0.0104	|.....	0.0273	|.....
45	0.0770	-0.8987	|||.....	0.0114	|.....	0.0273	|.....
46	8.4000	0.3571	|.....	0.0016	|.....	0.0245	|.....
47	2.0000	0.9769	|||.....	0.0130	|.....	0.0264	|.....
48	1.1000	0.2789	|.....	0.0011	|.....	0.0268	|.....
49	39.2000	0.6402	||.....	0.0072	|.....	0.0334	|.....
50	34.7000	-0.2506	|.....	0.0010	|.....	0.0302	|.....
51	5.5000	1.0011	|||.....	0.0130	|.....	0.0252	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Means

Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	30.2000	245.0000	169.6257	75.3743	-450.6635	74.8779
11	20.2000	6.0000	63.6818	-57.6818	-110.8314	12.4703
12	12.0000	46.9000	-23.1923	70.0923	33.8207	95.3064
13	9.0700	1.2000	-54.2339	55.4339	0.3643	210.0483
14	16.3000	39.6000	22.3636	17.2364	-52.0790	61.9136
15	11.1000	4.1000	-32.7272	36.8272	18.6429	135.4525
16	1.6100	0.7100	-133.2681	133.9781	-42.0647	459.4361
17	2.3600	5.1000	-125.3223	130.4223	-38.2588	434.8234
18	1.5200	0.3500	-134.2216	134.5716	-42.5185	462.3867
19	1.9700	3.6000	-129.4541	133.0541	-40.2435	447.6276
20	4.5000	2.6000	-102.6503	105.2503	-27.0903	364.2859
21	1.3200	0.6600	-136.3404	137.0004	-43.5248	468.9415
22	34.6000	45.6000	216.2411	-170.6411	-594.2663	96.4138
23	8.7700	4.5000	-57.4122	61.9122	-1.7600	220.4954
24	24.5000	5.8000	109.2377	-103.4377	-262.2523	44.5987
25	26.0000	6.8000	125.1293	-118.3293	-312.3286	53.0613
26	53.8000	9.2000	419.6535	-410.4535	-1216.7797	186.2719
27	62.3000	7.4000	509.7059	-502.3059	-1491.7158	225.3971
28	32.1000	10.8000	189.7551	-178.9551	-512.7756	84.2792
29	50.1000	3.6000	380.4542	-376.8542	-1097.0329	169.1722
30	26.6000	18.1000	131.4859	-113.3859	-332.2249	56.3121
31	16.2000	42.9000	21.3042	21.5958	-51.0854	63.6942
32	8.4500	1.9000	-60.8024	62.7024	-3.9421	231.5550
33	29.2000	4.0000	159.0313	-155.0313	-417.8850	69.8418
34	5.3200	0.4600	-93.9629	94.4229	-22.6417	337.0885
35	2.2700	1.5000	-126.2758	127.7758	-38.7180	437.7794
36	1.6800	1.8000	-132.5265	134.3265	-41.7114	457.1408
37	3.4200	6.8000	-114.0922	120.8922	-32.7931	399.9506
38	4.4100	1.4000	-103.6038	105.0038	-27.5717	367.2642
39	1.3100	0.6700	-136.4464	137.1164	-43.5751	469.2692
40	7.0800	0.9400	-75.3167	76.2567	-12.5793	278.1994
41	1.0900	0.1800	-138.7772	138.9572	-44.6787	476.4762
42	0.9700	0.2100	-140.0485	140.2585	-45.2793	480.4059
43	1.1100	0.5400	-138.5653	139.1053	-44.5785	475.8211
44	1.0700	0.0730	-138.9890	139.0620	-44.7789	477.1312
45	0.4500	0.0770	-145.5576	145.6346	-47.8717	497.4243
46	20.5000	8.4000	66.8601	-58.4601	-122.4121	15.7283
47	29.3000	2.0000	160.0908	-158.0908	-421.1662	70.3488
48	18.6000	1.1000	46.7307	-45.6307	-45.4287	-8.5444
49	27.7000	39.2000	143.1398	-103.9398	-368.5595	62.1301
50	13.6000	34.7000	-6.2412	40.9412	-3.2527	87.9920
51	30.0000	5.5000	167.5069	-162.0069	-444.1134	73.8763

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Individuals

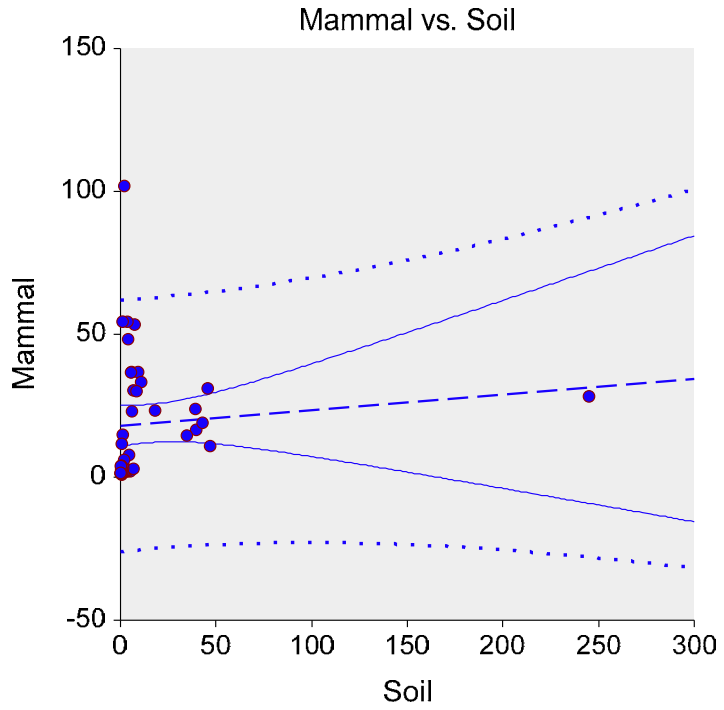
Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	30.2000	245.0000	169.6257	75.3743	-461.0960	85.3103
11	20.2000	6.0000	63.6818	-57.6818	-423.1960	324.8350
12	12.0000	46.9000	-23.1923	70.0923	-313.2502	442.3774
13	9.0700	1.2000	-54.2339	55.4339	-259.0691	469.4817
14	16.3000	39.6000	22.3636	17.2364	-378.4063	388.2409
15	11.1000	4.1000	-32.7272	36.8272	-297.4884	451.5838
16	1.6100	0.7100	-133.2681	133.9781	-75.5899	492.9613
17	2.3600	5.1000	-125.3223	130.4223	-97.9216	494.4861
18	1.5200	0.3500	-134.2216	134.5716	-72.8310	492.6992
19	1.9700	3.6000	-129.4541	133.0541	-86.4525	493.8366
20	4.5000	2.6000	-102.6503	105.2503	-156.0475	493.2432
21	1.3200	0.6600	-136.3404	137.0004	-66.6354	492.0522
22	34.6000	45.6000	216.2411	-170.6411	-405.2228	-92.6296
23	8.7700	4.5000	-57.4122	61.9122	-253.0396	471.7750
24	24.5000	5.8000	109.2377	-103.4377	-455.4520	237.7984
25	26.0000	6.8000	125.1293	-118.3293	-461.7646	202.4973
26	53.8000	9.2000	419.6535	-410.4535	-1105.5504	75.0426
27	62.3000	7.4000	509.7059	-502.3059	-1403.5040	137.1852
28	32.1000	10.8000	189.7551	-178.9551	-447.8500	19.3536
29	50.1000	3.6000	380.4542	-376.8542	-971.0106	43.1499
30	26.6000	18.1000	131.4859	-113.3859	-463.4532	187.5404
31	16.2000	42.9000	21.3042	21.5958	-377.0779	389.6867
32	8.4500	1.9000	-60.8024	62.7024	-246.5041	474.1170
33	29.2000	4.0000	159.0313	-155.0313	-464.2268	116.1836
34	5.3200	0.4600	-93.9629	94.4229	-176.4485	490.8954
35	2.2700	1.5000	-126.2758	127.7758	-95.3014	494.3628
36	1.6800	1.8000	-132.5265	134.3265	-77.7236	493.1530
37	3.4200	6.8000	-114.0922	120.8922	-127.6633	494.8209
38	4.4100	1.4000	-103.6038	105.0038	-153.7501	493.4426
39	1.3100	0.6700	-136.4464	137.1164	-66.3233	492.0174
40	7.0800	0.9400	-75.3167	76.2567	-217.2618	482.8820
41	1.0900	0.1800	-138.7772	138.9572	-59.3971	491.1946
42	0.9700	0.2100	-140.0485	140.2585	-55.5707	490.6973
43	1.1100	0.5400	-138.5653	139.1053	-60.0315	491.2741
44	1.0700	0.0730	-138.9890	139.0620	-58.7618	491.1141
45	0.4500	0.0770	-145.5576	145.6346	-38.5703	488.1230
46	20.5000	8.4000	66.8601	-58.4601	-426.0585	319.3748
47	29.3000	2.0000	160.0908	-158.0908	-464.0117	113.1943
48	18.6000	1.1000	46.7307	-45.6307	-406.4974	352.5244
49	27.7000	39.2000	143.1398	-103.9398	-465.1683	158.7388
50	13.6000	34.7000	-6.2412	40.9412	-339.4285	424.1677
51	30.0000	5.5000	167.5069	-162.0069	-461.9038	91.6667

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	17.9784	Rows Prediction Only	0
Slope	0.0550	Sum of Frequencies	42
R-Squared	0.0101	Sum of Weights	42.0000
Correlation	0.1006	Coefficient of Variation	1.1418
Mean Square Error	460.4685	Square Root of MSE	21.45853

Linear Regression Report

Y = Mammal X = Soil

Summary Statement

The equation of the straight line relating Mammal and Soil is estimated as: Mammal = (17.9784) + (0.0550) Soil using the 42 observations in this dataset. The y-intercept, the estimated value of Mammal when Soil is zero, is 17.9784 with a standard error of 3.5477. The slope, the estimated change in Mammal per unit change in Soil, is 0.0550 with a standard error of 0.0860. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Soil, is 0.0101. The correlation between Mammal and Soil is 0.1006.

A significance test that the slope is zero resulted in a t-value of 0.6395. The significance level of this t-test is 0.5261. Since 0.5261 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.0550. The lower limit of the 95% confidence interval for the slope is -0.1188 and the upper limit is 0.2289. The estimated intercept is 17.9784. The lower limit of the 95% confidence interval for the intercept is 10.8082 and the upper limit is 25.1487.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Soil
Count	42	42
Mean	18.7931	14.8088
Standard Deviation	21.3033	38.9564
Minimum	0.8900	0.0730
Maximum	101.9000	245.0000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	17.9784	0.0550
Lower 95% Confidence Limit	10.8082	-0.1188
Upper 95% Confidence Limit	25.1487	0.2289
Standard Error	3.5477	0.0860
Standardized Coefficient	0.0000	0.1006
T Value	5.0676	0.6395
Prob Level (T Test)	0.0000	0.5261
Prob Level (Randomization Test N =1000)		0.5310
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9986	0.0957
Regression of Y on X	17.9784	0.0550
Inverse Regression from X on Y	-61.7021	5.4356
Orthogonal Regression of Y and X	17.6379	0.0780

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(17.9784185725118) + (0.0550156544868287) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	17.9784	0.9000	11.5095	24.2691
Bootstrap Mean	17.7458	0.9500	10.1254	25.3608
Bias (BM - OV)	-0.2326	0.9900	6.4293	27.3327
Bias Corrected	18.2110			
Standard Error	3.8856			
Slope				
Original Value	0.0550	0.9000	-0.2255	0.1203
Bootstrap Mean	0.0961	0.9500	-0.2782	0.1692
Bias (BM - OV)	0.0411	0.9900	-0.4490	0.2887
Bias Corrected	0.0139			
Standard Error	0.1149			
Correlation				
Original Value	0.1006	0.9000	-0.0781	0.2122
Bootstrap Mean	0.1228	0.9500	-0.1171	0.2393
Bias (BM - OV)	0.0222	0.9900	-0.1964	0.3055
Bias Corrected	0.0784			
Standard Error	0.0898			
R-Squared				
Original Value	0.0101	0.9000	0.0000	0.0200
Bootstrap Mean	0.0231	0.9500	0.0000	0.0202
Bias (BM - OV)	0.0130	0.9900	0.0000	0.0202
Bias Corrected	-0.0029			
Standard Error	0.0290			
Standard Error of Estimate				
Original Value	21.4585	0.9000	15.1992	28.3334
Bootstrap Mean	20.7508	0.9500	14.3742	29.1153
Bias (BM - OV)	-0.7077	0.9900	12.3758	30.6936
Bias Corrected	22.1662			
Standard Error	4.0588			
Orthogonal Intercept				
Original Value	17.6379	0.9000	3.9092	210.3003
Bootstrap Mean	60.5336	0.9500	-311.7706	374.1996
Bias (BM - OV)	42.8957	0.9900	-3380.8512	1202.7734
Bias Corrected	-25.2578			
Standard Error	2017.7861			
Orthogonal Slope				
Original Value	0.0780	0.9000	-23.5674	0.2665
Bootstrap Mean	-3.6897	0.9500	-43.7268	32.5145
Bias (BM - OV)	-3.7677	0.9900	-127.5392	325.6535
Bias Corrected	3.8457			
Standard Error	216.5360			

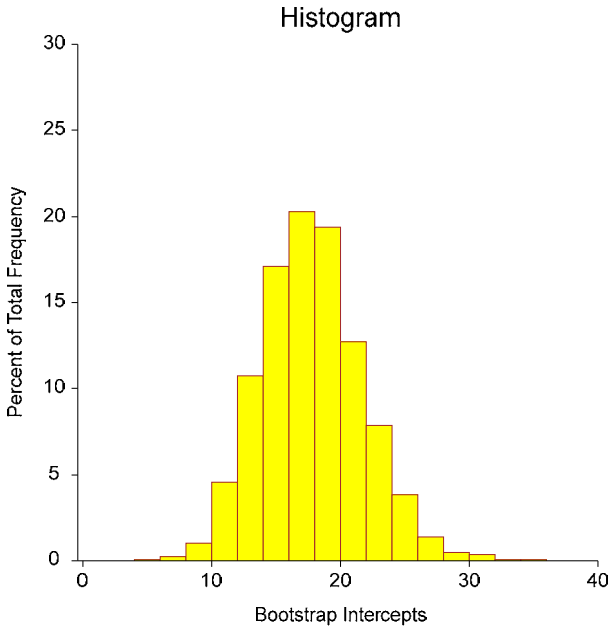
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

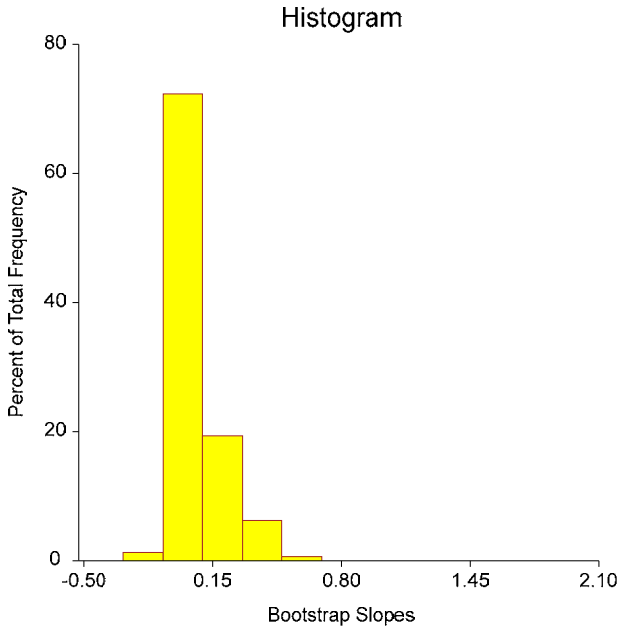
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

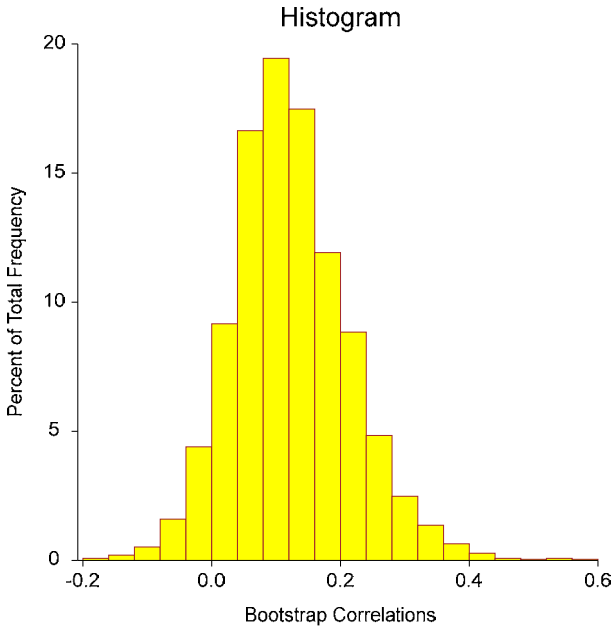
Linear Regression Report

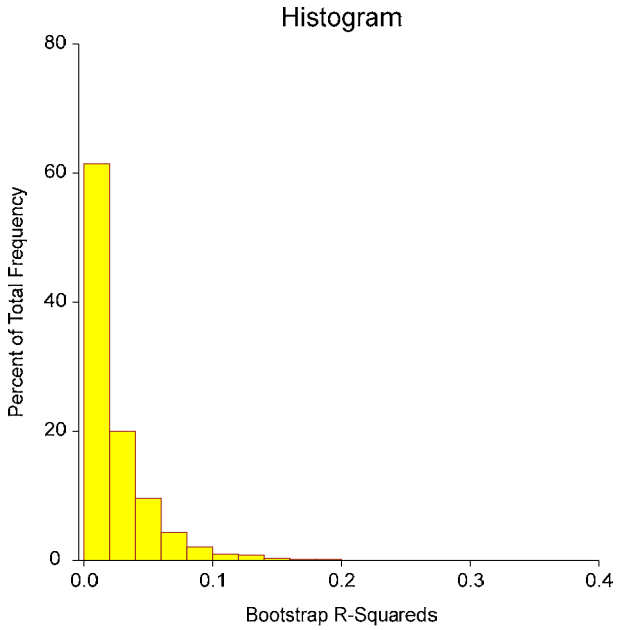
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Histograms Section



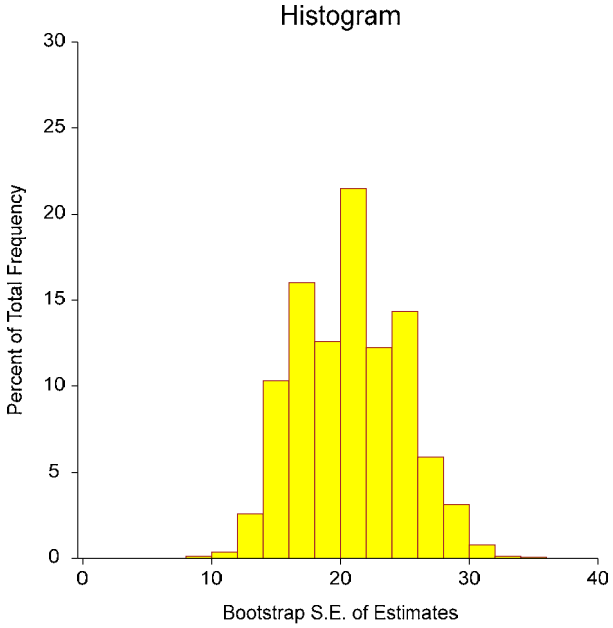


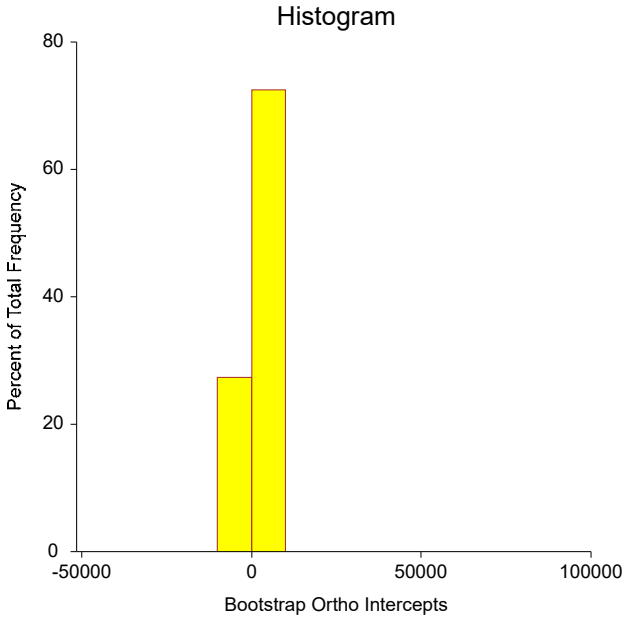


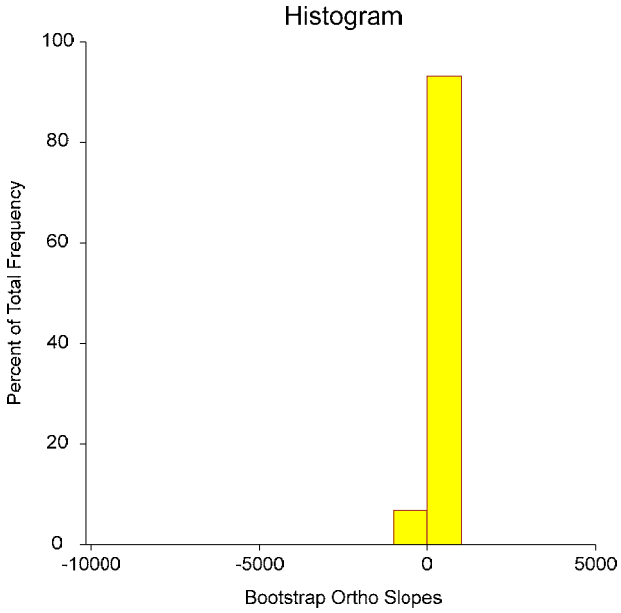


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.1006	0.0101	0.5727
Lower 95% Conf. Limit (r dist'n)	-0.2077		
Upper 95% Conf. Limit (r dist'n)	0.3886		
Lower 95% Conf. Limit (Fisher's z)	-0.2097		0.3254
Upper 95% Conf. Limit (Fisher's z)	0.3925		0.7467
Adjusted (Rbar)		0.0146	
T-Value for H0: Rho = 0	0.6395	0.6395	4.4186
Prob Level for H0: Rho = 0	0.5261	0.5261	0.0001
Prob Level (Randomization Test N =1000)	0.5310		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14833.64	14833.64			
Slope	1	188.3277	188.3277	0.4090	0.5261	0.0957
Error	40	18418.74	460.4685			
Lack of Fit	38	16675.42	438.8267	0.5034	0.8488	
Pure Error	2	1743.324	871.6622			
Adj. Total	41	18607.07	453.8309			
Total	42	33440.71				

s = Square Root(460.4685) = 21.45853

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	621.97	789.3116	0.02733403	-0.0002380009
1	621.97	71432.3	15111.93	-0.0002380009	1.607157E-05
2 (Y'Y)			33440.71		
Determinant		2613310			3.826565E-07

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	12.58646	-0.1095919
1	-0.1095919	0.007400454

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7770	0.000001	No
Anderson Darling	2.8090	0.000000	No
D'Agostino Skewness	4.1322	0.000036	No
D'Agostino Kurtosis	3.2312	0.001233	No
D'Agostino Omnibus	27.5159	0.000001	No
Constant Residual Variance?			
Modified Levene Test	0.0071	0.933397	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.5034	0.848812	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

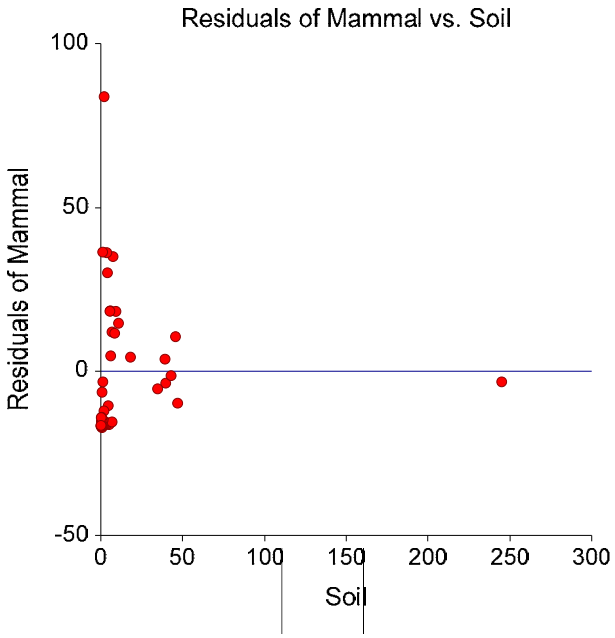
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

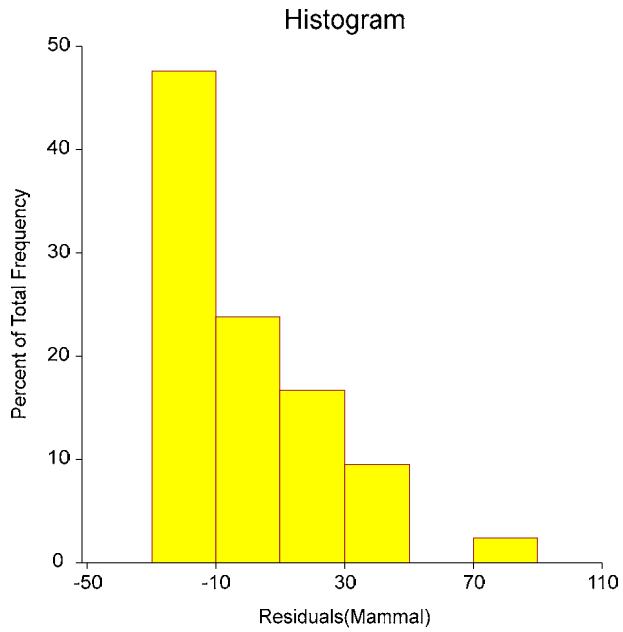
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

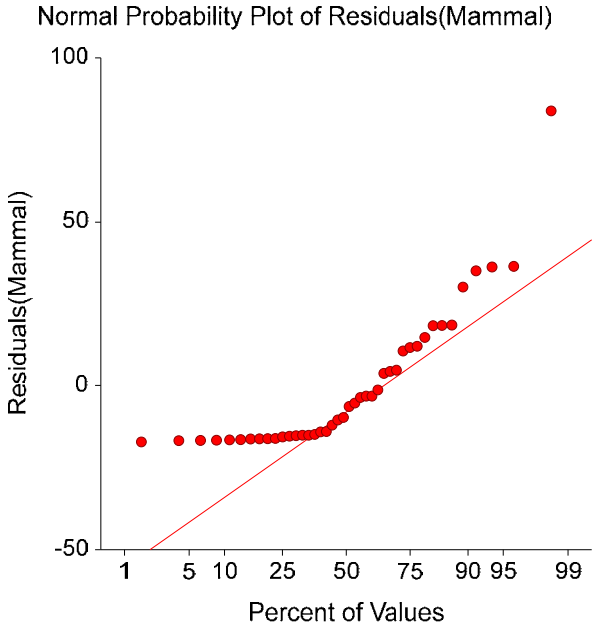
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Original Data Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
10	245.0000	28.3000	31.4573	-3.1573
11	6.0000	23.0667	18.3085	4.7582
12	46.9000	10.9000	20.5587	-9.6587
13	1.2000	14.8900	18.0444	-3.1544
14	39.6000	16.6000	20.1570	-3.5570
15	4.1000	2.6000	18.2040	-15.6040
16	0.7100	11.6950	18.0175	-6.3225
17	5.1000	2.0767	18.2590	-16.1823
18	0.3500	2.7800	17.9977	-15.2177
19	3.6000	2.1100	18.1765	-16.0665
20	2.6000	1.9900	18.1215	-16.1315
21	0.6600	0.8900	18.0147	-17.1247
22	45.6000	31.1000	20.4871	10.6129
23	4.5000	7.8000	18.2260	-10.4260
24	5.8000	36.8000	18.2975	18.5025
25	6.8000	30.4000	18.3525	12.0475
26	9.2000	36.8000	18.4846	18.3154
27	7.4000	53.4233	18.3855	35.0378
28	10.8000	33.3000	18.5726	14.7274
29	3.6000	54.4000	18.1765	36.2235
30	18.1000	23.3500	18.9742	4.3758
31	42.9000	19.0700	20.3386	-1.2686
32	1.9000	6.0800	18.0829	-12.0029
33	4.0000	48.3000	18.1985	30.1015
34	0.4600	4.0533	18.0037	-13.9504
35	1.5000	2.9867	18.0609	-15.0743
36	1.8000	1.8400	18.0774	-16.2374
37	6.8000	2.9700	18.3525	-15.3825
38	1.4000	3.2100	18.0554	-14.8454
39	0.6700	2.9400	18.0153	-15.0753
40	0.9400	1.5200	18.0301	-16.5101
41	0.1800	1.3900	17.9883	-16.5983
42	0.2100	3.9267	17.9900	-14.0633
43	0.5400	1.2767	18.0081	-16.7315
44	0.0730	1.3100	17.9824	-16.6724
45	0.0770	1.5500	17.9827	-16.4327
46	8.4000	30.1000	18.4406	11.6594
47	2.0000	101.9000	18.0884	83.8116
48	1.1000	54.4500	18.0389	36.4111
49	39.2000	23.9000	20.1350	3.7650
50	34.7000	14.6000	19.8875	-5.2875
51	5.5000	36.6667	18.2810	18.3857

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	245.0000	28.3000	31.4573	20.0773	-9.1205	72.0350
11	6.0000	23.0667	18.3085	3.3967	11.4435	25.1736
12	46.9000	10.9000	20.5587	4.3110	11.8458	29.2715
13	1.2000	14.8900	18.0444	3.5120	10.9464	25.1424
14	39.6000	16.6000	20.1570	3.9385	12.1970	28.1171
15	4.1000	2.6000	18.2040	3.4369	11.2578	25.1502
16	0.7100	11.6950	18.0175	3.5263	10.8906	25.1443
17	5.1000	2.0767	18.2590	3.4148	11.3574	25.1606
18	0.3500	2.7800	17.9977	3.5370	10.8490	25.1463
19	3.6000	2.1100	18.1765	3.4487	11.2065	25.1465
20	2.6000	1.9900	18.1215	3.4737	11.1008	25.1421
21	0.6600	0.8900	18.0147	3.5278	10.8849	25.1446
22	45.6000	31.1000	20.4871	4.2403	11.9172	29.0570
23	4.5000	7.8000	18.2260	3.4278	11.2981	25.1539
24	5.8000	36.8000	18.2975	3.4006	11.4246	25.1704
25	6.8000	30.4000	18.3525	3.3820	11.5172	25.1879
26	9.2000	36.8000	18.4846	3.3461	11.7219	25.2473
27	7.4000	53.4233	18.3855	3.3719	11.5707	25.2004
28	10.8000	33.3000	18.5726	3.3290	11.8444	25.3008
29	3.6000	54.4000	18.1765	3.4487	11.2065	25.1465
30	18.1000	23.3500	18.9742	3.3232	12.2578	25.6907
31	42.9000	19.0700	20.3386	4.0992	12.0538	28.6234
32	1.9000	6.0800	18.0829	3.4924	11.0246	25.1413
33	4.0000	48.3000	18.1985	3.4392	11.2476	25.1494
34	0.4600	4.0533	18.0037	3.5337	10.8618	25.1456
35	1.5000	2.9867	18.0609	3.5035	10.9802	25.1417
36	1.8000	1.8400	18.0774	3.4951	11.0135	25.1414
37	6.8000	2.9700	18.3525	3.3820	11.5172	25.1879
38	1.4000	3.2100	18.0554	3.5063	10.9690	25.1419
39	0.6700	2.9400	18.0153	3.5275	10.8860	25.1445
40	0.9400	1.5200	18.0301	3.5195	10.9169	25.1433
41	0.1800	1.3900	17.9883	3.5422	10.8292	25.1474
42	0.2100	3.9267	17.9900	3.5413	10.8328	25.1472
43	0.5400	1.2767	18.0081	3.5313	10.8711	25.1452
44	0.0730	1.3100	17.9824	3.5455	10.8167	25.1481
45	0.0770	1.5500	17.9827	3.5454	10.8172	25.1481
46	8.4000	30.1000	18.4406	3.3567	11.6564	25.2247
47	2.0000	101.9000	18.0884	3.4897	11.0356	25.1413
48	1.1000	54.4500	18.0389	3.5149	10.9351	25.1428
49	39.2000	23.9000	20.1350	3.9200	12.2124	28.0576
50	34.7000	14.6000	19.8875	3.7271	12.3546	27.4203
51	5.5000	36.6667	18.2810	3.4066	11.3960	25.1660

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	245.0000	28.3000	31.4573	29.3865	-27.9351	90.8496
11	6.0000	23.0667	18.3085	21.7257	-25.6008	62.2178
12	46.9000	10.9000	20.5587	21.8873	-23.6772	64.7945
13	1.2000	14.8900	18.0444	21.7440	-25.9019	61.9907
14	39.6000	16.6000	20.1570	21.8170	-23.9367	64.2508
15	4.1000	2.6000	18.2040	21.7320	-25.7181	62.1260
16	0.7100	11.6950	18.0175	21.7463	-25.9335	61.9685
17	5.1000	2.0767	18.2590	21.7285	-25.6560	62.1740
18	0.3500	2.7800	17.9977	21.7481	-25.9568	61.9522
19	3.6000	2.1100	18.1765	21.7339	-25.7493	62.1023
20	2.6000	1.9900	18.1215	21.7379	-25.8124	62.0553
21	0.6600	0.8900	18.0147	21.7466	-25.9367	61.9662
22	45.6000	31.1000	20.4871	21.8735	-23.7208	64.6951
23	4.5000	7.8000	18.2260	21.7306	-25.6932	62.1451
24	5.8000	36.8000	18.2975	21.7263	-25.6130	62.2080
25	6.8000	30.4000	18.3525	21.7234	-25.5521	62.2572
26	9.2000	36.8000	18.4846	21.7178	-25.4088	62.3780
27	7.4000	53.4233	18.3855	21.7218	-25.5159	62.2870
28	10.8000	33.3000	18.5726	21.7152	-25.3155	62.4607
29	3.6000	54.4000	18.1765	21.7339	-25.7493	62.1023
30	18.1000	23.3500	18.9742	21.7143	-24.9121	62.8605
31	42.9000	19.0700	20.3386	21.8466	-23.8149	64.4921
32	1.9000	6.0800	18.0829	21.7409	-25.8570	62.0229
33	4.0000	48.3000	18.1985	21.7324	-25.7243	62.1213
34	0.4600	4.0533	18.0037	21.7475	-25.9497	61.9572
35	1.5000	2.9867	18.0609	21.7427	-25.8826	62.0045
36	1.8000	1.8400	18.0774	21.7413	-25.8634	62.0183
37	6.8000	2.9700	18.3525	21.7234	-25.5521	62.2572
38	1.4000	3.2100	18.0554	21.7431	-25.8890	61.9999
39	0.6700	2.9400	18.0153	21.7465	-25.9361	61.9666
40	0.9400	1.5200	18.0301	21.7452	-25.9186	61.9789
41	0.1800	1.3900	17.9883	21.7489	-25.9679	61.9445
42	0.2100	3.9267	17.9900	21.7488	-25.9659	61.9459
43	0.5400	1.2767	18.0081	21.7472	-25.9445	61.9608
44	0.0730	1.3100	17.9824	21.7495	-25.9749	61.9397
45	0.0770	1.5500	17.9827	21.7494	-25.9746	61.9399
46	8.4000	30.1000	18.4406	21.7195	-25.4562	62.3373
47	2.0000	101.9000	18.0884	21.7404	-25.8506	62.0275
48	1.1000	54.4500	18.0389	21.7445	-25.9083	61.9862
49	39.2000	23.9000	20.1350	21.8136	-23.9520	64.2220
50	34.7000	14.6000	19.8875	21.7798	-24.1312	63.9061
51	5.5000	36.6667	18.2810	21.7272	-25.6314	62.1934

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	245.0000	28.3000	31.4573	20.0773	-25.6908	88.6053
11	6.0000	23.0667	18.3085	3.3967	8.6401	27.9770
12	46.9000	10.9000	20.5587	4.3110	8.2878	32.8295
13	1.2000	14.8900	18.0444	3.5120	8.0479	28.0410
14	39.6000	16.6000	20.1570	3.9385	8.9465	31.3676
15	4.1000	2.6000	18.2040	3.4369	8.4212	27.9867
16	0.7100	11.6950	18.0175	3.5263	7.9803	28.0546
17	5.1000	2.0767	18.2590	3.4148	8.5390	27.9790
18	0.3500	2.7800	17.9977	3.5370	7.9298	28.0655
19	3.6000	2.1100	18.1765	3.4487	8.3602	27.9928
20	2.6000	1.9900	18.1215	3.4737	8.2339	28.0090
21	0.6600	0.8900	18.0147	3.5278	7.9733	28.0561
22	45.6000	31.1000	20.4871	4.2403	8.4176	32.5566
23	4.5000	7.8000	18.2260	3.4278	8.4690	27.9829
24	5.8000	36.8000	18.2975	3.4006	8.6180	27.9770
25	6.8000	30.4000	18.3525	3.3820	8.7259	27.9792
26	9.2000	36.8000	18.4846	3.3461	8.9602	28.0089
27	7.4000	53.4233	18.3855	3.3719	8.7877	27.9833
28	10.8000	33.3000	18.5726	3.3290	9.0968	28.0483
29	3.6000	54.4000	18.1765	3.4487	8.3602	27.9928
30	18.1000	23.3500	18.9742	3.3232	9.5150	28.4334
31	42.9000	19.0700	20.3386	4.0992	8.6707	32.0065
32	1.9000	6.0800	18.0829	3.4924	8.1422	28.0237
33	4.0000	48.3000	18.1985	3.4392	8.4091	27.9878
34	0.4600	4.0533	18.0037	3.5337	7.9453	28.0621
35	1.5000	2.9867	18.0609	3.5035	8.0887	28.0332
36	1.8000	1.8400	18.0774	3.4951	8.1289	28.0260
37	6.8000	2.9700	18.3525	3.3820	8.7259	27.9792
38	1.4000	3.2100	18.0554	3.5063	8.0751	28.0358
39	0.6700	2.9400	18.0153	3.5275	7.9747	28.0558
40	0.9400	1.5200	18.0301	3.5195	8.0122	28.0481
41	0.1800	1.3900	17.9883	3.5422	7.9058	28.0709
42	0.2100	3.9267	17.9900	3.5413	7.9100	28.0699
43	0.5400	1.2767	18.0081	3.5313	7.9566	28.0597
44	0.0730	1.3100	17.9824	3.5455	7.8906	28.0743
45	0.0770	1.5500	17.9827	3.5454	7.8911	28.0742
46	8.4000	30.1000	18.4406	3.3567	8.8860	27.9951
47	2.0000	101.9000	18.0884	3.4897	8.1555	28.0214
48	1.1000	54.4500	18.0389	3.5149	8.0342	28.0437
49	39.2000	23.9000	20.1350	3.9200	8.9772	31.2929
50	34.7000	14.6000	19.8875	3.7271	9.2785	30.4964
51	5.5000	36.6667	18.2810	3.4066	8.5845	27.9775

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	245.0000	28.3000	31.4573	-3.1573	-0.4168	11.1564
11	6.0000	23.0667	18.3085	4.7582	0.2246	20.6278
12	46.9000	10.9000	20.5587	-9.6587	-0.4595	88.6115
13	1.2000	14.8900	18.0444	-3.1544	-0.1490	21.1849
14	39.6000	16.6000	20.1570	-3.5570	-0.1686	21.4279
15	4.1000	2.6000	18.2040	-15.6040	-0.7367	600.1532
16	0.7100	11.6950	18.0175	-6.3225	-0.2987	54.0614
17	5.1000	2.0767	18.2590	-16.1823	-0.7639	779.2455
18	0.3500	2.7800	17.9977	-15.2177	-0.7190	547.3983
19	3.6000	2.1100	18.1765	-16.0665	-0.7586	761.4443
20	2.6000	1.9900	18.1215	-16.1315	-0.7618	810.6261
21	0.6600	0.8900	18.0147	-17.1247	-0.8090	1924.1268
22	45.6000	31.1000	20.4871	10.6129	0.5045	34.1250
23	4.5000	7.8000	18.2260	-10.4260	-0.4922	133.6665
24	5.8000	36.8000	18.2975	18.5025	0.8733	50.2785
25	6.8000	30.4000	18.3525	12.0475	0.5685	39.6299
26	9.2000	36.8000	18.4846	18.3154	0.8641	49.7702
27	7.4000	53.4233	18.3855	35.0378	1.6534	65.5852
28	10.8000	33.3000	18.5726	14.7274	0.6947	44.2265
29	3.6000	54.4000	18.1765	36.2235	1.7103	66.5874
30	18.1000	23.3500	18.9742	4.3758	0.2064	18.7400
31	42.9000	19.0700	20.3386	-1.2686	-0.0602	6.6523
32	1.9000	6.0800	18.0829	-12.0029	-0.5669	197.4169
33	4.0000	48.3000	18.1985	30.1015	1.4211	62.3220
34	0.4600	4.0533	18.0037	-13.9504	-0.6591	344.1709
35	1.5000	2.9867	18.0609	-15.0743	-0.7120	504.7190
36	1.8000	1.8400	18.0774	-16.2374	-0.7669	882.4699
37	6.8000	2.9700	18.3525	-15.3825	-0.7259	517.9301
38	1.4000	3.2100	18.0554	-14.8454	-0.7012	462.4748
39	0.6700	2.9400	18.0153	-15.0753	-0.7122	512.7646
40	0.9400	1.5200	18.0301	-16.5101	-0.7800	1086.1930
41	0.1800	1.3900	17.9883	-16.5983	-0.7843	1194.1238
42	0.2100	3.9267	17.9900	-14.0633	-0.6645	358.1487
43	0.5400	1.2767	18.0081	-16.7315	-0.7905	1310.5583
44	0.0730	1.3100	17.9824	-16.6724	-0.7878	1272.7049
45	0.0770	1.5500	17.9827	-16.4327	-0.7765	1060.1713
46	8.4000	30.1000	18.4406	11.6594	0.5501	38.7357
47	2.0000	101.9000	18.0884	83.8116	3.9584	82.2488
48	1.1000	54.4500	18.0389	36.4111	1.7200	66.8706
49	39.2000	23.9000	20.1350	3.7650	0.1785	15.7530
50	34.7000	14.6000	19.8875	-5.2875	-0.2502	36.2155
51	5.5000	36.6667	18.2810	18.3857	0.8678	50.1427

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	245.0000	-3.1573	*-0.4125	0.8754	0.6104	470.2239
11	6.0000	4.7582	0.2219	0.0251	0.0006	471.6800
12	46.9000	-9.6587	-0.4549	0.0404	0.0044	469.7827
13	1.2000	-3.1544	-0.1472	0.0268	0.0003	472.0132
14	39.6000	-3.5570	-0.1666	0.0337	0.0005	471.9397
15	4.1000	-15.6040	-0.7324	0.0257	0.0071	465.8678
16	0.7100	-6.3225	-0.2953	0.0270	0.0012	471.2220
17	5.1000	-16.1823	-0.7598	0.0253	0.0076	465.3864
18	0.3500	-15.2177	-0.7146	0.0272	0.0072	466.1717
19	3.6000	-16.0665	-0.7545	0.0258	0.0076	465.4811
20	2.6000	-16.1315	-0.7577	0.0262	0.0078	465.4234
21	0.6600	-17.1247	-0.8055	0.0270	0.0091	464.5471
22	45.6000	10.6129	0.4998	0.0390	0.0052	469.2700
23	4.5000	-10.4260	-0.4875	0.0255	0.0032	469.4152
24	5.8000	18.5025	0.8706	0.0251	0.0098	463.2713
25	6.8000	12.0475	0.5637	0.0248	0.0041	468.4590
26	9.2000	18.3154	0.8613	0.0243	0.0093	463.4596
27	7.4000	35.0378	1.6914	0.0247	0.0346	440.0003
28	10.8000	14.7274	0.6902	0.0241	0.0060	466.5768
29	3.6000	36.2235	1.7541	0.0258	0.0388	437.7386
30	18.1000	4.3758	0.2039	0.0240	0.0005	471.7724
31	42.9000	-1.2686	-0.0595	0.0365	0.0001	472.2326
32	1.9000	-12.0029	-0.5620	0.0265	0.0044	468.4808
33	4.0000	30.1015	1.4401	0.0257	0.0266	448.4295
34	0.4600	-13.9504	-0.6544	0.0271	0.0061	467.1462
35	1.5000	-15.0743	-0.7076	0.0267	0.0069	466.2893
36	1.8000	-16.2374	-0.7629	0.0265	0.0080	465.3308
37	6.8000	-15.3825	-0.7216	0.0248	0.0067	466.0536
38	1.4000	-14.8454	-0.6967	0.0267	0.0067	466.4694
39	0.6700	-15.0753	-0.7078	0.0270	0.0070	466.2863
40	0.9400	-16.5101	-0.7761	0.0269	0.0084	465.0928
41	0.1800	-16.5983	-0.7804	0.0272	0.0086	465.0133
42	0.2100	-14.0633	-0.6598	0.0272	0.0062	467.0622
43	0.5400	-16.7315	-0.7867	0.0271	0.0087	464.8976
44	0.0730	-16.6724	-0.7840	0.0273	0.0087	464.9479
45	0.0770	-16.4327	-0.7725	0.0273	0.0085	465.1572
46	8.4000	11.6594	0.5453	0.0245	0.0038	468.7022
47	2.0000	83.8116	*5.0116	0.0264	0.2128	287.2705
48	1.1000	36.4111	1.7649	0.0268	0.0408	437.3442
49	39.2000	3.7650	0.1763	0.0334	0.0005	471.8994
50	34.7000	-5.2875	-0.2473	0.0302	0.0010	471.5362
51	5.5000	18.3857	0.8651	0.0252	0.0097	463.3838

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.4125	-1.0934	* 0.6104	* 8.3700	0.2190	-1.0784
11	0.2219	0.0356	0.0006	1.0763	0.0352	-0.0079
12	-0.4549	-0.0933	0.0044	1.0846	-0.0454	-0.0597
13	-0.1472	-0.0244	0.0003	1.0797	-0.0244	0.0081
14	-0.1666	-0.0311	0.0005	1.0871	-0.0184	-0.0168
15	-0.7324	-0.1188	0.0071	1.0505	-0.1183	0.0319
16	-0.2953	-0.0492	0.0012	1.0763	-0.0492	0.0169
17	-0.7598	-0.1225	0.0076	1.0480	-0.1216	0.0300
18	-0.7146	-0.1194	0.0072	1.0535	-0.1194	0.0420
19	-0.7545	-0.1229	0.0076	1.0490	-0.1224	0.0343
20	-0.7577	-0.1243	0.0078	1.0491	-0.1241	0.0376
21	-0.8055	-0.1342	0.0091	1.0461	-0.1342	0.0463
22	0.4998	0.1007	0.0052	1.0808	0.0508	0.0629
23	-0.4875	-0.0789	0.0032	1.0664	-0.0784	0.0204
24	0.8706	0.1397	0.0098	1.0383	0.1384	-0.0318
25	0.5637	0.0900	0.0041	1.0614	0.0888	-0.0183
26	0.8613	0.1360	0.0093	1.0383	0.1326	-0.0196
27	1.6914	0.2691	0.0346	0.9362	0.2649	-0.0509
28	0.6902	0.1084	0.0060	1.0520	0.1046	-0.0112
29	1.7541	0.2856	0.0388	0.9277	0.2846	-0.0799
30	0.2039	0.0320	0.0005	1.0755	0.0287	0.0027
31	-0.0595	-0.0116	0.0001	1.0916	-0.0063	-0.0068
32	-0.5620	-0.0927	0.0044	1.0633	-0.0926	0.0295
33	1.4401	0.2338	0.0266	0.9734	0.2328	-0.0632
34	-0.6544	-0.1093	0.0061	1.0579	-0.1092	0.0382
35	-0.7076	-0.1171	0.0069	1.0535	-0.1170	0.0383
36	-0.7629	-0.1259	0.0080	1.0491	-0.1258	0.0403
37	-0.7216	-0.1152	0.0067	1.0505	-0.1137	0.0235
38	-0.6967	-0.1154	0.0067	1.0544	-0.1153	0.0380
39	-0.7078	-0.1179	0.0070	1.0539	-0.1179	0.0407
40	-0.7761	-0.1290	0.0084	1.0484	-0.1290	0.0437
41	-0.7804	-0.1306	0.0086	1.0484	-0.1306	0.0464
42	-0.6598	-0.1104	0.0062	1.0576	-0.1104	0.0392
43	-0.7867	-0.1313	0.0087	1.0477	-0.1312	0.0456
44	-0.7840	-0.1313	0.0087	1.0482	-0.1313	0.0470
45	-0.7725	-0.1294	0.0085	1.0491	-0.1294	0.0463
46	0.5453	0.0864	0.0038	1.0621	0.0846	-0.0142
47	* 5.0116	0.8260	0.2128	0.3998	0.8251	-0.2608
48	1.7649	0.2931	0.0408	0.9270	0.2930	-0.0983
49	0.1763	0.0328	0.0005	1.0865	0.0195	0.0175
50	-0.2473	-0.0436	0.0010	1.0813	-0.0290	-0.0200
51	0.8651	0.1391	0.0097	1.0389	0.1379	-0.0327

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
10	245.0000	-3.1573	|.....	-0.4168	|.....	-0.4125	|.....
11	6.0000	4.7582	|.....	0.2246	|.....	0.2219	|.....
12	46.9000	-9.6587	|.....	-0.4595	|.....	-0.4549	|.....
13	1.2000	-3.1544	|.....	-0.1490	|.....	-0.1472	|.....
14	39.6000	-3.5570	|.....	-0.1686	|.....	-0.1666	|.....
15	4.1000	-15.6040	||.....	-0.7367	||.....	-0.7324	||.....
16	0.7100	-6.3225	|.....	-0.2987	|.....	-0.2953	|.....
17	5.1000	-16.1823	||.....	-0.7639	||.....	-0.7598	||.....
18	0.3500	-15.2177	||.....	-0.7190	||.....	-0.7146	|.....
19	3.6000	-16.0665	||.....	-0.7586	||.....	-0.7545	||.....
20	2.6000	-16.1315	||.....	-0.7618	||.....	-0.7577	||.....
21	0.6600	-17.1247	||.....	-0.8090	||.....	-0.8055	||.....
22	45.6000	10.6129	|.....	0.5045	|.....	0.4998	|.....
23	4.5000	-10.4260	|.....	-0.4922	|.....	-0.4875	|.....
24	5.8000	18.5025	|||.....	0.8733	|||.....	0.8706	||.....
25	6.8000	12.0475	|.....	0.5685	|.....	0.5637	|.....
26	9.2000	18.3154	|||.....	0.8641	|||.....	0.8613	||.....
27	7.4000	35.0378	||||||.....	1.6534	||||||.....	1.6914	||||.....
28	10.8000	14.7274	||.....	0.6947	||.....	0.6902	|.....
29	3.6000	36.2235	||||||.....	1.7103	||||||.....	1.7541	|||||.....
30	18.1000	4.3758	|.....	0.2064	|.....	0.2039	|.....
31	42.9000	-1.2686	|.....	-0.0602	|.....	-0.0595	|.....
32	1.9000	-12.0029	|.....	-0.5669	|.....	-0.5620	|.....
33	4.0000	30.1015	|||||.....	1.4211	|||||.....	1.4401	||||.....
34	0.4600	-13.9504	||.....	-0.6591	||.....	-0.6544	|.....
35	1.5000	-15.0743	||.....	-0.7120	||.....	-0.7076	|.....
36	1.8000	-16.2374	||.....	-0.7669	||.....	-0.7629	||.....
37	6.8000	-15.3825	||.....	-0.7259	||.....	-0.7216	||.....
38	1.4000	-14.8454	||.....	-0.7012	||.....	-0.6967	|.....
39	0.6700	-15.0753	||.....	-0.7122	||.....	-0.7078	|.....
40	0.9400	-16.5101	||.....	-0.7800	||.....	-0.7761	||.....
41	0.1800	-16.5983	||.....	-0.7843	||.....	-0.7804	||.....
42	0.2100	-14.0633	||.....	-0.6645	||.....	-0.6598	|.....
43	0.5400	-16.7315	||.....	-0.7905	||.....	-0.7867	||.....
44	0.0730	-16.6724	||.....	-0.7878	||.....	-0.7840	||.....
45	0.0770	-16.4327	||.....	-0.7765	||.....	-0.7725	||.....
46	8.4000	11.6594	|.....	0.5501	|.....	0.5453	|.....
47	2.0000	83.8116	|||||||||||||||	3.9584	|||||||||||||||	* 5.0116	|||||||||||||||
48	1.1000	36.4111	||||||.....	1.7200	||||||.....	1.7649	|||||.....
49	39.2000	3.7650	|.....	0.1785	|.....	0.1763	|.....
50	34.7000	-5.2875	|.....	-0.2502	|.....	-0.2473	|.....
51	5.5000	18.3857	|||.....	0.8678	|||.....	0.8651	||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	245.0000	-1.0934	|||||||||||||||	* 0.6104	|||||||||||||||	-1.0784	|||||||||||||||
11	6.0000	0.0356	|.....	0.0006	|.....	-0.0079	|.....
12	46.9000	-0.0933	|.....	0.0044	|.....	-0.0597	|.....
13	1.2000	-0.0244	|.....	0.0003	|.....	0.0081	|.....
14	39.6000	-0.0311	|.....	0.0005	|.....	-0.0168	|.....
15	4.1000	-0.1188	|.....	0.0071	|.....	0.0319	|.....
16	0.7100	-0.0492	|.....	0.0012	|.....	0.0169	|.....
17	5.1000	-0.1225	|.....	0.0076	|.....	0.0300	|.....
18	0.3500	-0.1194	|.....	0.0072	|.....	0.0420	|.....
19	3.6000	-0.1229	|.....	0.0076	|.....	0.0343	|.....
20	2.6000	-0.1243	|.....	0.0078	|.....	0.0376	|.....
21	0.6600	-0.1342	|.....	0.0091	|.....	0.0463	|.....
22	45.6000	0.1007	|.....	0.0052	|.....	0.0629	|.....
23	4.5000	-0.0789	|.....	0.0032	|.....	0.0204	|.....
24	5.8000	0.1397	|.....	0.0098	|.....	-0.0318	|.....
25	6.8000	0.0900	|.....	0.0041	|.....	-0.0183	|.....
26	9.2000	0.1360	|.....	0.0093	|.....	-0.0196	|.....
27	7.4000	0.2691	|||.....	0.0346	|.....	-0.0509	|.....
28	10.8000	0.1084	|.....	0.0060	|.....	-0.0112	|.....
29	3.6000	0.2856	|||.....	0.0388	|.....	-0.0799	|.....
30	18.1000	0.0320	|.....	0.0005	|.....	0.0027	|.....
31	42.9000	-0.0116	|.....	0.0001	|.....	-0.0068	|.....
32	1.9000	-0.0927	|.....	0.0044	|.....	0.0295	|.....
33	4.0000	0.2338	|||.....	0.0266	|.....	-0.0632	|.....
34	0.4600	-0.1093	|.....	0.0061	|.....	0.0382	|.....
35	1.5000	-0.1171	|.....	0.0069	|.....	0.0383	|.....
36	1.8000	-0.1259	|.....	0.0080	|.....	0.0403	|.....
37	6.8000	-0.1152	|.....	0.0067	|.....	0.0235	|.....
38	1.4000	-0.1154	|.....	0.0067	|.....	0.0380	|.....
39	0.6700	-0.1179	|.....	0.0070	|.....	0.0407	|.....
40	0.9400	-0.1290	|.....	0.0084	|.....	0.0437	|.....
41	0.1800	-0.1306	|.....	0.0086	|.....	0.0464	|.....
42	0.2100	-0.1104	|.....	0.0062	|.....	0.0392	|.....
43	0.5400	-0.1313	|.....	0.0087	|.....	0.0456	|.....
44	0.0730	-0.1313	|.....	0.0087	|.....	0.0470	|.....
45	0.0770	-0.1294	|.....	0.0085	|.....	0.0463	|.....
46	8.4000	0.0864	|.....	0.0038	|.....	-0.0142	|.....
47	2.0000	0.8260	|||||||||||....	0.2128	|||||.....	-0.2608	|||.....
48	1.1000	0.2931	|||.....	0.0408	|.....	-0.0983	|.....
49	39.2000	0.0328	|.....	0.0005	|.....	0.0175	|.....
50	34.7000	-0.0436	|.....	0.0010	|.....	-0.0200	|.....
51	5.5000	0.1391	|.....	0.0097	|.....	-0.0327	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	245.0000	-0.4125	|.....	* 0.6104	||||||||||||||	0.8754	||||||||||||||
11	6.0000	0.2219	|.....	0.0006	|.....	0.0251	|.....
12	46.9000	-0.4549	|.....	0.0044	|.....	0.0404	|.....
13	1.2000	-0.1472	|.....	0.0003	|.....	0.0268	|.....
14	39.6000	-0.1666	|.....	0.0005	|.....	0.0337	|.....
15	4.1000	-0.7324	||.....	0.0071	|.....	0.0257	|.....
16	0.7100	-0.2953	|.....	0.0012	|.....	0.0270	|.....
17	5.1000	-0.7598	||.....	0.0076	|.....	0.0253	|.....
18	0.3500	-0.7146	|.....	0.0072	|.....	0.0272	|.....
19	3.6000	-0.7545	||.....	0.0076	|.....	0.0258	|.....
20	2.6000	-0.7577	||.....	0.0078	|.....	0.0262	|.....
21	0.6600	-0.8055	||.....	0.0091	|.....	0.0270	|.....
22	45.6000	0.4998	|.....	0.0052	|.....	0.0390	|.....
23	4.5000	-0.4875	|.....	0.0032	|.....	0.0255	|.....
24	5.8000	0.8706	||.....	0.0098	|.....	0.0251	|.....
25	6.8000	0.5637	|.....	0.0041	|.....	0.0248	|.....
26	9.2000	0.8613	||.....	0.0093	|.....	0.0243	|.....
27	7.4000	1.6914	||||.....	0.0346	|.....	0.0247	|.....
28	10.8000	0.6902	|.....	0.0060	|.....	0.0241	|.....
29	3.6000	1.7541	|||||.....	0.0388	|.....	0.0258	|.....
30	18.1000	0.2039	|.....	0.0005	|.....	0.0240	|.....
31	42.9000	-0.0595	|.....	0.0001	|.....	0.0365	|.....
32	1.9000	-0.5620	|.....	0.0044	|.....	0.0265	|.....
33	4.0000	1.4401	||||.....	0.0266	|.....	0.0257	|.....
34	0.4600	-0.6544	|.....	0.0061	|.....	0.0271	|.....
35	1.5000	-0.7076	|.....	0.0069	|.....	0.0267	|.....
36	1.8000	-0.7629	||.....	0.0080	|.....	0.0265	|.....
37	6.8000	-0.7216	||.....	0.0067	|.....	0.0248	|.....
38	1.4000	-0.6967	|.....	0.0067	|.....	0.0267	|.....
39	0.6700	-0.7078	|.....	0.0070	|.....	0.0270	|.....
40	0.9400	-0.7761	||.....	0.0084	|.....	0.0269	|.....
41	0.1800	-0.7804	||.....	0.0086	|.....	0.0272	|.....
42	0.2100	-0.6598	|.....	0.0062	|.....	0.0272	|.....
43	0.5400	-0.7867	||.....	0.0087	|.....	0.0271	|.....
44	0.0730	-0.7840	||.....	0.0087	|.....	0.0273	|.....
45	0.0770	-0.7725	||.....	0.0085	|.....	0.0273	|.....
46	8.4000	0.5453	|.....	0.0038	|.....	0.0245	|.....
47	2.0000	* 5.0116	|||||||||||||||	0.2128	|||||.....	0.0264	|.....
48	1.1000	1.7649	|||||.....	0.0408	|.....	0.0268	|.....
49	39.2000	0.1763	|.....	0.0005	|.....	0.0334	|.....
50	34.7000	-0.2473	|.....	0.0010	|.....	0.0302	|.....
51	5.5000	0.8651	||.....	0.0097	|.....	0.0252	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Means

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	28.3000	245.0000	187.6117	57.3883	-49.6504	40.8133
11	23.0667	6.0000	92.4873	-86.4873	-23.8380	36.1695
12	10.9000	46.9000	-128.6619	175.5619	0.7918	60.7531
13	14.8900	1.2000	-56.1371	57.3371	-9.2964	54.7020
14	16.6000	39.6000	-25.0550	64.6550	-18.8321	57.3208
15	2.6000	4.1000	-279.5280	283.6280	-47.6557	142.7735
16	11.6950	0.7100	-114.2115	114.9215	8.8677	49.4614
17	2.0767	5.1000	-289.0405	294.1405	-50.2230	147.4576
18	2.7800	0.3500	-276.2563	276.6063	-46.7679	141.1576
19	2.1100	3.6000	-288.4346	292.0346	-50.0600	147.1598
20	1.9900	2.6000	-290.6158	293.2158	-50.6462	148.2314
21	0.8900	0.6600	-310.6101	311.2701	-55.9765	158.0111
22	31.1000	45.6000	238.5063	-192.9063	-77.4691	57.3063
23	7.8000	4.5000	-185.0095	189.5095	-20.3219	94.4060
24	36.8000	5.8000	342.1132	-336.3132	-129.3121	86.0931
25	30.4000	6.8000	225.7827	-218.9827	-70.7725	53.4411
26	36.8000	9.2000	342.1132	-332.9132	-129.3121	86.0931
27	53.4233	7.4000	644.2696	-636.8696	-272.8199	162.3606
28	33.3000	10.8000	278.4949	-267.6949	-97.9033	68.8416
29	54.4000	3.6000	662.0221	-658.4221	-281.1422	166.7324
30	23.3500	18.1000	97.6373	-79.5373	-22.6564	33.8418
31	19.0700	42.9000	19.8413	23.0587	-26.2872	54.7850
32	6.0800	1.9000	-216.2733	218.1733	-29.8807	110.9221
33	48.3000	4.0000	551.1446	-547.1446	-229.0464	139.3107
34	4.0533	0.4600	-253.1113	253.5713	-40.4056	129.6447
35	2.9867	1.5000	-272.4997	273.9997	-45.7453	139.2990
36	1.8400	1.8000	-293.3423	295.1423	-51.3776	149.5695
37	2.9700	6.8000	-272.8027	279.6027	-45.8279	139.4490
38	3.2100	1.4000	-268.4403	269.8403	-44.6361	137.2865
39	2.9400	0.6700	-273.3480	274.0180	-45.9765	139.7190
40	1.5200	0.9400	-299.1588	300.0988	-52.9328	152.4191
41	1.3900	0.1800	-301.5218	301.7018	-53.5628	153.5750
42	3.9267	0.2100	-255.4137	255.6237	-41.0456	130.7971
43	1.2767	0.5400	-303.5818	304.1218	-54.1112	154.5818
44	1.3100	0.0730	-302.9759	303.0489	-53.9500	154.2857
45	1.5500	0.0770	-298.6135	298.6905	-52.7873	152.1523
46	30.1000	8.4000	220.3297	-211.9297	-67.8622	51.7443
47	101.9000	2.0000	1525.4128	-1523.4128	-682.9027	376.3585
48	54.4500	1.1000	662.9310	-661.8310	-281.5681	166.9560
49	23.9000	39.2000	107.6345	-68.4345	-19.6212	28.5819
50	14.6000	34.7000	-61.4083	96.1083	-7.1743	53.7529
51	36.6667	5.5000	339.6896	-334.1896	-128.1313	85.4516

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Individuals

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	28.3000	245.0000	187.6117	57.3883	-263.4532	254.6162
11	23.0667	6.0000	92.4873	-86.4873	-258.4947	270.8261
12	10.9000	46.9000	-128.6619	175.5619	-230.4671	292.0119
13	14.8900	1.2000	-56.1371	57.3371	-242.1913	287.5968
14	16.6000	39.6000	-25.0550	64.6550	-246.4523	284.9410
15	2.6000	4.1000	-279.5280	283.6280	-197.5515	292.6692
16	11.6950	0.7100	-114.2115	114.9215	-233.0051	291.3342
17	2.0767	5.1000	-289.0405	294.1405	-195.0536	292.2882
18	2.7800	0.3500	-276.2563	276.6063	-198.3981	292.7878
19	2.1100	3.6000	-288.4346	292.0346	-195.2143	292.3141
20	1.9900	2.6000	-290.6158	293.2158	-194.6346	292.2198
21	0.8900	0.6600	-310.6101	311.2701	-189.1851	291.2198
22	31.1000	45.6000	238.5063	-192.9063	-264.2542	244.0914
23	7.8000	4.5000	-185.0095	189.5095	-219.5788	293.6629
24	36.8000	5.8000	342.1132	-336.3132	-261.4950	218.2760
25	30.4000	6.8000	225.7827	-218.9827	-264.1802	246.8488
26	36.8000	9.2000	342.1132	-332.9132	-261.4950	218.2760
27	53.4233	7.4000	644.2696	-636.8696	-202.8757	92.4165
28	33.3000	10.8000	278.4949	-267.6949	-263.9180	234.8563
29	54.4000	3.6000	662.0221	-658.4221	-195.0345	80.6247
30	23.3500	18.1000	97.6373	-79.5373	-258.8745	270.0599
31	19.0700	42.9000	19.8413	23.0587	-251.8114	280.3091
32	6.0800	1.9000	-216.2733	218.1733	-212.8339	293.8753
33	48.3000	4.0000	551.1446	-547.1446	-232.5462	142.8105
34	4.0533	0.4600	-253.1113	253.5713	-204.2089	293.4481
35	2.9867	1.5000	-272.4997	273.9997	-199.3624	292.9162
36	1.8400	1.8000	-293.3423	295.1423	-193.9060	292.0980
37	2.9700	6.8000	-272.8027	279.6027	-199.2850	292.9061
38	3.2100	1.4000	-268.4403	269.8403	-200.3952	293.0456
39	2.9400	0.6700	-273.3480	274.0180	-199.1454	292.8879
40	1.5200	0.9400	-299.1588	300.0988	-192.3365	291.8228
41	1.3900	0.1800	-301.5218	301.7018	-191.6929	291.7050
42	3.9267	0.2100	-255.4137	255.6237	-203.6447	293.3962
43	1.2767	0.5400	-303.5818	304.1218	-191.1290	291.5996
44	1.3100	0.0730	-302.9759	303.0489	-191.2951	291.6309
45	1.5500	0.0770	-298.6135	298.6905	-192.4845	291.8495
46	30.1000	8.4000	220.3297	-211.9297	-264.1224	248.0045
47	101.9000	2.0000	1525.4128	-1523.4128	-613.0151	306.4709
48	54.4500	1.1000	662.9310	-661.8310	-194.6065	79.9945
49	23.9000	39.2000	107.6345	-68.4345	-259.5761	268.5367
50	14.6000	34.7000	-61.4083	96.1083	-241.4236	288.0022
51	36.6667	5.5000	339.6896	-334.1896	-261.6323	218.9527

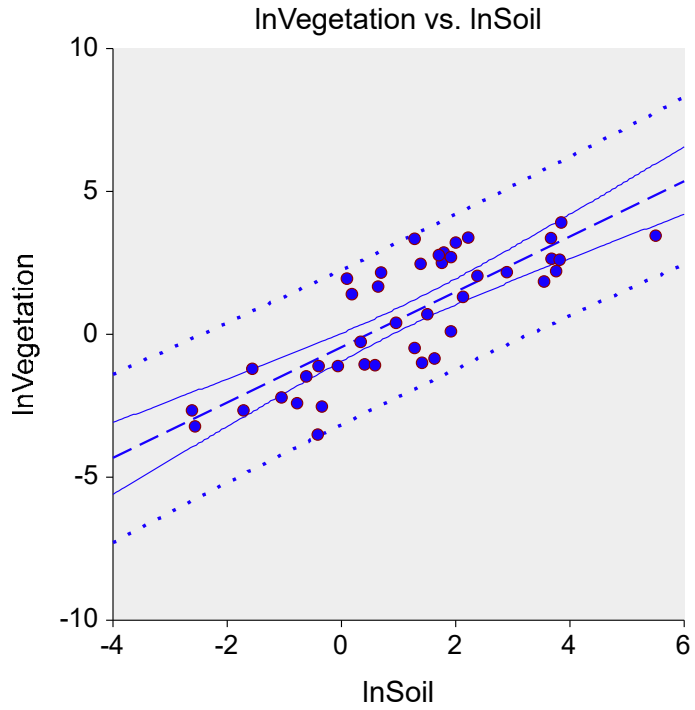
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
ln Transformation - All Data

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnVegetation	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-0.4508	Rows Prediction Only	0
Slope	0.9710	Sum of Frequencies	42
R-Squared	0.6484	Sum of Weights	42.0000
Correlation	0.8053	Coefficient of Variation	1.9504
Mean Square Error	1.745938	Square Root of MSE	1.321339

Linear Regression Report

Y = lnVegetation X = lnSoil

Summary Statement

The equation of the straight line relating lnVegetation and lnSoil is estimated as: lnVegetation = (-0.4508) + (0.9710) lnSoil using the 42 observations in this dataset. The y-intercept, the estimated value of lnVegetation when lnSoil is zero, is -0.4508 with a standard error of 0.2425. The slope, the estimated change in lnVegetation per unit change in lnSoil, is 0.9710 with a standard error of 0.1130. The value of R-Squared, the proportion of the variation in lnVegetation that can be accounted for by variation in lnSoil, is 0.6484. The correlation between lnVegetation and lnSoil is 0.8053.

A significance test that the slope is zero resulted in a t-value of 8.5896. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.9710. The lower limit of the 95% confidence interval for the slope is 0.7425 and the upper limit is 1.1994. The estimated intercept is -0.4508. The lower limit of the 95% confidence interval for the intercept is -0.9410 and the upper limit is 0.0394.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnVegetation	lnSoil
Count	42	42
Mean	0.6775	1.1620
Standard Deviation	2.2012	1.8255
Minimum	-3.5066	-2.6173
Maximum	3.9140	5.5013

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	-0.4508	0.9710
Lower 95% Confidence Limit	-0.9410	0.7425
Upper 95% Confidence Limit	0.0394	1.1994
Standard Error	0.2425	0.1130
Standardized Coefficient	0.0000	0.8053
T Value	-1.8588	8.5896
Prob Level (T Test)	0.0704	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.4421	1.0000
Regression of Y on X	-0.4508	0.9710
Inverse Regression from X on Y	-1.0625	1.4974
Orthogonal Regression of Y and X	-0.7875	1.2607

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(-0.450826820430194) + (0.970966941059202) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	-0.4508	0.9000	-0.8507	-0.0992
Bootstrap Mean	-0.4432	0.9500	-0.9319	-0.0434
Bias (BM - OV)	0.0076	0.9900	-1.1220	0.1211
Bias Corrected	-0.4584			
Standard Error	0.2318			
Slope				
Original Value	0.9710	0.9000	0.8099	1.1038
Bootstrap Mean	0.9767	0.9500	0.7758	1.1303
Bias (BM - OV)	0.0057	0.9900	0.7176	1.1878
Bias Corrected	0.9653			
Standard Error	0.0898			
Correlation				
Original Value	0.8053	0.9000	0.7447	0.8863
Bootstrap Mean	0.8036	0.9500	0.7350	0.9108
Bias (BM - OV)	-0.0017	0.9900	0.7158	0.9566
Bias Corrected	0.8069			
Standard Error	0.0444			
R-Squared				
Original Value	0.6484	0.9000	0.5473	0.7724
Bootstrap Mean	0.6478	0.9500	0.5304	0.8072
Bias (BM - OV)	-0.0007	0.9900	0.4964	0.8693
Bias Corrected	0.6491			
Standard Error	0.0697			
Standard Error of Estimate				
Original Value	1.3213	0.9000	1.1766	1.5309
Bootstrap Mean	1.2910	0.9500	1.1459	1.5621
Bias (BM - OV)	-0.0303	0.9900	1.0746	1.6319
Bias Corrected	1.3517			
Standard Error	0.1077			
Orthogonal Intercept				
Original Value	-0.7875	0.9000	-1.1808	-0.3611
Bootstrap Mean	-0.7957	0.9500	-1.2489	-0.2711
Bias (BM - OV)	-0.0082	0.9900	-1.3793	-0.0907
Bias Corrected	-0.7793			
Standard Error	0.2456			
Orthogonal Slope				
Original Value	1.2607	0.9000	0.9692	1.4556
Bootstrap Mean	1.2804	0.9500	0.8959	1.4868
Bias (BM - OV)	0.0198	0.9900	0.7230	1.5431
Bias Corrected	1.2409			
Standard Error	0.1516			

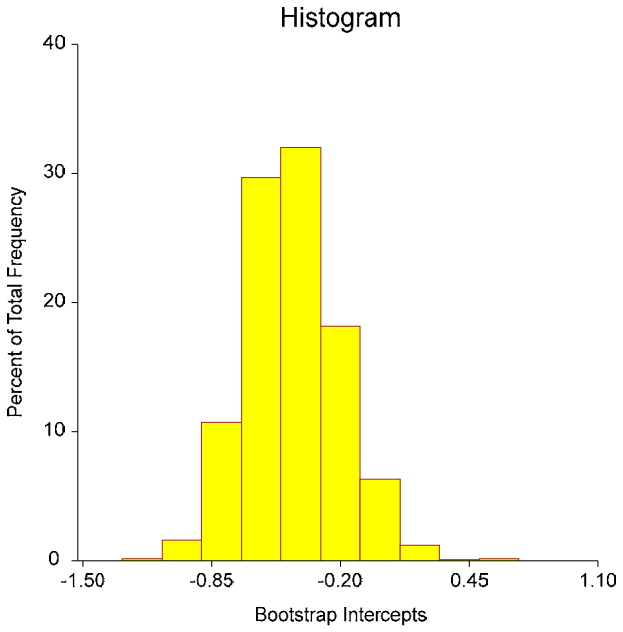
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

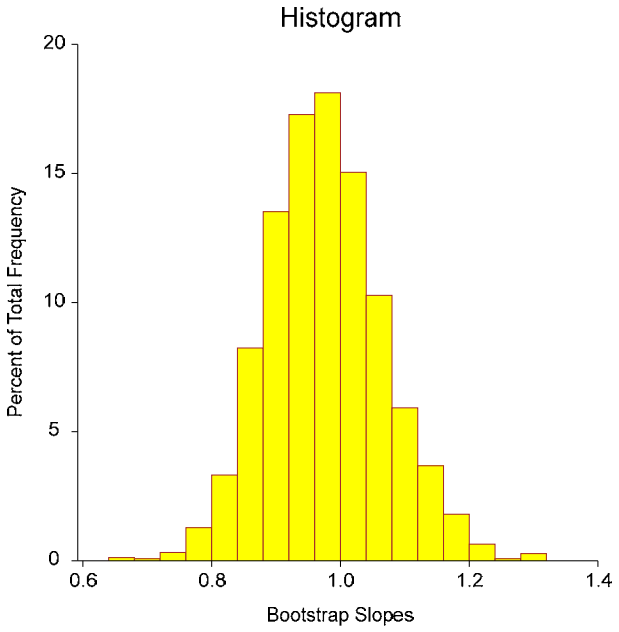
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

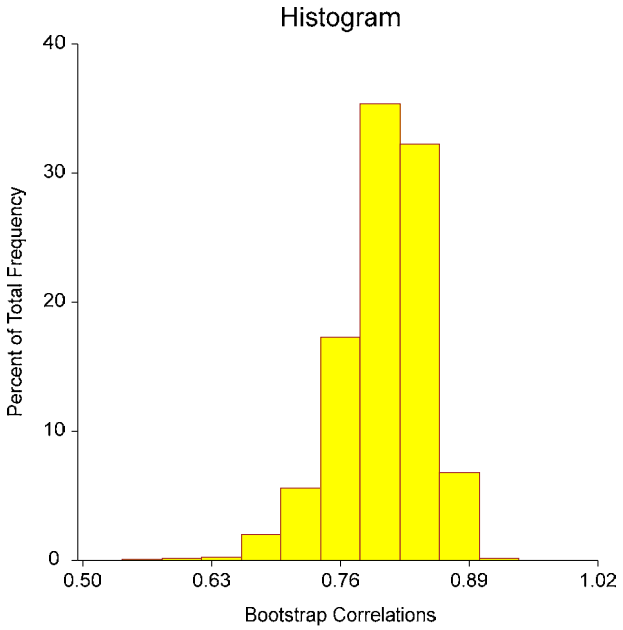
Linear Regression Report

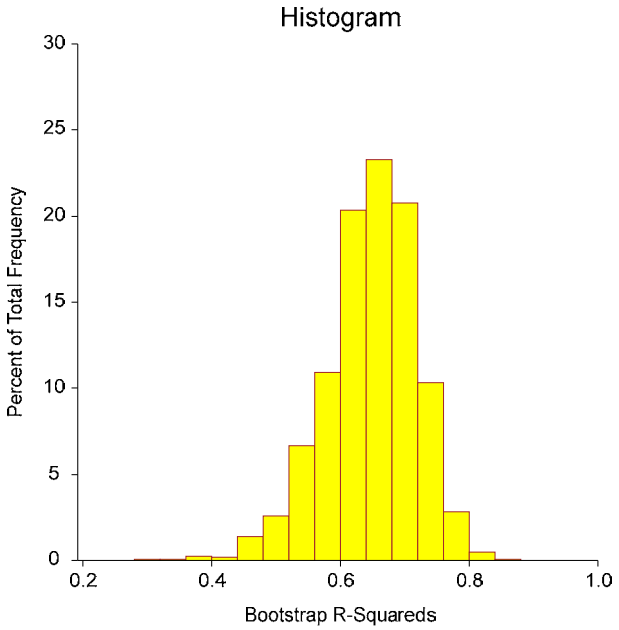
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Histograms Section



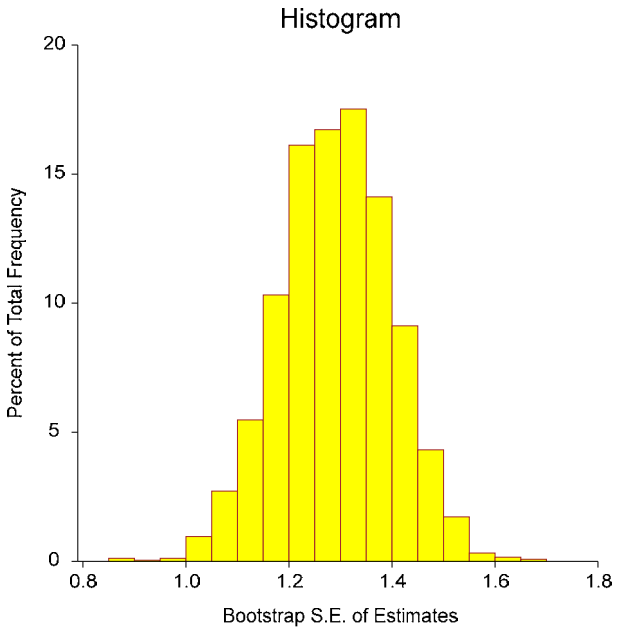


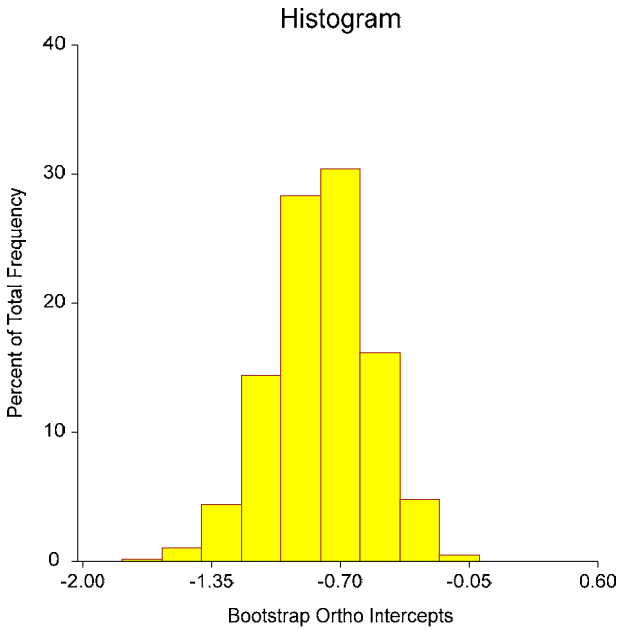


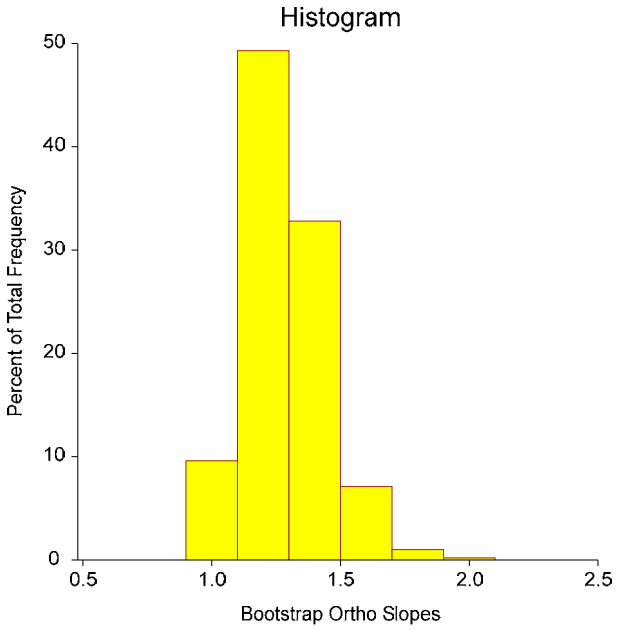


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8053	0.6484	0.8324
Lower 95% Conf. Limit (r dist'n)	0.6592		
Upper 95% Conf. Limit (r dist'n)	0.8885		
Lower 95% Conf. Limit (Fisher's z)	0.6638		0.7074
Upper 95% Conf. Limit (Fisher's z)	0.8911		0.9069
Adjusted (Rbar)		0.6397	
T-Value for H0: Rho = 0	8.5896	8.5896	9.4999
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	19.27681	19.27681			
Slope	1	128.817	128.817	73.7810	0.0000	1.0000
Error	40	69.8375	1.745938			
Lack of Fit	38	59.16567	1.556991	0.2918	0.9572	
Pure Error	2	10.67184	5.335918			
Adj. Total	41	198.6545	4.845232			
Total	42	217.9313				

s = Square Root(1.745938) = 1.321339

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	48.80563	28.45393	0.03369226	-0.008504649
1	48.80563	193.3498	165.7334	-0.008504649	0.00731873
2 (Y'Y)			217.9313		
Determinant		5738.701			0.0001742555

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.05882458	-0.01484859
1	-0.01484859	0.01277805

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9616	0.168753	No
Anderson Darling	0.6886	0.072183	No
D'Agostino Skewness	0.5444	0.586143	Yes
D'Agostino Kurtosis	-1.6285	0.103425	No
D'Agostino Omnibus	2.9483	0.228971	Yes
Constant Residual Variance?			
Modified Levene Test	0.0025	0.960226	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.2918	0.957181	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

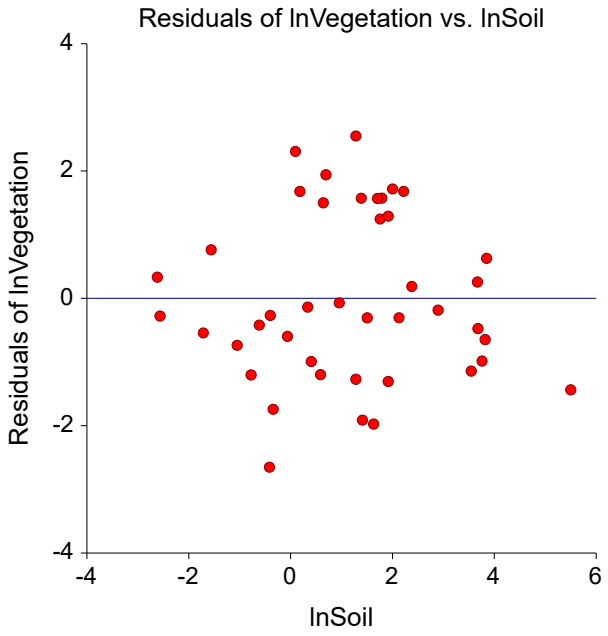
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

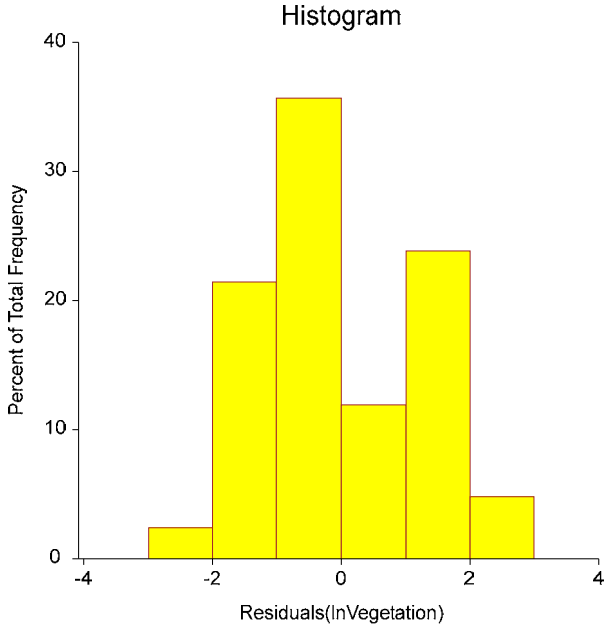
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

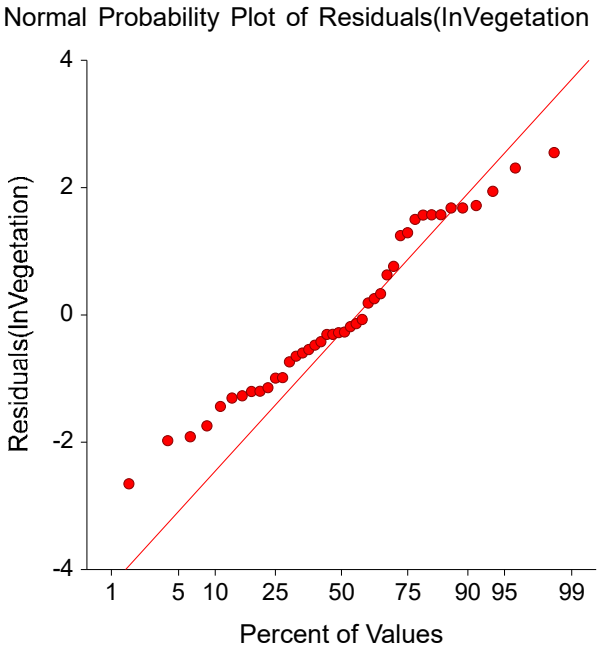
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Original Data Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual
10	5.5013	3.4532	4.8907	-1.4376
11	1.7918	2.8622	1.2889	1.5733
12	3.8480	3.9140	3.2855	0.6285
13	0.1823	1.4061	-0.2738	1.6799
14	3.6788	2.6462	3.1212	-0.4750
15	1.4110	-0.9943	0.9192	-1.9134
16	-0.3425	-2.5257	-0.7834	-1.7424
17	1.6292	-0.8440	1.1311	-1.9751
18	-1.0498	-2.2073	-1.4702	-0.7371
19	1.2809	-0.4780	0.7929	-1.2710
20	0.9555	0.4055	0.4769	-0.0715
21	-0.4155	-3.5066	-0.8543	-2.6523
22	3.8199	2.6101	3.2582	-0.6481
23	1.5041	0.7031	1.0096	-0.3065
24	1.7579	2.5014	1.2560	1.2454
25	1.9169	2.7014	1.4104	1.2909
26	2.2192	3.3844	1.7039	1.6804
27	2.0015	3.2108	1.4925	1.7183
28	2.3795	2.0464	1.8596	0.1868
29	1.2809	3.3429	0.7929	2.5499
30	2.8959	2.1759	2.3610	-0.1851
31	3.7589	2.2138	3.1989	-0.9852
32	0.6419	1.6734	0.1724	1.5010
33	1.3863	2.4681	0.8952	1.5729
34	-0.7765	-2.4079	-1.2048	-1.2031
35	0.4055	-1.0498	-0.0571	-0.9927
36	0.5878	-1.0788	0.1199	-1.1987
37	1.9169	0.1044	1.4104	-1.3061
38	0.3365	-0.2614	-0.1241	-0.1372
39	-0.4005	-1.1087	-0.8397	-0.2690
40	-0.0619	-1.1087	-0.5109	-0.5978
41	-1.7148	-2.6593	-2.1158	-0.5434
42	-1.5606	-1.2040	-1.9662	0.7622
43	-0.6162	-1.4697	-1.0491	-0.4206
44	-2.6173	-2.6593	-2.9921	0.3329
45	-2.5639	-3.2189	-2.9403	-0.2785
46	2.1282	1.3110	1.6156	-0.3046
47	0.6931	2.1633	0.2222	1.9411
48	0.0953	1.9488	-0.3583	2.3070
49	3.6687	3.3673	3.1113	0.2560
50	3.5467	1.8500	2.9929	-1.1429
51	1.7047	2.7726	1.2044	1.5682

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	5.5013	3.4532	4.8907	0.5312	3.8171	5.9643
11	1.7918	2.8622	1.2889	0.2160	0.8524	1.7254
12	3.8480	3.9140	3.2855	0.3657	2.5463	4.0246
13	0.1823	1.4061	-0.2738	0.2320	-0.7427	0.1951
14	3.6788	2.6462	3.1212	0.3500	2.4138	3.8286
15	1.4110	-0.9943	0.9192	0.2058	0.5032	1.3352
16	-0.3425	-2.5257	-0.7834	0.2655	-1.3200	-0.2468
17	1.6292	-0.8440	1.1311	0.2106	0.7054	1.5568
18	-1.0498	-2.2073	-1.4702	0.3226	-2.1222	-0.8181
19	1.2809	-0.4780	0.7929	0.2043	0.3800	1.2059
20	0.9555	0.4055	0.4769	0.2052	0.0622	0.8917
21	-0.4155	-3.5066	-0.8543	0.2709	-1.4017	-0.3068
22	3.8199	2.6101	3.2582	0.3631	2.5243	3.9920
23	1.5041	0.7031	1.0096	0.2075	0.5902	1.4290
24	1.7579	2.5014	1.2560	0.2147	0.8220	1.6900
25	1.9169	2.7014	1.4104	0.2210	0.9637	1.8571
26	2.2192	3.3844	1.7039	0.2363	1.2263	2.1816
27	2.0015	3.2108	1.4925	0.2249	1.0380	1.9471
28	2.3795	2.0464	1.8596	0.2460	1.3625	2.3568
29	1.2809	3.3429	0.7929	0.2043	0.3800	1.2059
30	2.8959	2.1759	2.3610	0.2828	1.7894	2.9326
31	3.7589	2.2138	3.1989	0.3574	2.4766	3.9213
32	0.6419	1.6734	0.1724	0.2122	-0.2565	0.6013
33	1.3863	2.4681	0.8952	0.2055	0.4800	1.3105
34	-0.7765	-2.4079	-1.2048	0.2993	-1.8098	-0.5999
35	0.4055	-1.0498	-0.0571	0.2211	-0.5040	0.3897
36	0.5878	-1.0788	0.1199	0.2140	-0.3126	0.5523
37	1.9169	0.1044	1.4104	0.2210	0.9637	1.8571
38	0.3365	-0.2614	-0.1241	0.2242	-0.5773	0.3291
39	-0.4005	-1.1087	-0.8397	0.2698	-1.3849	-0.2945
40	-0.0619	-1.1087	-0.5109	0.2464	-1.0089	-0.0129
41	-1.7148	-2.6593	-2.1158	0.3838	-2.8916	-1.3401
42	-1.5606	-1.2040	-1.9662	0.3692	-2.7123	-1.2200
43	-0.6162	-1.4697	-1.0491	0.2863	-1.6278	-0.4705
44	-2.6173	-2.6593	-2.9921	0.4734	-3.9489	-2.0354
45	-2.5639	-3.2189	-2.9403	0.4679	-3.8861	-1.9946
46	2.1282	1.3110	1.6156	0.2313	1.1481	2.0831
47	0.6931	2.1633	0.2222	0.2107	-0.2036	0.6480
48	0.0953	1.9488	-0.3583	0.2369	-0.8370	0.1205
49	3.6687	3.3673	3.1113	0.3491	2.4058	3.8169
50	3.5467	1.8500	2.9929	0.3380	2.3098	3.6760
51	1.7047	2.7726	1.2044	0.2129	0.7741	1.6347

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	5.5013	3.4532	4.8907	1.4241	2.0125	7.7690
11	1.7918	2.8622	1.2889	1.3389	-1.4170	3.9949
12	3.8480	3.9140	3.2855	1.3710	0.5145	6.0564
13	0.1823	1.4061	-0.2738	1.3416	-2.9852	2.4376
14	3.6788	2.6462	3.1212	1.3669	0.3586	5.8838
15	1.4110	-0.9943	0.9192	1.3373	-1.7835	3.6219
16	-0.3425	-2.5257	-0.7834	1.3478	-3.5073	1.9405
17	1.6292	-0.8440	1.1311	1.3380	-1.5731	3.8354
18	-1.0498	-2.2073	-1.4702	1.3602	-4.2191	1.2788
19	1.2809	-0.4780	0.7929	1.3370	-1.9094	3.4952
20	0.9555	0.4055	0.4769	1.3372	-2.2256	3.1795
21	-0.4155	-3.5066	-0.8543	1.3488	-3.5803	1.8718
22	3.8199	2.6101	3.2582	1.3703	0.4887	6.0277
23	1.5041	0.7031	1.0096	1.3375	-1.6937	3.7128
24	1.7579	2.5014	1.2560	1.3387	-1.4496	3.9616
25	1.9169	2.7014	1.4104	1.3397	-1.2972	4.1181
26	2.2192	3.3844	1.7039	1.3423	-1.0090	4.4169
27	2.0015	3.2108	1.4925	1.3403	-1.2164	4.2015
28	2.3795	2.0464	1.8596	1.3440	-0.8568	4.5760
29	1.2809	3.3429	0.7929	1.3370	-1.9094	3.4952
30	2.8959	2.1759	2.3610	1.3513	-0.3700	5.0920
31	3.7589	2.2138	3.1989	1.3688	0.4324	5.9654
32	0.6419	1.6734	0.1724	1.3383	-2.5324	2.8771
33	1.3863	2.4681	0.8952	1.3372	-1.8074	3.5978
34	-0.7765	-2.4079	-1.2048	1.3548	-3.9430	1.5334
35	0.4055	-1.0498	-0.0571	1.3397	-2.7648	2.6505
36	0.5878	-1.0788	0.1199	1.3386	-2.5854	2.8252
37	1.9169	0.1044	1.4104	1.3397	-1.2972	4.1181
38	0.3365	-0.2614	-0.1241	1.3402	-2.8328	2.5846
39	-0.4005	-1.1087	-0.8397	1.3486	-3.5653	1.8859
40	-0.0619	-1.1087	-0.5109	1.3441	-3.2275	2.2057
41	-1.7148	-2.6593	-2.1158	1.3760	-4.8968	0.6651
42	-1.5606	-1.2040	-1.9662	1.3719	-4.7390	0.8066
43	-0.6162	-1.4697	-1.0491	1.3520	-3.7816	1.6834
44	-2.6173	-2.6593	-2.9921	1.4036	-5.8289	-0.1554
45	-2.5639	-3.2189	-2.9403	1.4018	-5.7734	-0.1073
46	2.1282	1.3110	1.6156	1.3414	-1.0955	4.3267
47	0.6931	2.1633	0.2222	1.3380	-2.4821	2.9265
48	0.0953	1.9488	-0.3583	1.3424	-3.0714	2.3548
49	3.6687	3.3673	3.1113	1.3667	0.3492	5.8735
50	3.5467	1.8500	2.9929	1.3639	0.2364	5.7494
51	1.7047	2.7726	1.2044	1.3384	-1.5005	3.9094

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	5.5013	3.4532	4.8907	0.5312	3.3787	6.4027
11	1.7918	2.8622	1.2889	0.2160	0.6742	1.9036
12	3.8480	3.9140	3.2855	0.3657	2.2445	4.3265
13	0.1823	1.4061	-0.2738	0.2320	-0.9342	0.3866
14	3.6788	2.6462	3.1212	0.3500	2.1249	4.1175
15	1.4110	-0.9943	0.9192	0.2058	0.3333	1.5050
16	-0.3425	-2.5257	-0.7834	0.2655	-1.5391	-0.0276
17	1.6292	-0.8440	1.1311	0.2106	0.5316	1.7306
18	-1.0498	-2.2073	-1.4702	0.3226	-2.3885	-0.5519
19	1.2809	-0.4780	0.7929	0.2043	0.2113	1.3745
20	0.9555	0.4055	0.4769	0.2052	-0.1072	1.0611
21	-0.4155	-3.5066	-0.8543	0.2709	-1.6253	-0.0833
22	3.8199	2.6101	3.2582	0.3631	2.2247	4.2917
23	1.5041	0.7031	1.0096	0.2075	0.4189	1.6003
24	1.7579	2.5014	1.2560	0.2147	0.6448	1.8672
25	1.9169	2.7014	1.4104	0.2210	0.7813	2.0396
26	2.2192	3.3844	1.7039	0.2363	1.0313	2.3766
27	2.0015	3.2108	1.4925	0.2249	0.8524	2.1327
28	2.3795	2.0464	1.8596	0.2460	1.1594	2.5598
29	1.2809	3.3429	0.7929	0.2043	0.2113	1.3745
30	2.8959	2.1759	2.3610	0.2828	1.5560	3.1660
31	3.7589	2.2138	3.1989	0.3574	2.1816	4.2162
32	0.6419	1.6734	0.1724	0.2122	-0.4316	0.7764
33	1.3863	2.4681	0.8952	0.2055	0.3104	1.4800
34	-0.7765	-2.4079	-1.2048	0.2993	-2.0568	-0.3528
35	0.4055	-1.0498	-0.0571	0.2211	-0.6865	0.5722
36	0.5878	-1.0788	0.1199	0.2140	-0.4892	0.7289
37	1.9169	0.1044	1.4104	0.2210	0.7813	2.0396
38	0.3365	-0.2614	-0.1241	0.2242	-0.7624	0.5141
39	-0.4005	-1.1087	-0.8397	0.2698	-1.6075	-0.0719
40	-0.0619	-1.1087	-0.5109	0.2464	-1.2122	0.1904
41	-1.7148	-2.6593	-2.1158	0.3838	-3.2084	-1.0233
42	-1.5606	-1.2040	-1.9662	0.3692	-3.0170	-0.9153
43	-0.6162	-1.4697	-1.0491	0.2863	-1.8641	-0.2342
44	-2.6173	-2.6593	-2.9921	0.4734	-4.3395	-1.6447
45	-2.5639	-3.2189	-2.9403	0.4679	-4.2723	-1.6084
46	2.1282	1.3110	1.6156	0.2313	0.9573	2.2740
47	0.6931	2.1633	0.2222	0.2107	-0.3774	0.8218
48	0.0953	1.9488	-0.3583	0.2369	-1.0325	0.3160
49	3.6687	3.3673	3.1113	0.3491	2.1177	4.1050
50	3.5467	1.8500	2.9929	0.3380	2.0309	3.9550
51	1.7047	2.7726	1.2044	0.2129	0.5984	1.8105

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	5.5013	3.4532	4.8907	-1.4376	-1.1882	41.6302
11	1.7918	2.8622	1.2889	1.5733	1.2069	54.9678
12	3.8480	3.9140	3.2855	0.6285	0.4950	16.0589
13	0.1823	1.4061	-0.2738	1.6799	1.2914	119.4722
14	3.6788	2.6462	3.1212	-0.4750	-0.3728	17.9512
15	1.4110	-0.9943	0.9192	-1.9134	-1.4660	192.4509
16	-0.3425	-2.5257	-0.7834	-1.7424	-1.3461	68.9843
17	1.6292	-0.8440	1.1311	-1.9751	-1.5141	234.0227
18	-1.0498	-2.2073	-1.4702	-0.7371	-0.5753	33.3944
19	1.2809	-0.4780	0.7929	-1.2710	-0.9736	265.8699
20	0.9555	0.4055	0.4769	-0.0715	-0.0548	17.6287
21	-0.4155	-3.5066	-0.8543	-2.6523	-2.0508	75.6377
22	3.8199	2.6101	3.2582	-0.6481	-0.5101	24.8310
23	1.5041	0.7031	1.0096	-0.3065	-0.2349	43.5907
24	1.7579	2.5014	1.2560	1.2454	0.9553	49.7890
25	1.9169	2.7014	1.4104	1.2909	0.9909	47.7877
26	2.2192	3.3844	1.7039	1.6804	1.2926	49.6528
27	2.0015	3.2108	1.4925	1.7183	1.3197	53.5155
28	2.3795	2.0464	1.8596	0.1868	0.1439	9.1266
29	1.2809	3.3429	0.7929	2.5499	1.9533	76.2803
30	2.8959	2.1759	2.3610	-0.1851	-0.1434	8.5078
31	3.7589	2.2138	3.1989	-0.9852	-0.7744	44.5018
32	0.6419	1.6734	0.1724	1.5010	1.1509	89.6978
33	1.3863	2.4681	0.8952	1.5729	1.2050	63.7284
34	-0.7765	-2.4079	-1.2048	-1.2031	-0.9348	49.9652
35	0.4055	-1.0498	-0.0571	-0.9927	-0.7620	94.5578
36	0.5878	-1.0788	0.1199	-1.1987	-0.9193	111.1136
37	1.9169	0.1044	1.4104	-1.3061	-1.0026	1251.5154
38	0.3365	-0.2614	-0.1241	-0.1372	-0.1054	52.5095
39	-0.4005	-1.1087	-0.8397	-0.2690	-0.2079	24.2621
40	-0.0619	-1.1087	-0.5109	-0.5978	-0.4605	53.9169
41	-1.7148	-2.6593	-2.1158	-0.5434	-0.4298	20.4350
42	-1.5606	-1.2040	-1.9662	0.7622	0.6008	63.3064
43	-0.6162	-1.4697	-1.0491	-0.4206	-0.3260	28.6153
44	-2.6173	-2.6593	-2.9921	0.3329	0.2698	12.5176
45	-2.5639	-3.2189	-2.9403	-0.2785	-0.2254	8.6533
46	2.1282	1.3110	1.6156	-0.3046	-0.2341	23.2324
47	0.6931	2.1633	0.2222	1.9411	1.4881	89.7289
48	0.0953	1.9488	-0.3583	2.3070	1.7747	118.3852
49	3.6687	3.3673	3.1113	0.2560	0.2008	7.6013
50	3.5467	1.8500	2.9929	-1.1429	-0.8947	61.7781
51	1.7047	2.7726	1.2044	1.5682	1.2025	56.5595

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	5.5013	-1.4376	*-1.1945	0.1616	0.1361	1.7275
11	1.7918	1.5733	1.2140	0.0267	0.0200	1.7255
12	3.8480	0.6285	0.4903	0.0766	0.0102	1.7797
13	0.1823	1.6799	1.3026	0.0308	0.0265	1.7160
14	3.6788	-0.4750	-0.3688	0.0702	0.0052	1.7845
15	1.4110	-1.9134	-1.4881	0.0243	0.0267	1.6945
16	-0.3425	-1.7424	-1.3603	0.0404	0.0381	1.7096
17	1.6292	-1.9751	-1.5398	0.0254	0.0299	1.6881
18	-1.0498	-0.7371	-0.5704	0.0596	0.0105	1.7759
19	1.2809	-1.2710	-0.9729	0.0239	0.0116	1.7483
20	0.9555	-0.0715	-0.0541	0.0241	0.0000	1.7906
21	-0.4155	-2.6523	*-2.1407	0.0420	0.0922	1.6024
22	3.8199	-0.6481	-0.5054	0.0755	0.0106	1.7791
23	1.5041	-0.3065	-0.2321	0.0247	0.0007	1.7882
24	1.7579	1.2454	0.9542	0.0264	0.0124	1.7499
25	1.9169	1.2909	0.9907	0.0280	0.0141	1.7467
26	2.2192	1.6804	1.3039	0.0320	0.0276	1.7159
27	2.0015	1.7183	1.3324	0.0290	0.0260	1.7127
28	2.3795	0.1868	0.1421	0.0347	0.0004	1.7898
29	1.2809	2.5499	*2.0279	0.0239	0.0467	1.6199
30	2.8959	-0.1851	-0.1417	0.0458	0.0005	1.7898
31	3.7589	-0.9852	-0.7705	0.0732	0.0237	1.7639
32	0.6419	1.5010	1.1557	0.0258	0.0175	1.7314
33	1.3863	1.5729	1.2121	0.0242	0.0180	1.7257
34	-0.7765	-1.2031	-0.9333	0.0513	0.0236	1.7516
35	0.4055	-0.9927	-0.7580	0.0280	0.0084	1.7647
36	0.5878	-1.1987	-0.9175	0.0262	0.0114	1.7529
37	1.9169	-1.3061	-1.0026	0.0280	0.0145	1.7457
38	0.3365	-0.1372	-0.1041	0.0288	0.0002	1.7902
39	-0.4005	-0.2690	-0.2054	0.0417	0.0009	1.7888
40	-0.0619	-0.5978	-0.4559	0.0348	0.0038	1.7812
41	-1.7148	-0.5434	-0.4254	0.0844	0.0085	1.7824
42	-1.5606	0.7622	0.5959	0.0781	0.0153	1.7745
43	-0.6162	-0.4206	-0.3224	0.0470	0.0026	1.7859
44	-2.6173	0.3329	*0.2667	0.1283	0.0054	1.7874
45	-2.5639	-0.2785	*-0.2227	0.1254	0.0036	1.7884
46	2.1282	-0.3046	-0.2313	0.0306	0.0009	1.7883
47	0.6931	1.9411	1.5118	0.0254	0.0289	1.6916
48	0.0953	2.3070	1.8258	0.0321	0.0523	1.6497
49	3.6687	0.2560	0.1984	0.0698	0.0015	1.7889
50	3.5467	-1.1429	-0.8925	0.0654	0.0280	1.7549
51	1.7047	1.5682	1.2094	0.0260	0.0193	1.7260

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-1.1945	-0.5245	0.1361	* 1.1677	0.0931	-0.4843
11	1.2140	0.2011	0.0200	1.0035	0.1237	0.0663
12	0.4903	0.1412	0.0102	1.1253	0.0027	0.1172
13	1.3026	0.2323	0.0265	0.9968	0.2317	-0.1109
14	-0.3688	-0.1013	0.0052	1.1235	-0.0050	-0.0823
15	-1.4881	-0.2347	0.0267	0.9654	-0.1780	-0.0321
16	-1.3603	-0.2790	0.0381	0.9991	-0.2769	0.1787
17	-1.5398	-0.2486	0.0299	0.9592	-0.1686	-0.0623
18	-0.5704	-0.1436	0.0105	1.1002	-0.1366	0.1113
19	-0.9729	-0.1523	0.0116	1.0272	-0.1223	-0.0100
20	-0.0541	-0.0085	0.0000	1.0778	-0.0076	0.0010
21	* -2.1407	-0.4484	0.0922	0.8793	-0.4436	0.2952
22	-0.5054	-0.1444	0.0106	1.1231	-0.0035	-0.1195
23	-0.2321	-0.0369	0.0007	1.0756	-0.0268	-0.0069
24	0.9542	0.1571	0.0124	1.0317	0.0987	0.0493
25	0.9907	0.1681	0.0141	1.0297	0.0952	0.0649
26	1.3039	0.2370	0.0276	0.9978	0.1070	0.1199
27	1.3324	0.2301	0.0260	0.9910	0.1228	0.0971
28	0.1421	0.0269	0.0004	1.0886	0.0106	0.0151
29	* 2.0279	0.3174	0.0467	0.8819	0.2549	0.0209
30	-0.1417	-0.0310	0.0005	1.1013	-0.0072	-0.0215
31	-0.7705	-0.2165	0.0237	1.1012	-0.0075	-0.1778
32	1.1557	0.1880	0.0175	1.0095	0.1801	-0.0521
33	1.2121	0.1908	0.0180	1.0012	0.1464	0.0235
34	-0.9333	-0.2171	0.0236	1.0609	-0.2104	0.1589
35	-0.7580	-0.1286	0.0084	1.0510	-0.1267	0.0498
36	-0.9175	-0.1506	0.0114	1.0351	-0.1453	0.0457
37	-1.0026	-0.1701	0.0145	1.0285	-0.0963	-0.0657
38	-0.1041	-0.0179	0.0002	1.0825	-0.0177	0.0075
39	-0.2054	-0.0428	0.0009	1.0953	-0.0424	0.0281
40	-0.4559	-0.0865	0.0038	1.0783	-0.0865	0.0486
41	-0.4254	-0.1291	0.0085	1.1383	-0.1169	0.1094
42	0.5959	0.1734	0.0153	1.1205	0.1588	-0.1446
43	-0.3224	-0.0715	0.0026	1.0979	-0.0700	0.0502
44	0.2667	0.1023	0.0054	* 1.2024	0.0871	-0.0924
45	-0.2227	-0.0843	0.0036	* 1.1997	-0.0720	0.0759
46	-0.2313	-0.0411	0.0009	1.0822	-0.0200	-0.0194
47	1.5118	0.2442	0.0289	0.9632	0.2319	-0.0614
48	1.8258	0.3327	0.0523	0.9224	0.3325	-0.1694
49	0.1984	0.0544	0.0015	1.1286	0.0028	0.0441
50	-0.8925	-0.2361	0.0280	1.0810	-0.0177	-0.1883
51	1.2094	0.1975	0.0193	1.0033	0.1281	0.0569

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
10	5.5013	-1.4376	|||||||.....	-1.1882	|||||||.....	-1.1945	|||||||.....
11	1.7918	1.5733	|||||||.....	1.2069	|||||||.....	1.2140	|||||||.....
12	3.8480	0.6285	|||.....	0.4950	|||.....	0.4903	|||.....
13	0.1823	1.6799	||||||||.....	1.2914	|||||||.....	1.3026	|||||||.....
14	3.6788	-0.4750	||.....	-0.3728	||.....	-0.3688	||.....
15	1.4110	-1.9134	|||||||||.....	-1.4660	|||||||||.....	-1.4881	|||||||||.....
16	-0.3425	-1.7424	||||||||.....	-1.3461	||||||||.....	-1.3603	||||||||.....
17	1.6292	-1.9751	|||||||||....	-1.5141	|||||||||.....	-1.5398	|||||||||.....
18	-1.0498	-0.7371	|||.....	-0.5753	|||.....	-0.5704	|||.....
19	1.2809	-1.2710	||||||.....	-0.9736	||||||.....	-0.9729	||||||.....
20	0.9555	-0.0715	|.....	-0.0548	|.....	-0.0541	|.....
21	-0.4155	-2.6523	||||||||||||||	-2.0508	||||||||||||||	* -2.1407	||||||||||||||
22	3.8199	-0.6481	|||.....	-0.5101	|||.....	-0.5054	|||.....
23	1.5041	-0.3065	|.....	-0.2349	|.....	-0.2321	|.....
24	1.7579	1.2454	||||||.....	0.9553	||||||.....	0.9542	||||||.....
25	1.9169	1.2909	|||||||.....	0.9909	|||||||.....	0.9907	||||||.....
26	2.2192	1.6804	||||||||.....	1.2926	|||||||.....	1.3039	|||||||.....
27	2.0015	1.7183	||||||||.....	1.3197	|||||||.....	1.3324	|||||||.....
28	2.3795	0.1868	|.....	0.1439	|.....	0.1421	|.....
29	1.2809	2.5499	|||||||||||||.	1.9533	|||||||||||||.	* 2.0279	|||||||||||||.
30	2.8959	-0.1851	|.....	-0.1434	|.....	-0.1417	|.....
31	3.7589	-0.9852	|||||.....	-0.7744	|||||.....	-0.7705	|||||.....
32	0.6419	1.5010	|||||||.....	1.1509	|||||||.....	1.1557	|||||||.....
33	1.3863	1.5729	|||||||.....	1.2050	|||||||.....	1.2121	|||||||.....
34	-0.7765	-1.2031	||||||.....	-0.9348	||||||.....	-0.9333	||||||.....
35	0.4055	-0.9927	|||||.....	-0.7620	|||||.....	-0.7580	|||||.....
36	0.5878	-1.1987	||||||.....	-0.9193	||||||.....	-0.9175	||||||.....
37	1.9169	-1.3061	|||||||.....	-1.0026	|||||||.....	-1.0026	||||||.....
38	0.3365	-0.1372	|.....	-0.1054	|.....	-0.1041	|.....
39	-0.4005	-0.2690	|.....	-0.2079	|.....	-0.2054	|.....
40	-0.0619	-0.5978	|||.....	-0.4605	|||.....	-0.4559	||.....
41	-1.7148	-0.5434	||.....	-0.4298	||.....	-0.4254	||.....
42	-1.5606	0.7622	||||.....	0.6008	||||.....	0.5959	|||.....
43	-0.6162	-0.4206	||.....	-0.3260	||.....	-0.3224	|.....
44	-2.6173	0.3329	|.....	0.2698	|.....	0.2667	|.....
45	-2.5639	-0.2785	|.....	-0.2254	|.....	-0.2227	|.....
46	2.1282	-0.3046	|.....	-0.2341	|.....	-0.2313	|.....
47	0.6931	1.9411	|||||||||.....	1.4881	|||||||||.....	1.5118	|||||||||.....
48	0.0953	2.3070	||||||||||...	1.7747	||||||||||...	1.8258	||||||||||...
49	3.6687	0.2560	|.....	0.2008	|.....	0.1984	|.....
50	3.5467	-1.1429	||||||.....	-0.8947	||||||.....	-0.8925	||||||.....
51	1.7047	1.5682	|||||||.....	1.2025	|||||||.....	1.2094	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	5.5013	-0.5245	|||||||||||||||	0.1361	|||||||||||||||	-0.4843	|||||||||||||||
11	1.7918	0.2011	|||||.....	0.0200	||.....	0.0663	||.....
12	3.8480	0.1412	|||.....	0.0102	|.....	0.1172	|||.....
13	0.1823	0.2323	||||||.....	0.0265	||.....	-0.1109	|||.....
14	3.6788	-0.1013	||.....	0.0052	|.....	-0.0823	||.....
15	1.4110	-0.2347	||||||.....	0.0267	||.....	-0.0321	|.....
16	-0.3425	-0.2790	|||||||.....	0.0381	||||.....	0.1787	|||||.....
17	1.6292	-0.2486	||||||.....	0.0299	|||.....	-0.0623	|.....
18	-1.0498	-0.1436	|||.....	0.0105	|.....	0.1113	|||.....
19	1.2809	-0.1523	||||.....	0.0116	|.....	-0.0100	|.....
20	0.9555	-0.0085	|.....	0.0000	|.....	0.0010	|.....
21	-0.4155	-0.4484	||||||||||...	0.0922	|||||||||.....	0.2952	|||||||||.....
22	3.8199	-0.1444	|||.....	0.0106	|.....	-0.1195	|||.....
23	1.5041	-0.0369	|.....	0.0007	|.....	-0.0069	|.....
24	1.7579	0.1571	||||.....	0.0124	|.....	0.0493	|.....
25	1.9169	0.1681	||||.....	0.0141	|.....	0.0649	|.....
26	2.2192	0.2370	||||||.....	0.0276	|||.....	0.1199	|||.....
27	2.0015	0.2301	||||||.....	0.0260	||.....	0.0971	||.....
28	2.3795	0.0269	|.....	0.0004	|.....	0.0151	|.....
29	1.2809	0.3174	||||||||.....	0.0467	|||||.....	0.0209	|.....
30	2.8959	-0.0310	|.....	0.0005	|.....	-0.0215	|.....
31	3.7589	-0.2165	||||||.....	0.0237	||.....	-0.1778	|||||.....
32	0.6419	0.1880	|||||.....	0.0175	|.....	-0.0521	|.....
33	1.3863	0.1908	|||||.....	0.0180	|.....	0.0235	|.....
34	-0.7765	-0.2171	||||||.....	0.0236	||.....	0.1589	||||.....
35	0.4055	-0.1286	|||.....	0.0084	|.....	0.0498	|.....
36	0.5878	-0.1506	||||.....	0.0114	|.....	0.0457	|.....
37	1.9169	-0.1701	||||.....	0.0145	|.....	-0.0657	||.....
38	0.3365	-0.0179	|.....	0.0002	|.....	0.0075	|.....
39	-0.4005	-0.0428	|.....	0.0009	|.....	0.0281	|.....
40	-0.0619	-0.0865	||.....	0.0038	|.....	0.0486	|.....
41	-1.7148	-0.1291	|||.....	0.0085	|.....	0.1094	|||.....
42	-1.5606	0.1734	||||.....	0.0153	|.....	-0.1446	||||.....
43	-0.6162	-0.0715	|.....	0.0026	|.....	0.0502	|.....
44	-2.6173	0.1023	||.....	0.0054	|.....	-0.0924	||.....
45	-2.5639	-0.0843	||.....	0.0036	|.....	0.0759	||.....
46	2.1282	-0.0411	|.....	0.0009	|.....	-0.0194	|.....
47	0.6931	0.2442	||||||.....	0.0289	|||.....	-0.0614	|.....
48	0.0953	0.3327	|||||||||.....	0.0523	|||||.....	-0.1694	|||||.....
49	3.6687	0.0544	|.....	0.0015	|.....	0.0441	|.....
50	3.5467	-0.2361	||||||.....	0.0280	|||.....	-0.1883	|||||.....
51	1.7047	0.1975	|||||.....	0.0193	||.....	0.0569	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	5.5013	-1.1945	||||||||.....	0.1361	||||||||||||||	0.1616	||||||||||||||
11	1.7918	1.2140	||||||||.....	0.0200	||.....	0.0267	|.....
12	3.8480	0.4903	|||.....	0.0102	|.....	0.0766	|||||.....
13	0.1823	1.3026	||||||||.....	0.0265	||.....	0.0308	|.....
14	3.6788	-0.3688	||.....	0.0052	|.....	0.0702	|||||.....
15	1.4110	-1.4881	|||||||||.....	0.0267	||.....	0.0243	|.....
16	-0.3425	-1.3603	||||||||.....	0.0381	||||.....	0.0404	|.....
17	1.6292	-1.5398	|||||||||.....	0.0299	|||.....	0.0254	|.....
18	-1.0498	-0.5704	|||.....	0.0105	|.....	0.0596	|||.....
19	1.2809	-0.9729	||||||.....	0.0116	|.....	0.0239	|.....
20	0.9555	-0.0541	|.....	0.0000	|.....	0.0241	|.....
21	-0.4155	* -2.1407	|||||||||||||||	0.0922	|||||||||.....	0.0420	|.....
22	3.8199	-0.5054	|||.....	0.0106	|.....	0.0755	|||||.....
23	1.5041	-0.2321	|.....	0.0007	|.....	0.0247	|.....
24	1.7579	0.9542	||||||.....	0.0124	|.....	0.0264	|.....
25	1.9169	0.9907	||||||.....	0.0141	|.....	0.0280	|.....
26	2.2192	1.3039	||||||||.....	0.0276	|||.....	0.0320	|.....
27	2.0015	1.3324	||||||||.....	0.0260	||.....	0.0290	|.....
28	2.3795	0.1421	|.....	0.0004	|.....	0.0347	|.....
29	1.2809	* 2.0279	||||||||||||||.	0.0467	|||||.....	0.0239	|.....
30	2.8959	-0.1417	|.....	0.0005	|.....	0.0458	||.....
31	3.7589	-0.7705	|||||.....	0.0237	||.....	0.0732	|||||.....
32	0.6419	1.1557	|||||||.....	0.0175	|.....	0.0258	|.....
33	1.3863	1.2121	||||||||.....	0.0180	|.....	0.0242	|.....
34	-0.7765	-0.9333	||||||.....	0.0236	||.....	0.0513	||.....
35	0.4055	-0.7580	|||||.....	0.0084	|.....	0.0280	|.....
36	0.5878	-0.9175	||||||.....	0.0114	|.....	0.0262	|.....
37	1.9169	-1.0026	||||||.....	0.0145	|.....	0.0280	|.....
38	0.3365	-0.1041	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.2054	|.....	0.0009	|.....	0.0417	|.....
40	-0.0619	-0.4559	||.....	0.0038	|.....	0.0348	|.....
41	-1.7148	-0.4254	||.....	0.0085	|.....	0.0844	||||||.....
42	-1.5606	0.5959	|||.....	0.0153	|.....	0.0781	|||||.....
43	-0.6162	-0.3224	|.....	0.0026	|.....	0.0470	||.....
44	-2.6173	0.2667	|.....	0.0054	|.....	0.1283	||||||||||....
45	-2.5639	-0.2227	|.....	0.0036	|.....	0.1254	||||||||||....
46	2.1282	-0.2313	|.....	0.0009	|.....	0.0306	|.....
47	0.6931	1.5118	|||||||||.....	0.0289	|||.....	0.0254	|.....
48	0.0953	1.8258	||||||||||...	0.0523	|||||.....	0.0321	|.....
49	3.6687	0.1984	|.....	0.0015	|.....	0.0698	||||.....
50	3.5467	-0.8925	||||||.....	0.0280	|||.....	0.0654	||||.....
51	1.7047	1.2094	||||||||.....	0.0193	||.....	0.0260	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Means

Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.4532	5.5013	4.0207	1.4805	3.3530	5.0235
11	2.8622	1.7918	3.4121	-1.6203	2.8335	4.2544
12	3.9140	3.8480	4.4954	-0.6473	3.7526	5.6288
13	1.4061	0.1823	1.9124	-1.7301	1.4815	2.4314
14	2.6462	3.6788	3.1896	0.4892	2.6408	3.9761
15	-0.9943	1.4110	-0.5597	1.9707	-1.2726	-0.0486
16	-2.5257	-0.3425	-2.1369	1.7945	-3.2608	-1.3998
17	-0.8440	1.6292	-0.4049	2.0341	-1.0824	0.0889
18	-2.2073	-1.0498	-1.8090	0.7591	-2.8423	-1.1238
19	-0.4780	1.2809	-0.0280	1.3090	-0.6255	0.4300
20	0.4055	0.9555	0.8819	0.0736	0.4233	1.3077
21	-3.5066	-0.4155	-3.1471	2.7316	-4.5584	-2.2409
22	2.6101	3.8199	3.1524	0.6675	2.6084	3.9297
23	0.7031	1.5041	1.1884	0.3156	0.7533	1.6267
24	2.5014	1.7579	3.0405	-1.2827	2.5106	3.7906
25	2.7014	1.9169	3.2464	-1.3295	2.6902	4.0470
26	3.3844	2.2192	3.9499	-1.7307	3.2930	4.9336
27	3.2108	2.0015	3.7712	-1.7697	3.1411	4.7070
28	2.0464	2.3795	2.5719	-0.1924	2.0942	3.2149
29	3.3429	1.2809	3.9071	-2.6262	3.2567	4.8793
30	2.1759	2.8959	2.7053	0.1907	2.2140	3.3774
31	2.2138	3.7589	2.7443	1.0146	2.2488	3.4252
32	1.6734	0.6419	2.1877	-1.5458	1.7419	2.7537
33	2.4681	1.3863	3.0062	-1.6199	2.4805	3.7481
34	-2.4079	-0.7765	-2.0156	1.2391	-3.1058	-1.2979
35	-1.0498	0.4055	-0.6169	1.0224	-1.3433	-0.0991
36	-1.0788	0.5878	-0.6468	1.2345	-1.3802	-0.1254
37	0.1044	1.9169	0.5718	1.3451	0.0765	0.9979
38	-0.2614	0.3365	0.1951	0.1413	-0.3602	0.6371
39	-1.1087	-0.4005	-0.6775	0.2770	-1.4183	-0.1524
40	-1.1087	-0.0619	-0.6775	0.6156	-1.4183	-0.1524
41	-2.6593	-1.7148	-2.2745	0.5597	-3.4368	-1.5150
42	-1.2040	-1.5606	-0.7757	-0.7850	-1.5401	-0.2384
43	-1.4697	-0.6162	-1.0493	0.4331	-1.8818	-0.4760
44	-2.6593	-2.6173	-2.2745	-0.3428	-3.4368	-1.5150
45	-3.2189	-2.5639	-2.8508	0.2869	-4.1768	-1.9952
46	1.3110	2.1282	1.8145	0.3137	1.3869	2.3187
47	2.1633	0.6931	2.6923	-1.9992	2.2024	3.3616
48	1.9488	0.0953	2.4713	-2.3760	2.0031	3.0931
49	3.3673	3.6687	3.9323	-0.2636	3.2781	4.9112
50	1.8500	3.5467	2.3697	1.1771	1.9102	2.9707
51	2.7726	1.7047	3.3198	-1.6151	2.7538	4.1387

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Individuals

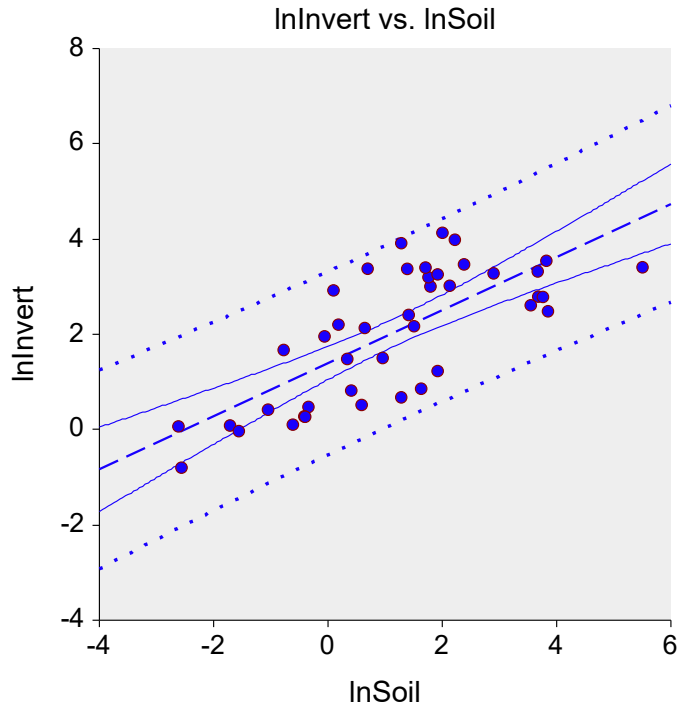
Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.4532	5.5013	4.0207	1.4805	1.2377	7.1388
11	2.8622	1.7918	3.4121	-1.6203	0.6263	6.4616
12	3.9140	3.8480	4.4954	-0.6473	1.7095	7.6720
13	1.4061	0.1823	1.9124	-1.7301	-0.9130	4.8258
14	2.6462	3.6788	3.1896	0.4892	0.4009	6.2160
15	-0.9943	1.4110	-0.5597	1.9707	-3.5558	2.2347
16	-2.5257	-0.3425	-2.1369	1.7945	-5.3092	0.6486
17	-0.8440	1.6292	-0.4049	2.0341	-3.3865	2.3931
18	-2.2073	-1.0498	-1.8090	0.7591	-4.9405	0.9743
19	-0.4780	1.2809	-0.0280	1.3090	-2.9764	2.7809
20	0.4055	0.9555	0.8819	0.0736	-1.9987	3.7296
21	-3.5066	-0.4155	-3.1471	2.7316	-6.4575	-0.3418
22	2.6101	3.8199	3.1524	0.6675	0.3632	6.1750
23	0.7031	1.5041	1.1884	0.3156	-1.6734	4.0533
24	2.5014	1.7579	3.0405	-1.2827	0.2493	6.0519
25	2.7014	1.9169	3.2464	-1.3295	0.4586	6.2786
26	3.3844	2.2192	3.9499	-1.7307	1.1670	7.0596
27	3.2108	2.0015	3.7712	-1.7697	0.9879	6.8602
28	2.0464	2.3795	2.5719	-0.1924	-0.2302	5.5393
29	3.3429	1.2809	3.9071	-2.6262	1.1242	7.0118
30	2.1759	2.8959	2.7053	0.1907	-0.0933	5.6847
31	2.2138	3.7589	2.7443	1.0146	-0.0533	5.7273
32	1.6734	0.6419	2.1877	-1.5458	-0.6269	5.1225
33	2.4681	1.3863	3.0062	-1.6199	0.2144	6.0142
34	-2.4079	-0.7765	-2.0156	1.2391	-5.1726	0.7688
35	-1.0498	0.4055	-0.6169	1.0224	-3.6186	2.1762
36	-1.0788	0.5878	-0.6468	1.2345	-3.6513	2.1458
37	0.1044	1.9169	0.5718	1.3451	-2.3299	3.4043
38	-0.2614	0.3365	0.1951	0.1413	-2.7350	3.0119
39	-1.1087	-0.4005	-0.6775	0.2770	-3.6851	2.1144
40	-1.1087	-0.0619	-0.6775	0.6156	-3.6851	2.1144
41	-2.6593	-1.7148	-2.2745	0.5597	-5.4644	0.5127
42	-1.2040	-1.5606	-0.7757	-0.7850	-3.7929	2.0145
43	-1.4697	-0.6162	-1.0493	0.4331	-4.0947	1.7369
44	-2.6593	-2.6173	-2.2745	-0.3428	-5.4644	0.5127
45	-3.2189	-2.5639	-2.8508	0.2869	-6.1188	-0.0532
46	1.3110	2.1282	1.8145	0.3137	-1.0151	4.7207
47	2.1633	0.6931	2.6923	-1.9992	-0.1066	5.6706
48	1.9488	0.0953	2.4713	-2.3760	-0.3338	5.4299
49	3.3673	3.6687	3.9323	-0.2636	1.1494	7.0399
50	1.8500	3.5467	2.3697	1.1771	-0.4386	5.3195
51	2.7726	1.7047	3.3198	-1.6151	0.5329	6.3596

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnInvert	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.3957	Rows Prediction Only	0
Slope	0.5568	Sum of Frequencies	42
R-Squared	0.5478	Sum of Weights	42.0000
Correlation	0.7401	Coefficient of Variation	0.4578
Mean Square Error	0.8744082	Square Root of MSE	0.9350979

Linear Regression Report

Y = lnInvert X = lnSoil

Summary Statement

The equation of the straight line relating lnInvert and lnSoil is estimated as: lnInvert = (1.3957) + (0.5568) lnSoil using the 42 observations in this dataset. The y-intercept, the estimated value of lnInvert when lnSoil is zero, is 1.3957 with a standard error of 0.1716. The slope, the estimated change in lnInvert per unit change in lnSoil, is 0.5568 with a standard error of 0.0800. The value of R-Squared, the proportion of the variation in lnInvert that can be accounted for by variation in lnSoil, is 0.5478. The correlation between lnInvert and lnSoil is 0.7401.

A significance test that the slope is zero resulted in a t-value of 6.9605. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5568. The lower limit of the 95% confidence interval for the slope is 0.3951 and the upper limit is 0.7185. The estimated intercept is 1.3957. The lower limit of the 95% confidence interval for the intercept is 1.0488 and the upper limit is 1.7426.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnInvert	lnSoil
Count	42	42
Mean	2.0427	1.1620
Standard Deviation	1.3734	1.8255
Minimum	-0.7985	-2.6173
Maximum	4.1320	5.5013

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.3957	0.5568
Lower 95% Confidence Limit	1.0488	0.3951
Upper 95% Confidence Limit	1.7426	0.7185
Standard Error	0.1716	0.0800
Standardized Coefficient	0.0000	0.7401
T Value	8.1314	6.9605
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	1.0000
Regression of Y on X	1.3957	0.5568
Inverse Regression from X on Y	0.8615	1.0165
Orthogonal Regression of Y and X	1.2484	0.6836

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.39569100604983) + (0.556823766760658) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.3957	0.9000	1.1111	1.6299
Bootstrap Mean	1.4038	0.9500	1.0490	1.6824
Bias (BM - OV)	0.0081	0.9900	0.9179	1.7577
Bias Corrected	1.3876			
Standard Error	0.1577			
Slope				
Original Value	0.5568	0.9000	0.4316	0.6614
Bootstrap Mean	0.5609	0.9500	0.4064	0.6814
Bias (BM - OV)	0.0041	0.9900	0.3503	0.7204
Bias Corrected	0.5527			
Standard Error	0.0693			
Correlation				
Original Value	0.7401	0.9000	0.6583	0.8479
Bootstrap Mean	0.7379	0.9500	0.6459	0.8793
Bias (BM - OV)	-0.0022	0.9900	0.6234	0.9384
Bias Corrected	0.7423			
Standard Error	0.0586			
R-Squared				
Original Value	0.5478	0.9000	0.4200	0.6957
Bootstrap Mean	0.5480	0.9500	0.3994	0.7345
Bias (BM - OV)	0.0002	0.9900	0.3615	0.8019
Bias Corrected	0.5475			
Standard Error	0.0842			
Standard Error of Estimate				
Original Value	0.9351	0.9000	0.8409	1.0785
Bootstrap Mean	0.9133	0.9500	0.8193	1.1056
Bias (BM - OV)	-0.0218	0.9900	0.7782	1.1586
Bias Corrected	0.9569			
Standard Error	0.0725			
Orthogonal Intercept				
Original Value	1.2484	0.9000	0.9935	1.4956
Bootstrap Mean	1.2489	0.9500	0.9341	1.5359
Bias (BM - OV)	0.0005	0.9900	0.7934	1.6678
Bias Corrected	1.2479			
Standard Error	0.1530			
Orthogonal Slope				
Original Value	0.6836	0.9000	0.4960	0.8139
Bootstrap Mean	0.6951	0.9500	0.4356	0.8323
Bias (BM - OV)	0.0115	0.9900	0.3375	0.8717
Bias Corrected	0.6720			
Standard Error	0.0983			

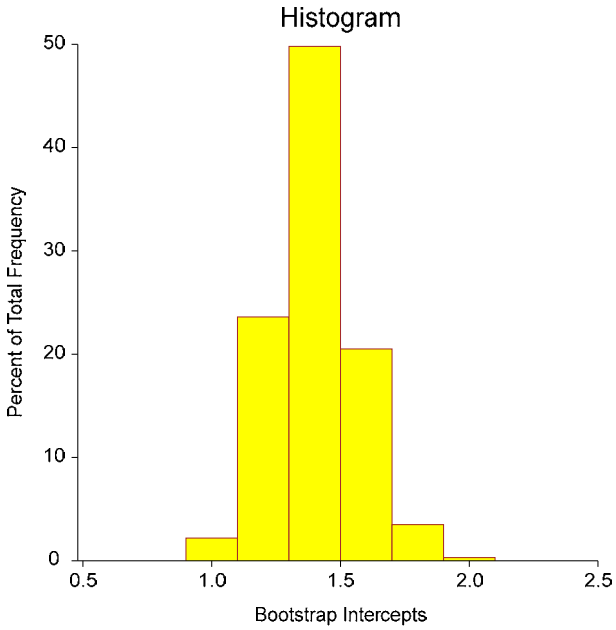
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

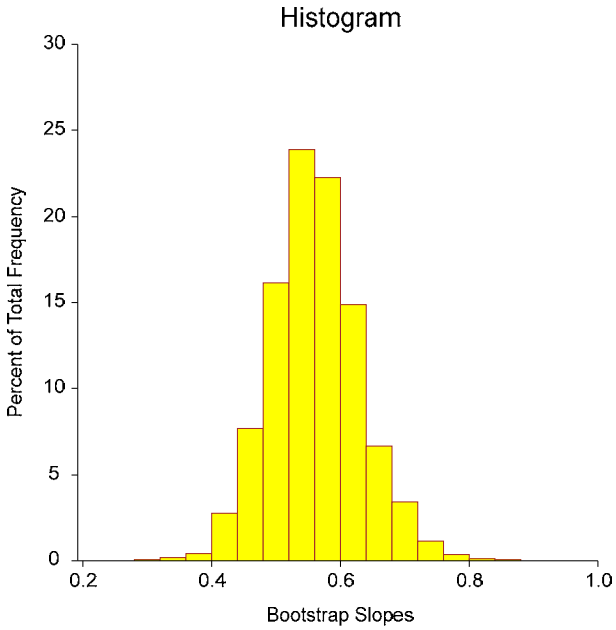
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

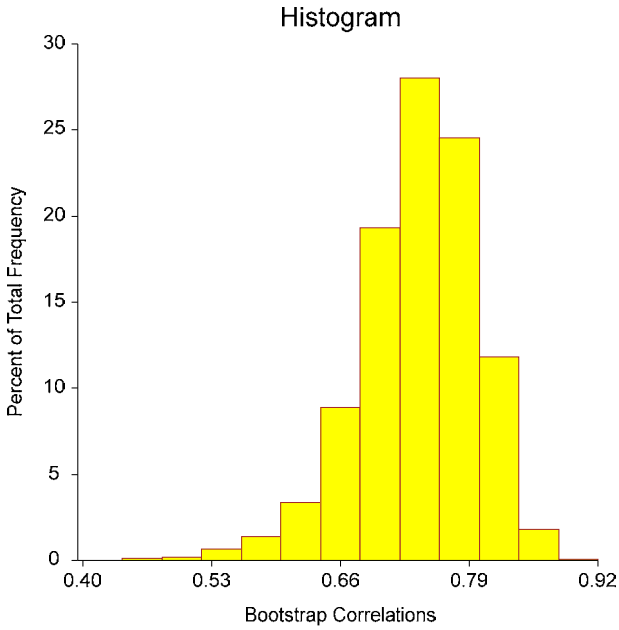
Linear Regression Report

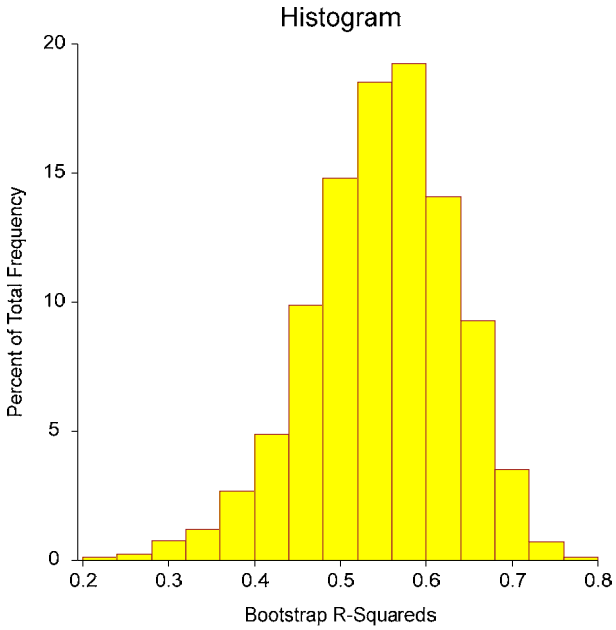
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Histograms Section



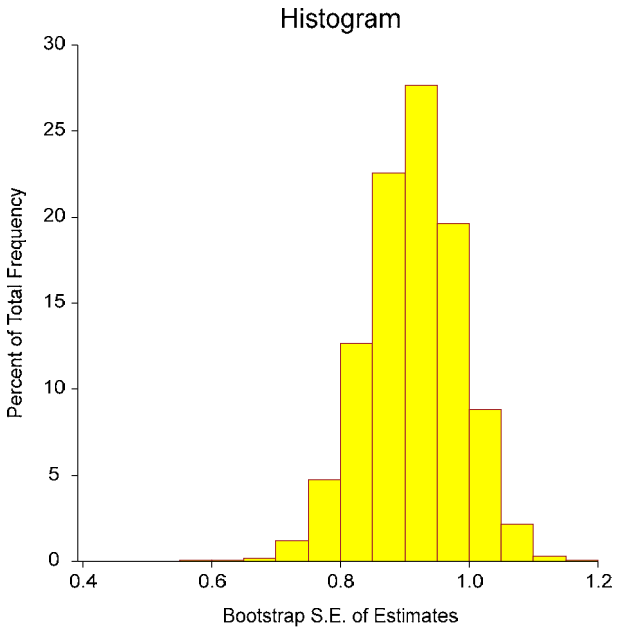


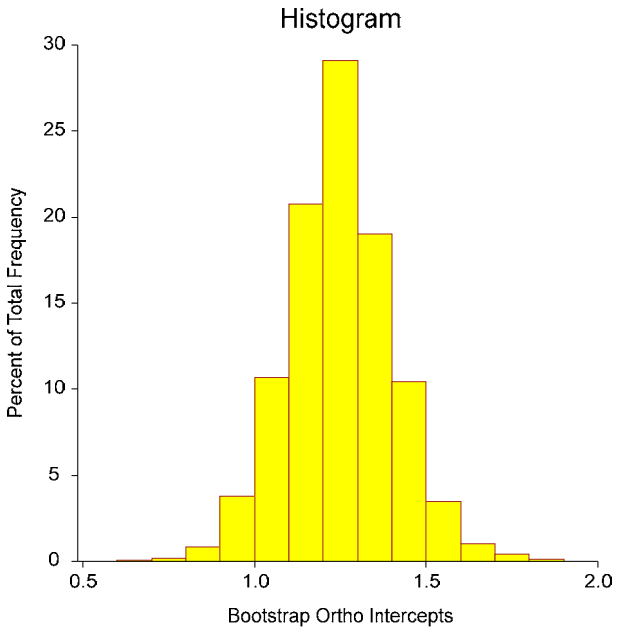


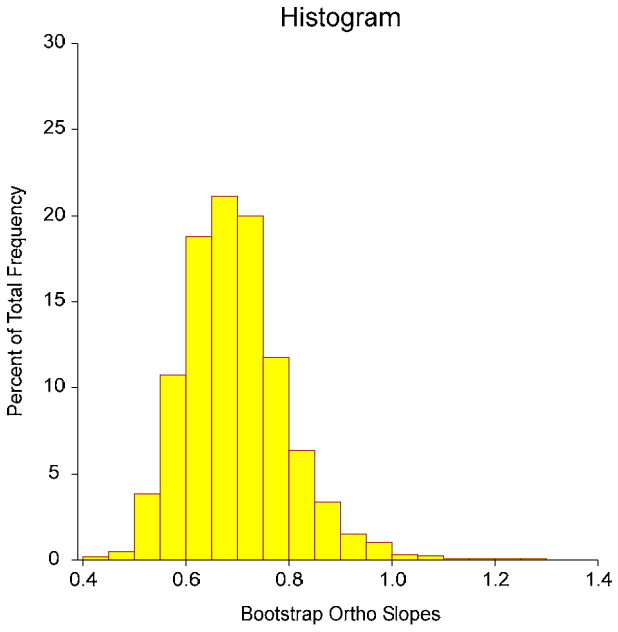


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.7401	0.5478	0.7539
Lower 95% Conf. Limit (r dist'n)	0.5580		
Upper 95% Conf. Limit (r dist'n)	0.8491		
Lower 95% Conf. Limit (Fisher's z)	0.5628		0.5837
Upper 95% Conf. Limit (Fisher's z)	0.8523		0.8606
Adjusted (Rbar)		0.5365	
T-Value for H0: Rho = 0	6.9605	6.9605	7.2572
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	175.2574	175.2574			
Slope	1	42.36428	42.36428	48.4491	0.0000	1.0000
Error	40	34.97633	0.8744082			
Lack of Fit	38	27.6832	0.7285053	0.1998	0.9882	
Pure Error	2	7.293124	3.646562			
Adj. Total	41	77.34061	1.886356			
Total	42	252.598				

s = Square Root(0.8744082) = 0.9350979

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	48.80563	85.79516	0.03369226	-0.008504649
1	48.80563	193.3498	175.7793	-0.008504649	0.00731873
2 (Y'Y)			252.598		
Determinant		5738.701			0.0001742555

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.02946078	-0.007436534
1	-0.007436534	0.006399557

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9540	0.089668	No
Anderson Darling	0.5929	0.121903	No
D'Agostino Skewness	0.8057	0.420434	Yes
D'Agostino Kurtosis	-2.2170	0.026621	No
D'Agostino Omnibus	5.5643	0.061904	No
Constant Residual Variance?			
Modified Levene Test	0.0114	0.915529	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.1998	0.988240	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

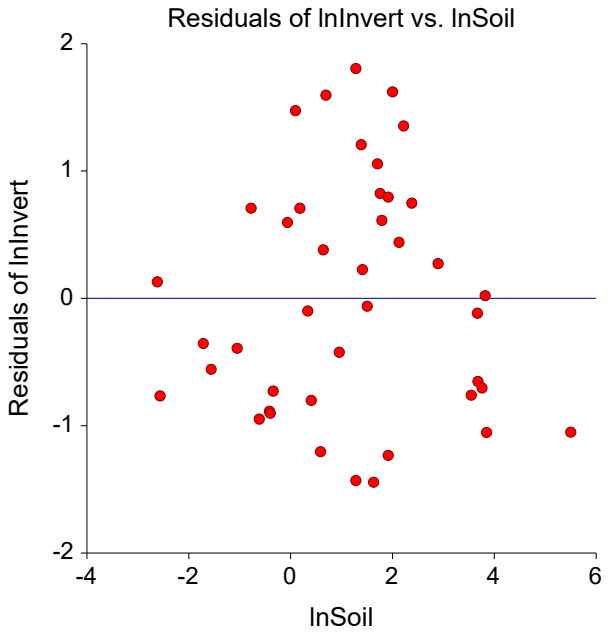
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

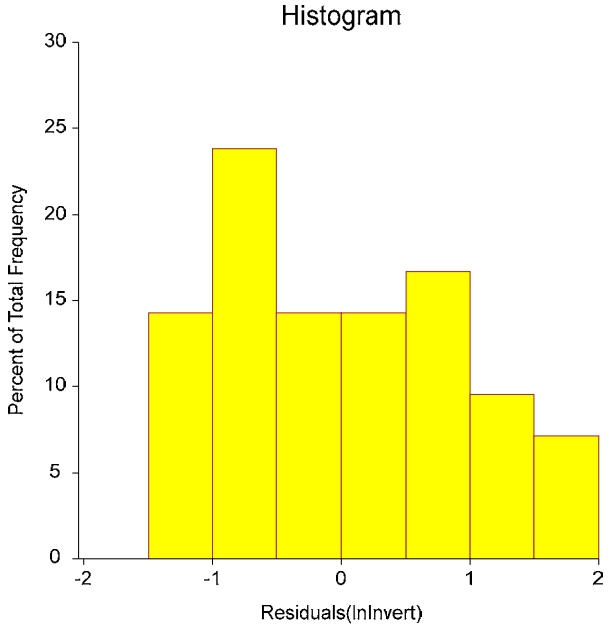
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

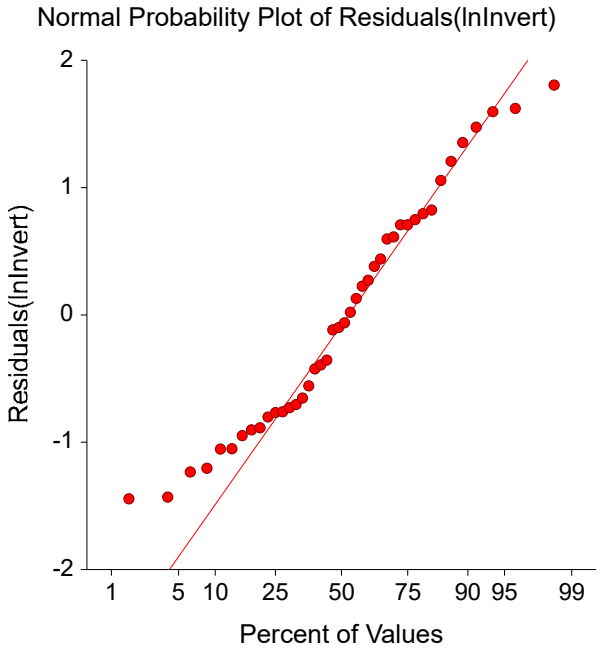
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Original Data Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual
10	5.5013	3.4078	4.4589	-1.0511
11	1.7918	3.0057	2.3934	0.6123
12	3.8480	2.4849	3.5384	-1.0535
13	0.1823	2.2050	1.4972	0.7078
14	3.6788	2.7912	3.4442	-0.6530
15	1.4110	2.4069	2.1814	0.2256
16	-0.3425	0.4762	1.2050	-0.7288
17	1.6292	0.8587	2.3029	-1.4442
18	-1.0498	0.4187	0.8111	-0.3924
19	1.2809	0.6780	2.1089	-1.4309
20	0.9555	1.5041	1.9277	-0.4237
21	-0.4155	0.2776	1.1643	-0.8867
22	3.8199	3.5439	3.5227	0.0211
23	1.5041	2.1713	2.2332	-0.0619
24	1.7579	3.1987	2.3745	0.8242
25	1.9169	3.2581	2.4631	0.7950
26	2.2192	3.9853	2.6314	1.3539
27	2.0015	4.1320	2.5102	1.6218
28	2.3795	3.4689	2.7207	0.7482
29	1.2809	3.9140	2.1089	1.8051
30	2.8959	3.2809	3.0082	0.2727
31	3.7589	2.7850	3.4887	-0.7037
32	0.6419	2.1342	1.7531	0.3811
33	1.3863	3.3742	2.1676	1.2066
34	-0.7765	1.6715	0.9633	0.7082
35	0.4055	0.8198	1.6215	-0.8017
36	0.5878	0.5188	1.7230	-1.2042
37	1.9169	1.2296	2.4631	-1.2334
38	0.3365	1.4839	1.5830	-0.0992
39	-0.4005	0.2700	1.1727	-0.9027
40	-0.0619	1.9573	1.3612	0.5960
41	-1.7148	0.0862	0.4409	-0.3547
42	-1.5606	-0.0305	0.5267	-0.5571
43	-0.6162	0.1044	1.0526	-0.9482
44	-2.6173	0.0677	-0.0617	0.1293
45	-2.5639	-0.7985	-0.0320	-0.7665
46	2.1282	3.0204	2.5807	0.4397
47	0.6931	3.3776	1.7817	1.5959
48	0.0953	2.9232	1.4488	1.4744
49	3.6687	3.3214	3.4385	-0.1171
50	3.5467	2.6101	3.3706	-0.7605
51	1.7047	3.4012	2.3449	1.0563

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	5.5013	3.4078	4.4589	0.3759	3.6992	5.2187
11	1.7918	3.0057	2.3934	0.1528	2.0845	2.7023
12	3.8480	2.4849	3.5384	0.2588	3.0153	4.0615
13	0.1823	2.2050	1.4972	0.1642	1.1654	1.8291
14	3.6788	2.7912	3.4442	0.2477	2.9435	3.9448
15	1.4110	2.4069	2.1814	0.1457	1.8870	2.4757
16	-0.3425	0.4762	1.2050	0.1879	0.8252	1.5847
17	1.6292	0.8587	2.3029	0.1491	2.0016	2.6041
18	-1.0498	0.4187	0.8111	0.2283	0.3497	1.2726
19	1.2809	0.6780	2.1089	0.1446	1.8167	2.4012
20	0.9555	1.5041	1.9277	0.1452	1.6342	2.2213
21	-0.4155	0.2776	1.1643	0.1917	0.7769	1.5517
22	3.8199	3.5439	3.5227	0.2570	3.0034	4.0420
23	1.5041	2.1713	2.2332	0.1469	1.9364	2.5300
24	1.7579	3.1987	2.3745	0.1520	2.0674	2.6816
25	1.9169	3.2581	2.4631	0.1564	2.1470	2.7792
26	2.2192	3.9853	2.6314	0.1672	2.2934	2.9694
27	2.0015	4.1320	2.5102	0.1592	2.1885	2.8318
28	2.3795	3.4689	2.7207	0.1741	2.3688	3.0725
29	1.2809	3.9140	2.1089	0.1446	1.8167	2.4012
30	2.8959	3.2809	3.0082	0.2001	2.6037	3.4127
31	3.7589	2.7850	3.4887	0.2529	2.9775	3.9999
32	0.6419	2.1342	1.7531	0.1502	1.4496	2.0566
33	1.3863	3.3742	2.1676	0.1454	1.8737	2.4615
34	-0.7765	1.6715	0.9633	0.2118	0.5352	1.3914
35	0.4055	0.8198	1.6215	0.1565	1.3052	1.9377
36	0.5878	0.5188	1.7230	0.1514	1.4169	2.0290
37	1.9169	1.2296	2.4631	0.1564	2.1470	2.7792
38	0.3365	1.4839	1.5830	0.1587	1.2623	1.9038
39	-0.4005	0.2700	1.1727	0.1909	0.7869	1.5585
40	-0.0619	1.9573	1.3612	0.1744	1.0088	1.7137
41	-1.7148	0.0862	0.4409	0.2716	-0.1081	0.9898
42	-1.5606	-0.0305	0.5267	0.2613	-0.0014	1.0547
43	-0.6162	0.1044	1.0526	0.2026	0.6431	1.4621
44	-2.6173	0.0677	-0.0617	0.3350	-0.7387	0.6154
45	-2.5639	-0.7985	-0.0320	0.3312	-0.7013	0.6373
46	2.1282	3.0204	2.5807	0.1637	2.2499	2.9116
47	0.6931	3.3776	1.7817	0.1491	1.4803	2.0830
48	0.0953	2.9232	1.4488	0.1676	1.1100	1.7876
49	3.6687	3.3214	3.4385	0.2470	2.9392	3.9378
50	3.5467	2.6101	3.3706	0.2392	2.8872	3.8540
51	1.7047	3.4012	2.3449	0.1507	2.0404	2.6495

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	5.5013	3.4078	4.4589	1.0078	2.4220	6.4958
11	1.7918	3.0057	2.3934	0.9475	0.4784	4.3084
12	3.8480	2.4849	3.5384	0.9703	1.5774	5.4993
13	0.1823	2.2050	1.4972	0.9494	-0.4216	3.4160
14	3.6788	2.7912	3.4442	0.9673	1.4891	5.3992
15	1.4110	2.4069	2.1814	0.9464	0.2687	4.0941
16	-0.3425	0.4762	1.2050	0.9538	-0.7227	3.1327
17	1.6292	0.8587	2.3029	0.9469	0.3891	4.2167
18	-1.0498	0.4187	0.8111	0.9626	-1.1343	2.7565
19	1.2809	0.6780	2.1089	0.9462	0.1966	4.0213
20	0.9555	1.5041	1.9277	0.9463	0.0152	3.8403
21	-0.4155	0.2776	1.1643	0.9545	-0.7649	3.0935
22	3.8199	3.5439	3.5227	0.9698	1.5627	5.4827
23	1.5041	2.1713	2.2332	0.9466	0.3201	4.1463
24	1.7579	3.1987	2.3745	0.9474	0.4598	4.2892
25	1.9169	3.2581	2.4631	0.9481	0.5469	4.3792
26	2.2192	3.9853	2.6314	0.9499	0.7115	4.5513
27	2.0015	4.1320	2.5102	0.9485	0.5931	4.4272
28	2.3795	3.4689	2.7207	0.9512	0.7983	4.6431
29	1.2809	3.9140	2.1089	0.9462	0.1966	4.0213
30	2.8959	3.2809	3.0082	0.9563	1.0755	4.9409
31	3.7589	2.7850	3.4887	0.9687	1.5309	5.4465
32	0.6419	2.1342	1.7531	0.9471	-0.1610	3.6672
33	1.3863	3.3742	2.1676	0.9463	0.2550	4.0802
34	-0.7765	1.6715	0.9633	0.9588	-0.9745	2.9011
35	0.4055	0.8198	1.6215	0.9481	-0.2947	3.5376
36	0.5878	0.5188	1.7230	0.9473	-0.1915	3.6375
37	1.9169	1.2296	2.4631	0.9481	0.5469	4.3792
38	0.3365	1.4839	1.5830	0.9485	-0.3339	3.5000
39	-0.4005	0.2700	1.1727	0.9544	-0.7562	3.1016
40	-0.0619	1.9573	1.3612	0.9512	-0.5612	3.2837
41	-1.7148	0.0862	0.4409	0.9738	-1.5272	2.4089
42	-1.5606	-0.0305	0.5267	0.9709	-1.4356	2.4890
43	-0.6162	0.1044	1.0526	0.9568	-0.8812	2.9863
44	-2.6173	0.0677	-0.0617	0.9933	-2.0692	1.9458
45	-2.5639	-0.7985	-0.0320	0.9920	-2.0369	1.9729
46	2.1282	3.0204	2.5807	0.9493	0.6621	4.4994
47	0.6931	3.3776	1.7817	0.9469	-0.1321	3.6954
48	0.0953	2.9232	1.4488	0.9500	-0.4713	3.3688
49	3.6687	3.3214	3.4385	0.9672	1.4838	5.3932
50	3.5467	2.6101	3.3706	0.9652	1.4198	5.3214
51	1.7047	3.4012	2.3449	0.9472	0.4307	4.2592

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	5.5013	3.4078	4.4589	0.3759	3.3889	5.5289
11	1.7918	3.0057	2.3934	0.1528	1.9584	2.8284
12	3.8480	2.4849	3.5384	0.2588	2.8016	4.2751
13	0.1823	2.2050	1.4972	0.1642	1.0298	1.9646
14	3.6788	2.7912	3.4442	0.2477	2.7391	4.1492
15	1.4110	2.4069	2.1814	0.1457	1.7668	2.5960
16	-0.3425	0.4762	1.2050	0.1879	0.6702	1.7398
17	1.6292	0.8587	2.3029	0.1491	1.8786	2.7271
18	-1.0498	0.4187	0.8111	0.2283	0.1612	1.4610
19	1.2809	0.6780	2.1089	0.1446	1.6974	2.5205
20	0.9555	1.5041	1.9277	0.1452	1.5144	2.3411
21	-0.4155	0.2776	1.1643	0.1917	0.6187	1.7100
22	3.8199	3.5439	3.5227	0.2570	2.7913	4.2541
23	1.5041	2.1713	2.2332	0.1469	1.8152	2.6512
24	1.7579	3.1987	2.3745	0.1520	1.9420	2.8070
25	1.9169	3.2581	2.4631	0.1564	2.0179	2.9083
26	2.2192	3.9853	2.6314	0.1672	2.1553	3.1074
27	2.0015	4.1320	2.5102	0.1592	2.0572	2.9632
28	2.3795	3.4689	2.7207	0.1741	2.2252	3.2162
29	1.2809	3.9140	2.1089	0.1446	1.6974	2.5205
30	2.8959	3.2809	3.0082	0.2001	2.4385	3.5779
31	3.7589	2.7850	3.4887	0.2529	2.7688	4.2087
32	0.6419	2.1342	1.7531	0.1502	1.3256	2.1805
33	1.3863	3.3742	2.1676	0.1454	1.7537	2.5815
34	-0.7765	1.6715	0.9633	0.2118	0.3604	1.5662
35	0.4055	0.8198	1.6215	0.1565	1.1761	2.0668
36	0.5878	0.5188	1.7230	0.1514	1.2920	2.1540
37	1.9169	1.2296	2.4631	0.1564	2.0179	2.9083
38	0.3365	1.4839	1.5830	0.1587	1.1314	2.0347
39	-0.4005	0.2700	1.1727	0.1909	0.6293	1.7161
40	-0.0619	1.9573	1.3612	0.1744	0.8649	1.8576
41	-1.7148	0.0862	0.4409	0.2716	-0.3323	1.2140
42	-1.5606	-0.0305	0.5267	0.2613	-0.2170	1.2703
43	-0.6162	0.1044	1.0526	0.2026	0.4758	1.6293
44	-2.6173	0.0677	-0.0617	0.3350	-1.0152	0.8919
45	-2.5639	-0.7985	-0.0320	0.3312	-0.9746	0.9106
46	2.1282	3.0204	2.5807	0.1637	2.1148	3.0467
47	0.6931	3.3776	1.7817	0.1491	1.3573	2.2060
48	0.0953	2.9232	1.4488	0.1676	0.9716	1.9259
49	3.6687	3.3214	3.4385	0.2470	2.7353	4.1417
50	3.5467	2.6101	3.3706	0.2392	2.6898	4.0514
51	1.7047	3.4012	2.3449	0.1507	1.9160	2.7738

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	5.5013	3.4078	4.4589	-1.0511	-1.2276	30.8430
11	1.7918	3.0057	2.3934	0.6123	0.6637	20.3713
12	3.8480	2.4849	3.5384	-1.0535	-1.1724	42.3940
13	0.1823	2.2050	1.4972	0.7078	0.7688	32.0984
14	3.6788	2.7912	3.4442	-0.6530	-0.7242	23.3947
15	1.4110	2.4069	2.1814	0.2256	0.2442	9.3722
16	-0.3425	0.4762	1.2050	-0.7288	-0.7956	153.0235
17	1.6292	0.8587	2.3029	-1.4442	-1.5645	168.1954
18	-1.0498	0.4187	0.8111	-0.3924	-0.4327	93.7199
19	1.2809	0.6780	2.1089	-1.4309	-1.5489	211.0385
20	0.9555	1.5041	1.9277	-0.4237	-0.4586	28.1678
21	-0.4155	0.2776	1.1643	-0.8867	-0.9688	319.3765
22	3.8199	3.5439	3.5227	0.0211	0.0235	0.5967
23	1.5041	2.1713	2.2332	-0.0619	-0.0670	2.8489
24	1.7579	3.1987	2.3745	0.8242	0.8932	25.7658
25	1.9169	3.2581	2.4631	0.7950	0.8623	24.4013
26	2.2192	3.9853	2.6314	1.3539	1.4716	33.9720
27	2.0015	4.1320	2.5102	1.6218	1.7600	39.2501
28	2.3795	3.4689	2.7207	0.7482	0.8143	21.5684
29	1.2809	3.9140	2.1089	1.8051	1.9539	46.1182
30	2.8959	3.2809	3.0082	0.2727	0.2986	8.3119
31	3.7589	2.7850	3.4887	-0.7037	-0.7817	25.2677
32	0.6419	2.1342	1.7531	0.3811	0.4129	17.8560
33	1.3863	3.3742	2.1676	1.2066	1.3062	35.7586
34	-0.7765	1.6715	0.9633	0.7082	0.7775	42.3681
35	0.4055	0.8198	1.6215	-0.8017	-0.8696	97.7926
36	0.5878	0.5188	1.7230	-1.2042	-1.3050	232.1136
37	1.9169	1.2296	2.4631	-1.2334	-1.3379	100.3089
38	0.3365	1.4839	1.5830	-0.0992	-0.1076	6.6833
39	-0.4005	0.2700	1.1727	-0.9027	-0.9861	334.2880
40	-0.0619	1.9573	1.3612	0.5960	0.6488	30.4524
41	-1.7148	0.0862	0.4409	-0.3547	-0.3964	411.5598
42	-1.5606	-0.0305	0.5267	-0.5571	-0.6205	1829.1495
43	-0.6162	0.1044	1.0526	-0.9482	-1.0387	908.6084
44	-2.6173	0.0677	-0.0617	0.1293	0.1482	191.1658
45	-2.5639	-0.7985	-0.0320	-0.7665	-0.8765	95.9954
46	2.1282	3.0204	2.5807	0.4397	0.4776	14.5570
47	0.6931	3.3776	1.7817	1.5959	1.7288	47.2508
48	0.0953	2.9232	1.4488	1.4744	1.6027	50.4385
49	3.6687	3.3214	3.4385	-0.1171	-0.1298	3.5245
50	3.5467	2.6101	3.3706	-0.7605	-0.8413	29.1383
51	1.7047	3.4012	2.3449	1.0563	1.1445	31.0556

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	5.5013	-1.0511	*-1.2357	0.1616	0.1452	0.8630
11	1.7918	0.6123	0.6590	0.0267	0.0060	0.8870
12	3.8480	-1.0535	-1.1780	0.0766	0.0570	0.8660
13	0.1823	0.7078	0.7648	0.0308	0.0094	0.8836
14	3.6788	-0.6530	-0.7198	0.0702	0.0198	0.8851
15	1.4110	0.2256	0.2413	0.0243	0.0007	0.8955
16	-0.3425	-0.7288	-0.7918	0.0404	0.0133	0.8826
17	1.6292	-1.4442	-1.5943	0.0254	0.0319	0.8420
18	-1.0498	-0.3924	-0.4283	0.0596	0.0059	0.8926
19	1.2809	-1.4309	-1.5774	0.0239	0.0294	0.8430
20	0.9555	-0.4237	-0.4541	0.0241	0.0026	0.8921
21	-0.4155	-0.8867	-0.9680	0.0420	0.0206	0.8758
22	3.8199	0.0211	0.0232	0.0755	0.0000	0.8968
23	1.5041	-0.0619	-0.0661	0.0247	0.0001	0.8967
24	1.7579	0.8242	0.8909	0.0264	0.0108	0.8789
25	1.9169	0.7950	0.8595	0.0280	0.0107	0.8802
26	2.2192	1.3539	1.4941	0.0320	0.0358	0.8483
27	2.0015	1.6218	1.8094	0.0290	0.0462	0.8274
28	2.3795	0.7482	0.8108	0.0347	0.0119	0.8820
29	1.2809	1.8051	*2.0285	0.0239	0.0468	0.8112
30	2.8959	0.2727	0.2951	0.0458	0.0021	0.8948
31	3.7589	-0.7037	-0.7778	0.0732	0.0241	0.8831
32	0.6419	0.3811	0.4086	0.0258	0.0023	0.8930
33	1.3863	1.2066	1.3182	0.0242	0.0211	0.8586
34	-0.7765	0.7082	0.7736	0.0513	0.0164	0.8833
35	0.4055	-0.8017	-0.8669	0.0280	0.0109	0.8799
36	0.5878	-1.2042	-1.3169	0.0262	0.0229	0.8586
37	1.9169	-1.2334	-1.3517	0.0280	0.0258	0.8567
38	0.3365	-0.0992	-0.1063	0.0288	0.0002	0.8966
39	-0.4005	-0.9027	-0.9857	0.0417	0.0211	0.8750
40	-0.0619	0.5960	0.6440	0.0348	0.0076	0.8874
41	-1.7148	-0.3547	-0.3922	0.0844	0.0072	0.8933
42	-1.5606	-0.5571	-0.6157	0.0781	0.0163	0.8882
43	-0.6162	-0.9482	-1.0398	0.0470	0.0266	0.8726
44	-2.6173	0.1293	*0.1463	0.1283	0.0016	0.8963
45	-2.5639	-0.7665	*-0.8739	0.1254	0.0551	0.8796
46	2.1282	0.4397	0.4729	0.0306	0.0036	0.8917
47	0.6931	1.5959	1.7747	0.0254	0.0390	0.8298
48	0.0953	1.4744	1.6359	0.0321	0.0426	0.8392
49	3.6687	-0.1171	-0.1282	0.0698	0.0006	0.8965
50	3.5467	-0.7605	-0.8382	0.0654	0.0248	0.8810
51	1.7047	1.0563	1.1491	0.0260	0.0175	0.8675

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-1.2357	-0.5425	0.1452	* 1.1620	0.0963	-0.5010
11	0.6590	0.1092	0.0060	1.0571	0.0672	0.0360
12	-1.1780	-0.3393	0.0570	1.0623	-0.0065	-0.2817
13	0.7648	0.1364	0.0094	1.0536	0.1360	-0.0651
14	-0.7198	-0.1977	0.0198	1.1019	-0.0098	-0.1607
15	0.2413	0.0381	0.0007	1.0749	0.0289	0.0052
16	-0.7918	-0.1624	0.0133	1.0618	-0.1612	0.1040
17	-1.5943	-0.2574	0.0319	0.9513	-0.1745	-0.0645
18	-0.4283	-0.1078	0.0059	1.1082	-0.1026	0.0836
19	-1.5774	-0.2469	0.0294	0.9523	-0.1983	-0.0162
20	-0.4541	-0.0714	0.0026	1.0666	-0.0640	0.0081
21	-0.9680	-0.2028	0.0206	1.0472	-0.2006	0.1335
22	0.0232	0.0066	0.0000	1.1378	0.0002	0.0055
23	-0.0661	-0.0105	0.0001	1.0783	-0.0076	-0.0020
24	0.8909	0.1467	0.0108	1.0378	0.0922	0.0460
25	0.8595	0.1458	0.0107	1.0424	0.0826	0.0563
26	1.4941	0.2716	0.0358	0.9722	0.1226	0.1373
27	1.8094	0.3125	0.0462	0.9220	0.1668	0.1319
28	0.8108	0.1536	0.0119	1.0539	0.0605	0.0860
29	* 2.0285	0.3175	0.0468	0.8818	0.2550	0.0209
30	0.2951	0.0647	0.0021	1.0975	0.0149	0.0448
31	-0.7778	-0.2185	0.0241	1.1006	-0.0076	-0.1795
32	0.4086	0.0665	0.0023	1.0706	0.0637	-0.0184
33	1.3182	0.2075	0.0211	0.9880	0.1592	0.0256
34	0.7736	0.1799	0.0164	1.0756	0.1744	-0.1317
35	-0.8669	-0.1471	0.0109	1.0417	-0.1449	0.0569
36	-1.3169	-0.2161	0.0229	0.9902	-0.2086	0.0656
37	-1.3517	-0.2293	0.0258	0.9875	-0.1299	-0.0885
38	-0.1063	-0.0183	0.0002	1.0825	-0.0181	0.0076
39	-0.9857	-0.2056	0.0211	1.0450	-0.2035	0.1346
40	0.6440	0.1222	0.0076	1.0670	0.1222	-0.0686
41	-0.3922	-0.1191	0.0072	1.1399	-0.1078	0.1009
42	-0.6157	-0.1792	0.0163	1.1191	-0.1641	0.1494
43	-1.0398	-0.2308	0.0266	1.0450	-0.2259	0.1620
44	0.1463	0.0561	0.0016	* 1.2055	0.0478	-0.0507
45	-0.8739	-0.3309	0.0551	* 1.1570	-0.2825	0.2979
46	0.4729	0.0841	0.0036	1.0729	0.0408	0.0397
47	1.7747	0.2866	0.0390	0.9241	0.2722	-0.0721
48	1.6359	0.2981	0.0426	0.9518	0.2979	-0.1518
49	-0.1282	-0.0351	0.0006	1.1299	-0.0018	-0.0285
50	-0.8382	-0.2218	0.0248	1.0861	-0.0167	-0.1769
51	1.1491	0.1876	0.0175	1.0104	0.1218	0.0541

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
10	5.5013	-1.0511	||||||||.....	-1.2276	||||||||.....	-1.2357	||||||||.....
11	1.7918	0.6123	||||.....	0.6637	||||.....	0.6590	||||.....
12	3.8480	-1.0535	|||||||.....	-1.1724	|||||||.....	-1.1780	|||||||.....
13	0.1823	0.7078	|||||.....	0.7688	|||||.....	0.7648	|||||.....
14	3.6788	-0.6530	|||||.....	-0.7242	|||||.....	-0.7198	|||||.....
15	1.4110	0.2256	|.....	0.2442	|.....	0.2413	|.....
16	-0.3425	-0.7288	|||||.....	-0.7956	|||||.....	-0.7918	|||||.....
17	1.6292	-1.4442	|||||||||....	-1.5645	|||||||||....	-1.5943	|||||||||....
18	-1.0498	-0.3924	|||.....	-0.4327	|||.....	-0.4283	|||.....
19	1.2809	-1.4309	|||||||||....	-1.5489	|||||||||....	-1.5774	|||||||||....
20	0.9555	-0.4237	|||.....	-0.4586	|||.....	-0.4541	|||.....
21	-0.4155	-0.8867	|||||||.....	-0.9688	|||||||.....	-0.9680	|||||||.....
22	3.8199	0.0211	|.....	0.0235	|.....	0.0232	|.....
23	1.5041	-0.0619	|.....	-0.0670	|.....	-0.0661	|.....
24	1.7579	0.8242	||||||.....	0.8932	||||||.....	0.8909	||||||.....
25	1.9169	0.7950	||||||.....	0.8623	||||||.....	0.8595	||||||.....
26	2.2192	1.3539	|||||||||....	1.4716	|||||||||....	1.4941	|||||||||....
27	2.0015	1.6218	||||||||||..	1.7600	||||||||||..	1.8094	||||||||||..
28	2.3795	0.7482	||||||.....	0.8143	||||||.....	0.8108	|||||.....
29	1.2809	1.8051	||||||||||||||	1.9539	||||||||||||||	* 2.0285	||||||||||||||
30	2.8959	0.2727	||.....	0.2986	||.....	0.2951	||.....
31	3.7589	-0.7037	|||||.....	-0.7817	|||||.....	-0.7778	|||||.....
32	0.6419	0.3811	|||.....	0.4129	|||.....	0.4086	||.....
33	1.3863	1.2066	||||||||.....	1.3062	||||||||.....	1.3182	||||||||.....
34	-0.7765	0.7082	|||||.....	0.7775	|||||.....	0.7736	|||||.....
35	0.4055	-0.8017	||||||.....	-0.8696	||||||.....	-0.8669	||||||.....
36	0.5878	-1.2042	||||||||.....	-1.3050	||||||||.....	-1.3169	||||||||.....
37	1.9169	-1.2334	|||||||||.....	-1.3379	|||||||||.....	-1.3517	||||||||.....
38	0.3365	-0.0992	|.....	-0.1076	|.....	-0.1063	|.....
39	-0.4005	-0.9027	|||||||.....	-0.9861	|||||||.....	-0.9857	|||||||.....
40	-0.0619	0.5960	||||.....	0.6488	||||.....	0.6440	||||.....
41	-1.7148	-0.3547	||.....	-0.3964	||.....	-0.3922	||.....
42	-1.5606	-0.5571	||||.....	-0.6205	||||.....	-0.6157	||||.....
43	-0.6162	-0.9482	|||||||.....	-1.0387	|||||||.....	-1.0398	|||||||.....
44	-2.6173	0.1293	|.....	0.1482	|.....	0.1463	|.....
45	-2.5639	-0.7665	||||||.....	-0.8765	||||||.....	-0.8739	||||||.....
46	2.1282	0.4397	|||.....	0.4776	|||.....	0.4729	|||.....
47	0.6931	1.5959	|||||||||||..	1.7288	|||||||||||..	1.7747	|||||||||||..
48	0.0953	1.4744	||||||||||...	1.6027	||||||||||...	1.6359	||||||||||...
49	3.6687	-0.1171	|.....	-0.1298	|.....	-0.1282	|.....
50	3.5467	-0.7605	||||||.....	-0.8413	||||||.....	-0.8382	||||||.....
51	1.7047	1.0563	|||||||.....	1.1445	|||||||.....	1.1491	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	5.5013	-0.5425	|||||||||||||||	0.1452	|||||||||||||||	-0.5010	|||||||||||||||
11	1.7918	0.1092	||.....	0.0060	|.....	0.0360	|.....
12	3.8480	-0.3393	|||||||||.....	0.0570	|||||.....	-0.2817	|||||||.....
13	0.1823	0.1364	|||.....	0.0094	|.....	-0.0651	|.....
14	3.6788	-0.1977	|||||.....	0.0198	||.....	-0.1607	||||.....
15	1.4110	0.0381	|.....	0.0007	|.....	0.0052	|.....
16	-0.3425	-0.1624	||||.....	0.0133	|.....	0.1040	|||.....
17	1.6292	-0.2574	|||||||.....	0.0319	|||.....	-0.0645	|.....
18	-1.0498	-0.1078	||.....	0.0059	|.....	0.0836	||.....
19	1.2809	-0.2469	||||||.....	0.0294	|||.....	-0.0162	|.....
20	0.9555	-0.0714	|.....	0.0026	|.....	0.0081	|.....
21	-0.4155	-0.2028	|||||.....	0.0206	||.....	0.1335	|||.....
22	3.8199	0.0066	|.....	0.0000	|.....	0.0055	|.....
23	1.5041	-0.0105	|.....	0.0001	|.....	-0.0020	|.....
24	1.7579	0.1467	|||.....	0.0108	|.....	0.0460	|.....
25	1.9169	0.1458	|||.....	0.0107	|.....	0.0563	|.....
26	2.2192	0.2716	|||||||.....	0.0358	|||.....	0.1373	||||.....
27	2.0015	0.3125	|||||||.....	0.0462	||||.....	0.1319	|||.....
28	2.3795	0.1536	||||.....	0.0119	|.....	0.0860	||.....
29	1.2809	0.3175	|||||||.....	0.0468	||||.....	0.0209	|.....
30	2.8959	0.0647	|.....	0.0021	|.....	0.0448	|.....
31	3.7589	-0.2185	|||||.....	0.0241	||.....	-0.1795	|||||.....
32	0.6419	0.0665	|.....	0.0023	|.....	-0.0184	|.....
33	1.3863	0.2075	|||||.....	0.0211	||.....	0.0256	|.....
34	-0.7765	0.1799	||||.....	0.0164	|.....	-0.1317	|||.....
35	0.4055	-0.1471	|||.....	0.0109	|.....	0.0569	|.....
36	0.5878	-0.2161	|||||.....	0.0229	||.....	0.0656	|.....
37	1.9169	-0.2293	||||||.....	0.0258	||.....	-0.0885	||.....
38	0.3365	-0.0183	|.....	0.0002	|.....	0.0076	|.....
39	-0.4005	-0.2056	|||||.....	0.0211	||.....	0.1346	|||.....
40	-0.0619	0.1222	|||.....	0.0076	|.....	-0.0686	||.....
41	-1.7148	-0.1191	|||.....	0.0072	|.....	0.1009	||.....
42	-1.5606	-0.1792	||||.....	0.0163	|.....	0.1494	||||.....
43	-0.6162	-0.2308	||||||.....	0.0266	||.....	0.1620	||||.....
44	-2.6173	0.0561	|.....	0.0016	|.....	-0.0507	|.....
45	-2.5639	-0.3309	|||||||||.....	0.0551	|||||.....	0.2979	|||||||.....
46	2.1282	0.0841	||.....	0.0036	|.....	0.0397	|.....
47	0.6931	0.2866	|||||||.....	0.0390	||||.....	-0.0721	||.....
48	0.0953	0.2981	|||||||.....	0.0426	||||.....	-0.1518	||||.....
49	3.6687	-0.0351	|.....	0.0006	|.....	-0.0285	|.....
50	3.5467	-0.2218	||||||.....	0.0248	||.....	-0.1769	|||||.....
51	1.7047	0.1876	|||||.....	0.0175	|.....	0.0541	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	5.5013	-1.2357	|||||||||.....	0.1452	||||||||||||||	0.1616	||||||||||||||
11	1.7918	0.6590	||||.....	0.0060	|.....	0.0267	|.....
12	3.8480	-1.1780	|||||||.....	0.0570	|||||.....	0.0766	|||||.....
13	0.1823	0.7648	|||||.....	0.0094	|.....	0.0308	|.....
14	3.6788	-0.7198	|||||.....	0.0198	||.....	0.0702	|||||.....
15	1.4110	0.2413	|.....	0.0007	|.....	0.0243	|.....
16	-0.3425	-0.7918	|||||.....	0.0133	|.....	0.0404	|.....
17	1.6292	-1.5943	||||||||||....	0.0319	|||.....	0.0254	|.....
18	-1.0498	-0.4283	|||.....	0.0059	|.....	0.0596	|||.....
19	1.2809	-1.5774	||||||||||....	0.0294	|||.....	0.0239	|.....
20	0.9555	-0.4541	|||.....	0.0026	|.....	0.0241	|.....
21	-0.4155	-0.9680	|||||||.....	0.0206	||.....	0.0420	|.....
22	3.8199	0.0232	|.....	0.0000	|.....	0.0755	|||||.....
23	1.5041	-0.0661	|.....	0.0001	|.....	0.0247	|.....
24	1.7579	0.8909	||||||.....	0.0108	|.....	0.0264	|.....
25	1.9169	0.8595	||||||.....	0.0107	|.....	0.0280	|.....
26	2.2192	1.4941	||||||||||....	0.0358	|||.....	0.0320	|.....
27	2.0015	1.8094	|||||||||||..	0.0462	||||.....	0.0290	|.....
28	2.3795	0.8108	|||||.....	0.0119	|.....	0.0347	|.....
29	1.2809	* 2.0285	||||||||||||||	0.0468	||||.....	0.0239	|.....
30	2.8959	0.2951	||.....	0.0021	|.....	0.0458	||.....
31	3.7589	-0.7778	|||||.....	0.0241	||.....	0.0732	|||||.....
32	0.6419	0.4086	||.....	0.0023	|.....	0.0258	|.....
33	1.3863	1.3182	||||||||.....	0.0211	||.....	0.0242	|.....
34	-0.7765	0.7736	|||||.....	0.0164	|.....	0.0513	||.....
35	0.4055	-0.8669	||||||.....	0.0109	|.....	0.0280	|.....
36	0.5878	-1.3169	||||||||.....	0.0229	||.....	0.0262	|.....
37	1.9169	-1.3517	||||||||.....	0.0258	||.....	0.0280	|.....
38	0.3365	-0.1063	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.9857	|||||||.....	0.0211	||.....	0.0417	|.....
40	-0.0619	0.6440	||||.....	0.0076	|.....	0.0348	|.....
41	-1.7148	-0.3922	||.....	0.0072	|.....	0.0844	|||||.....
42	-1.5606	-0.6157	||||.....	0.0163	|.....	0.0781	|||||.....
43	-0.6162	-1.0398	|||||||.....	0.0266	||.....	0.0470	||.....
44	-2.6173	0.1463	|.....	0.0016	|.....	0.1283	||||||||||....
45	-2.5639	-0.8739	||||||.....	0.0551	|||||.....	0.1254	||||||||||....
46	2.1282	0.4729	|||.....	0.0036	|.....	0.0306	|.....
47	0.6931	1.7747	|||||||||||..	0.0390	||||.....	0.0254	|.....
48	0.0953	1.6359	||||||||||...	0.0426	||||.....	0.0321	|.....
49	3.6687	-0.1282	|.....	0.0006	|.....	0.0698	||||.....
50	3.5467	-0.8382	||||||.....	0.0248	||.....	0.0654	||||.....
51	1.7047	1.1491	|||||||.....	0.0175	|.....	0.0260	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Means

Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.4078	5.5013	3.6136	1.8876	2.8886	4.7901
11	3.0057	1.7918	2.8914	-1.0996	2.2759	3.8254
12	2.4849	3.8480	1.9561	1.8919	1.4268	2.6317
13	2.2050	0.1823	1.4534	-1.2711	0.9252	2.0353
14	2.7912	3.6788	2.5061	1.1727	1.9362	3.3236
15	2.4069	1.4110	1.8161	-0.4051	1.2911	2.4616
16	0.4762	-0.3425	-1.6513	1.3088	-2.9569	-0.8637
17	0.8587	1.6292	-0.9645	2.5937	-2.0287	-0.2918
18	0.4187	-1.0498	-1.7546	0.7047	-3.0977	-0.9485
19	0.6780	1.2809	-1.2888	2.5698	-2.4650	-0.5640
20	1.5041	0.9555	0.1947	0.7609	-0.5218	0.7330
21	0.2776	-0.4155	-2.0079	1.5924	-3.4443	-1.1553
22	3.5439	3.8199	3.8579	-0.0380	3.0911	5.1211
23	2.1713	1.5041	1.3930	0.1111	0.8621	1.9664
24	3.1987	1.7579	3.2380	-1.4801	2.5730	4.2852
25	3.2581	1.9169	3.3447	-1.4278	2.6633	4.4280
26	3.9853	2.2192	4.6506	-2.4314	3.7376	6.2060
27	4.1320	2.0015	4.9141	-2.9126	3.9499	6.5691
28	3.4689	2.3795	3.7232	-1.3437	2.9797	4.9383
29	3.9140	1.2809	4.5227	-3.2417	3.6341	6.0301
30	3.2809	2.8959	3.3857	-0.4898	2.6978	4.4830
31	2.7850	3.7589	2.4951	1.2638	1.9263	3.3093
32	2.1342	0.6419	1.3262	-0.6844	0.7916	1.8911
33	3.3742	1.3863	3.5531	-2.1669	2.8382	4.7084
34	1.6715	-0.7765	0.4953	-1.2718	-0.1528	1.0206
35	0.8198	0.4055	-1.0343	1.4397	-2.1223	-0.3507
36	0.5188	0.5878	-1.5748	2.1626	-2.8528	-0.8008
37	1.2296	1.9169	-0.2982	2.2151	-1.1496	0.2842
38	1.4839	0.3365	0.1584	0.1781	-0.5671	0.6991
39	0.2700	-0.4005	-2.0216	1.6211	-3.4630	-1.1664
40	1.9573	-0.0619	1.0085	-1.0704	0.4450	1.5439
41	0.0862	-1.7148	-2.3518	0.6370	-3.9167	-1.4339
42	-0.0305	-1.5606	-2.5612	1.0006	-4.2054	-1.6027
43	0.1044	-0.6162	-2.3191	1.7029	-3.8717	-1.4075
44	0.0677	-2.6173	-2.3850	-0.2323	-3.9624	-1.4608
45	-0.7985	-2.5639	-3.9406	1.3766	-6.1184	-2.7023
46	3.0204	2.1282	2.9179	-0.7896	2.2988	3.8602
47	3.3776	0.6931	3.5593	-2.8661	2.8433	4.7167
48	2.9232	0.0953	2.7432	-2.6479	2.1465	3.6310
49	3.3214	3.6687	3.4584	0.2102	2.7590	4.5808
50	2.6101	3.5467	2.1809	1.3658	1.6392	2.9103
51	3.4012	1.7047	3.6017	-1.8969	2.8787	4.7739

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Individuals

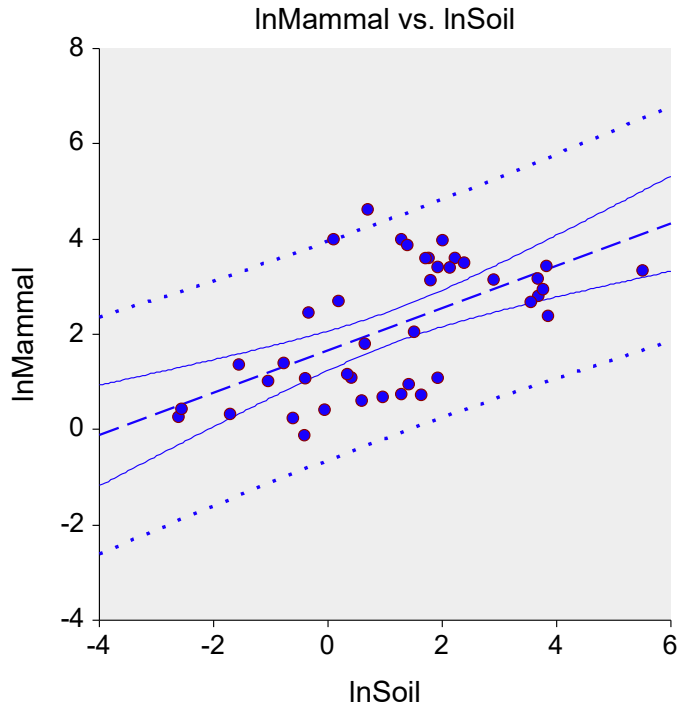
Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.4078	5.5013	3.6136	1.8876	0.1673	7.5114
11	3.0057	1.7918	2.8914	-1.0996	-0.5799	6.6811
12	2.4849	3.8480	1.9561	1.8919	-1.5685	5.6269
13	2.2050	0.1823	1.4534	-1.2711	-2.1098	5.0703
14	2.7912	3.6788	2.5061	1.1727	-0.9842	6.2440
15	2.4069	1.4110	1.8161	-0.4051	-1.7185	5.4712
16	0.4762	-0.3425	-1.6513	1.3088	-5.6084	1.7878
17	0.8587	1.6292	-0.9645	2.5937	-4.8119	2.4914
18	0.4187	-1.0498	-1.7546	0.7047	-5.7292	1.6830
19	0.6780	1.2809	-1.2888	2.5698	-5.1865	2.1575
20	1.5041	0.9555	0.1947	0.7609	-3.4964	3.7075
21	0.2776	-0.4155	-2.0079	1.5924	-6.0268	1.4272
22	3.5439	3.8199	3.8579	-0.0380	0.4168	7.7954
23	2.1713	1.5041	1.3930	0.1111	-2.1754	5.0039
24	3.1987	1.7579	3.2380	-1.4801	-0.2196	7.0779
25	3.2581	1.9169	3.3447	-1.4278	-0.1093	7.2007
26	3.9853	2.2192	4.6506	-2.4314	1.2163	8.7273
27	4.1320	2.0015	4.9141	-2.9126	1.4786	9.0405
28	3.4689	2.3795	3.7232	-1.3437	0.2794	7.6386
29	3.9140	1.2809	4.5227	-3.2417	1.0884	8.5758
30	3.2809	2.8959	3.3857	-0.4898	-0.0671	7.2479
31	2.7850	3.7589	2.4951	1.2638	-0.9959	6.2315
32	2.1342	0.6419	1.3262	-0.6844	-2.2479	4.9306
33	3.3742	1.3863	3.5531	-2.1669	0.1052	7.4414
34	1.6715	-0.7765	0.4953	-1.2718	-3.1612	4.0290
35	0.8198	0.4055	-1.0343	1.4397	-4.8923	2.4193
36	0.5188	0.5878	-1.5748	2.1626	-5.5191	1.8655
37	1.2296	1.9169	-0.2982	2.2151	-4.0513	3.1860
38	1.4839	0.3365	0.1584	0.1781	-3.5370	3.6689
39	0.2700	-0.4005	-2.0216	1.6211	-6.0429	1.4134
40	1.9573	-0.0619	1.0085	-1.0704	-2.5948	4.5836
41	0.0862	-1.7148	-2.3518	0.6370	-6.4331	1.0826
42	-0.0305	-1.5606	-2.5612	1.0006	-6.6821	0.8740
43	0.1044	-0.6162	-2.3191	1.7029	-6.3944	1.1152
44	0.0677	-2.6173	-2.3850	-0.2323	-6.4726	1.0494
45	-0.7985	-2.5639	-3.9406	1.3766	-8.3471	-0.4736
46	3.0204	2.1282	2.9179	-0.7896	-0.5523	6.7113
47	3.3776	0.6931	3.5593	-2.8661	0.1115	7.4485
48	2.9232	0.0953	2.7432	-2.6479	-0.7350	6.5125
49	3.3214	3.6687	3.4584	0.2102	0.0079	7.3319
50	2.6101	3.5467	2.1809	1.3658	-1.3287	5.8781
51	3.4012	1.7047	3.6017	-1.8969	0.1550	7.4976

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnMammal	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.6555	Rows Prediction Only	0
Slope	0.4446	Sum of Frequencies	42
R-Squared	0.3512	Sum of Weights	42.0000
Correlation	0.5926	Coefficient of Variation	0.5142
Mean Square Error	1.247638	Square Root of MSE	1.116977

Linear Regression Report

Y = lnMammal X = lnSoil

Summary Statement
The equation of the straight line relating lnMammal and lnSoil is estimated as: lnMammal = (1.6555) + (0.4446) lnSoil using the 42 observations in this dataset. The y-intercept, the estimated value of lnMammal when lnSoil is zero, is 1.6555 with a standard error of 0.2050. The slope, the estimated change in lnMammal per unit change in lnSoil, is 0.4446 with a standard error of 0.0956. The value of R-Squared, the proportion of the variation in lnMammal that can be accounted for by variation in lnSoil, is 0.3512. The correlation between lnMammal and lnSoil is 0.5926.

A significance test that the slope is zero resulted in a t-value of 4.6529. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.4446. The lower limit of the 95% confidence interval for the slope is 0.2515 and the upper limit is 0.6377. The estimated intercept is 1.6555. The lower limit of the 95% confidence interval for the intercept is 1.2412 and the upper limit is 2.0699.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnMammal	lnSoil
Count	42	42
Mean	2.1722	1.1620
Standard Deviation	1.3697	1.8255
Minimum	-0.1165	-2.6173
Maximum	4.6240	5.5013

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.6555	0.4446
Lower 95% Confidence Limit	1.2412	0.2515
Upper 95% Confidence Limit	2.0699	0.6377
Standard Error	0.2050	0.0956
Standardized Coefficient	0.0000	0.5926
T Value	8.0747	4.6529
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	0.9950
Regression of Y on X	1.6555	0.4446
Inverse Regression from X on Y	0.7009	1.2661
Orthogonal Regression of Y and X	1.4485	0.6228

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.65552632707018) + (0.444618320809551) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.6555	0.9000	1.3312	1.9533
Bootstrap Mean	1.6625	0.9500	1.2607	2.0067
Bias (BM - OV)	0.0070	0.9900	1.0994	2.1230
Bias Corrected	1.6485			
Standard Error	0.1922			
Slope				
Original Value	0.4446	0.9000	0.3343	0.5414
Bootstrap Mean	0.4483	0.9500	0.3086	0.5590
Bias (BM - OV)	0.0037	0.9900	0.2444	0.5998
Bias Corrected	0.4410			
Standard Error	0.0633			
Correlation				
Original Value	0.5926	0.9000	0.4720	0.7368
Bootstrap Mean	0.5914	0.9500	0.4509	0.7693
Bias (BM - OV)	-0.0012	0.9900	0.4198	0.8360
Bias Corrected	0.5938			
Standard Error	0.0803			
R-Squared				
Original Value	0.3512	0.9000	0.1938	0.5013
Bootstrap Mean	0.3562	0.9500	0.1632	0.5294
Bias (BM - OV)	0.0050	0.9900	0.1166	0.5804
Bias Corrected	0.3462			
Standard Error	0.0926			
Standard Error of Estimate				
Original Value	1.1170	0.9000	0.9689	1.3131
Bootstrap Mean	1.0943	0.9500	0.9366	1.3527
Bias (BM - OV)	-0.0226	0.9900	0.8607	1.4137
Bias Corrected	1.1396			
Standard Error	0.1051			
Orthogonal Intercept				
Original Value	1.4485	0.9000	1.1453	1.8038
Bootstrap Mean	1.4329	0.9500	1.0876	1.8830
Bias (BM - OV)	-0.0156	0.9900	0.9658	2.1195
Bias Corrected	1.4641			
Standard Error	0.2058			
Orthogonal Slope				
Original Value	0.6228	0.9000	0.3600	0.7581
Bootstrap Mean	0.6482	0.9500	0.2871	0.7806
Bias (BM - OV)	0.0255	0.9900	0.0015	0.8130
Bias Corrected	0.5973			
Standard Error	0.1291			

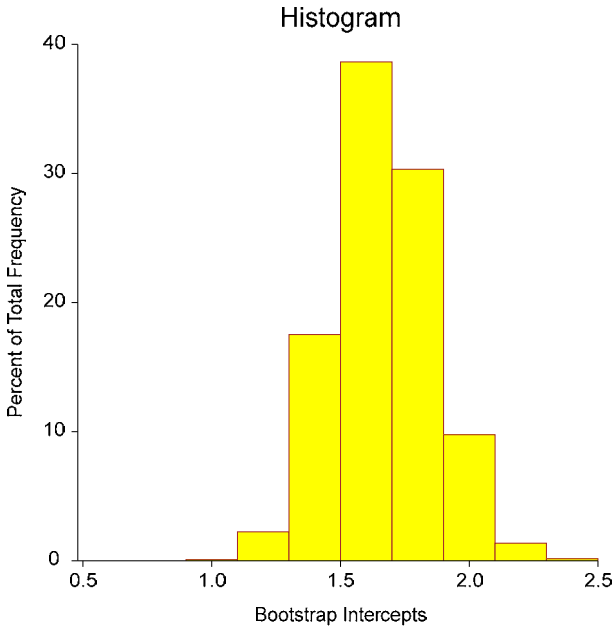
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

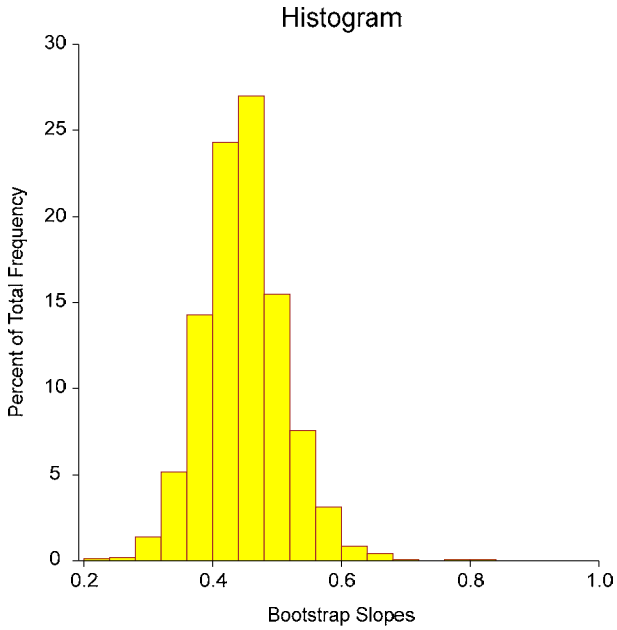
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

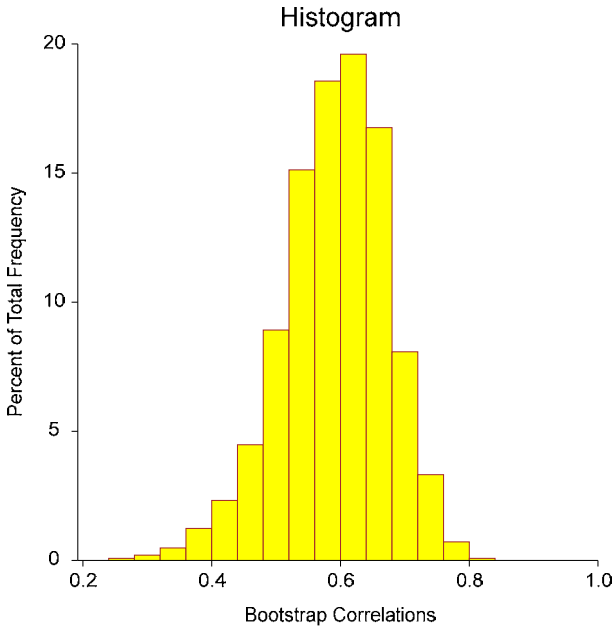
Linear Regression Report

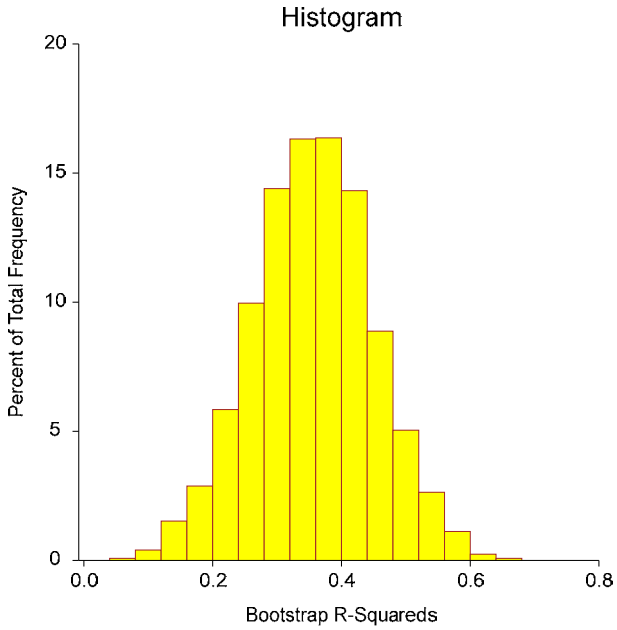
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Histograms Section



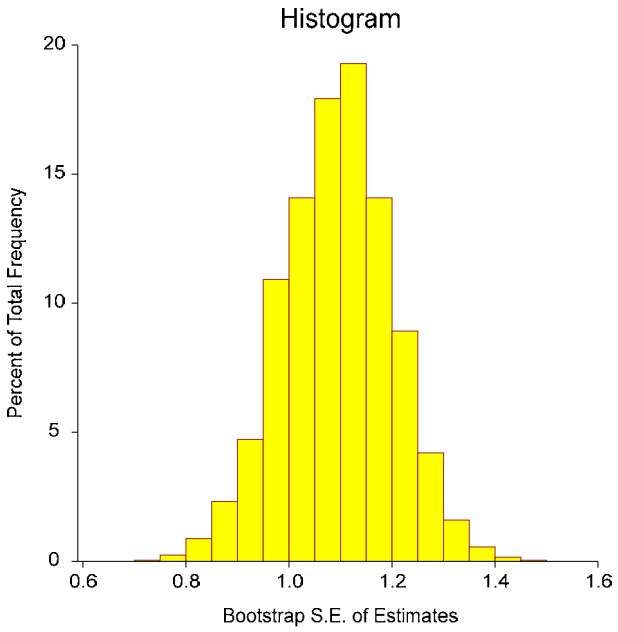


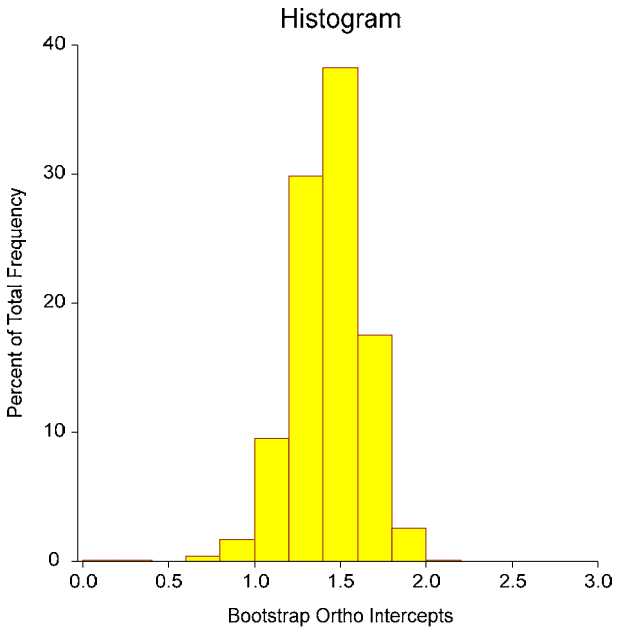


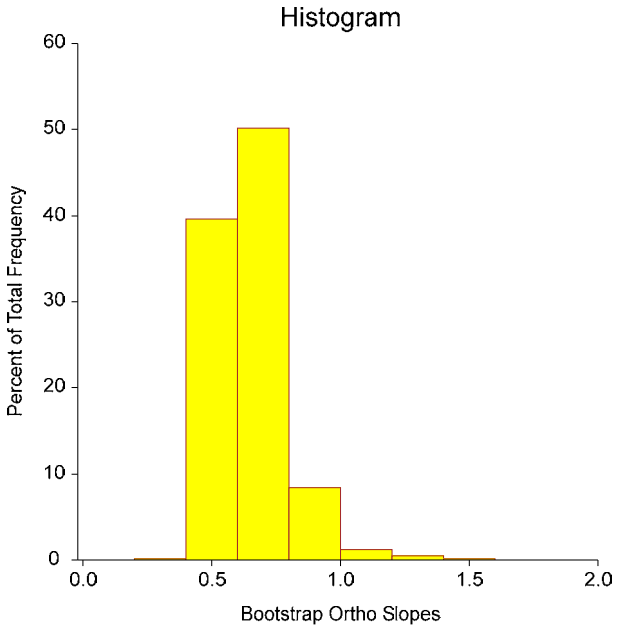


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.5926	0.3512	0.5727
Lower 95% Conf. Limit (r dist'n)	0.3480		
Upper 95% Conf. Limit (r dist'n)	0.7553		
Lower 95% Conf. Limit (Fisher's z)	0.3521		0.3254
Upper 95% Conf. Limit (Fisher's z)	0.7597		0.7467
Adjusted (Rbar)		0.3350	
T-Value for H0: Rho = 0	4.6529	4.6529	4.4186
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0001
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	198.1732	198.1732			
Slope	1	27.01089	27.01089	21.6496	0.0000	0.9950
Error	40	49.90554	1.247638			
Lack of Fit	38	41.92048	1.103171	0.2763	0.9636	
Pure Error	2	7.985058	3.992529			
Adj. Total	41	76.91644	1.876011			
Total	42	275.0897				

s = Square Root(1.247638) = 1.116977

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	48.80563	91.23199	0.03369226	-0.008504649
1	48.80563	193.3498	166.7659	-0.008504649	0.00731873
2 (Y'Y)			275.0897		
Determinant		5738.701			0.0001742555

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.04203575	-0.01061073
1	-0.01061073	0.009131129

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9609	0.159602	No
Anderson Darling	0.4614	0.259122	Yes
D'Agostino Skewness	1.2829	0.199516	No
D'Agostino Kurtosis	-0.6161	0.537834	Yes
D'Agostino Omnibus	2.0255	0.363222	Yes
Constant Residual Variance?			
Modified Levene Test	0.1298	0.720579	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	0.2763	0.963586	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

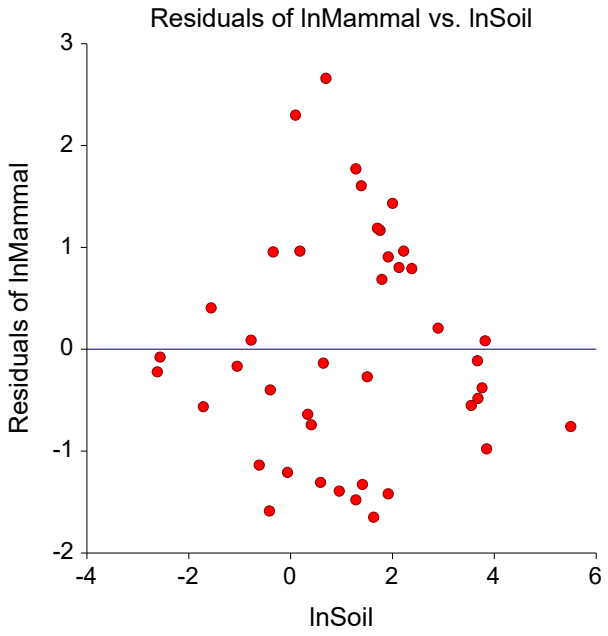
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

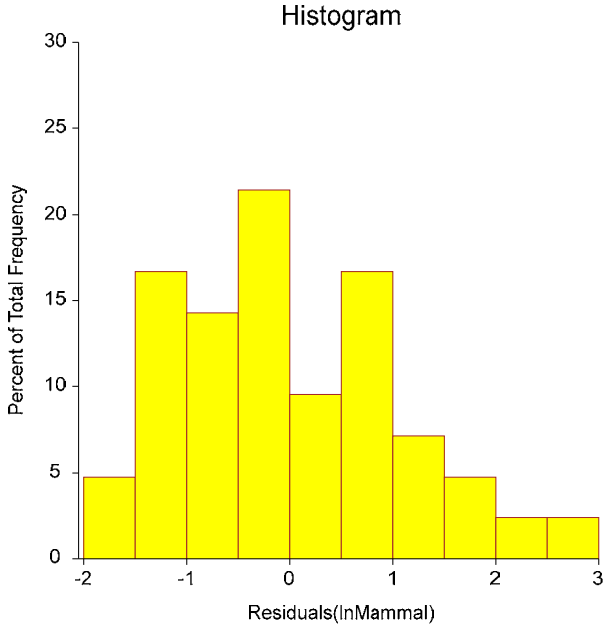
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

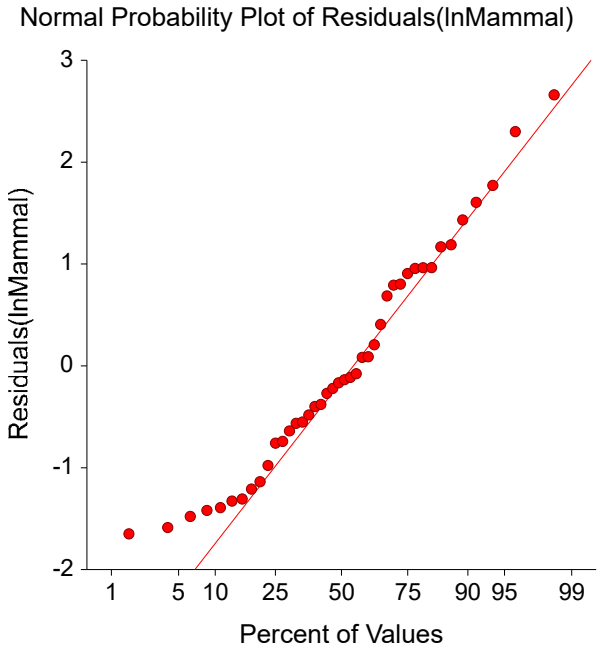
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Original Data Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual
10	5.5013	3.3429	4.1015	-0.7586
11	1.7918	3.1384	2.4522	0.6862
12	3.8480	2.3888	3.3664	-0.9777
13	0.1823	2.7007	1.7366	0.9641
14	3.6788	2.8094	3.2912	-0.4818
15	1.4110	0.9555	2.2829	-1.3274
16	-0.3425	2.4592	1.5032	0.9559
17	1.6292	0.7308	2.3799	-1.6492
18	-1.0498	1.0225	1.1888	-0.1663
19	1.2809	0.7467	2.2251	-1.4784
20	0.9555	0.6881	2.0804	-1.3922
21	-0.4155	-0.1165	1.4708	-1.5873
22	3.8199	3.4372	3.3539	0.0833
23	1.5041	2.0541	2.3243	-0.2701
24	1.7579	3.6055	2.4371	1.1684
25	1.9169	3.4144	2.5078	0.9066
26	2.2192	3.6055	2.6422	0.9633
27	2.0015	3.9782	2.5454	1.4328
28	2.3795	3.5056	2.7135	0.7920
29	1.2809	3.9964	2.2251	1.7713
30	2.8959	3.1506	2.9431	0.2075
31	3.7589	2.9481	3.3268	-0.3787
32	0.6419	1.8050	1.9409	-0.1359
33	1.3863	3.8774	2.2719	1.6055
34	-0.7765	1.3995	1.3103	0.0893
35	0.4055	1.0942	1.8358	-0.7416
36	0.5878	0.6098	1.9169	-1.3071
37	1.9169	1.0886	2.5078	-1.4193
38	0.3365	1.1663	1.8051	-0.6389
39	-0.4005	1.0784	1.4775	-0.3991
40	-0.0619	0.4187	1.6280	-1.2093
41	-1.7148	0.3293	0.8931	-0.5638
42	-1.5606	1.3678	0.9616	0.4062
43	-0.6162	0.2443	1.3816	-1.1373
44	-2.6173	0.2700	0.4918	-0.2218
45	-2.5639	0.4383	0.5155	-0.0773
46	2.1282	3.4045	2.6018	0.8027
47	0.6931	4.6240	1.9637	2.6603
48	0.0953	3.9973	1.6979	2.2994
49	3.6687	3.1739	3.2867	-0.1128
50	3.5467	2.6810	3.2325	-0.5515
51	1.7047	3.6019	2.4135	1.1884

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	5.5013	3.3429	4.1015	0.4490	3.1939	5.0090
11	1.7918	3.1384	2.4522	0.1826	2.0832	2.8211
12	3.8480	2.3888	3.3664	0.3092	2.7416	3.9913
13	0.1823	2.7007	1.7366	0.1961	1.3402	2.1330
14	3.6788	2.8094	3.2912	0.2959	2.6932	3.8892
15	1.4110	0.9555	2.2829	0.1740	1.9312	2.6345
16	-0.3425	2.4592	1.5032	0.2244	1.0496	1.9569
17	1.6292	0.7308	2.3799	0.1780	2.0201	2.7398
18	-1.0498	1.0225	1.1888	0.2727	0.6376	1.7400
19	1.2809	0.7467	2.2251	0.1727	1.8760	2.5741
20	0.9555	0.6881	2.0804	0.1735	1.7297	2.4310
21	-0.4155	-0.1165	1.4708	0.2290	1.0080	1.9336
22	3.8199	3.4372	3.3539	0.3069	2.7336	3.9743
23	1.5041	2.0541	2.3243	0.1754	1.9697	2.6788
24	1.7579	3.6055	2.4371	0.1815	2.0702	2.8040
25	1.9169	3.4144	2.5078	0.1868	2.1302	2.8854
26	2.2192	3.6055	2.6422	0.1998	2.2385	3.0460
27	2.0015	3.9782	2.5454	0.1901	2.1612	2.9296
28	2.3795	3.5056	2.7135	0.2079	2.2932	3.1338
29	1.2809	3.9964	2.2251	0.1727	1.8760	2.5741
30	2.8959	3.1506	2.9431	0.2391	2.4599	3.4263
31	3.7589	2.9481	3.3268	0.3021	2.7162	3.9374
32	0.6419	1.8050	1.9409	0.1794	1.5784	2.3034
33	1.3863	3.8774	2.2719	0.1737	1.9209	2.6229
34	-0.7765	1.3995	1.3103	0.2530	0.7989	1.8216
35	0.4055	1.0942	1.8358	0.1869	1.4581	2.2135
36	0.5878	0.6098	1.9169	0.1809	1.5513	2.2824
37	1.9169	1.0886	2.5078	0.1868	2.1302	2.8854
38	0.3365	1.1663	1.8051	0.1895	1.4220	2.1882
39	-0.4005	1.0784	1.4775	0.2280	1.0166	1.9383
40	-0.0619	0.4187	1.6280	0.2083	1.2071	2.0490
41	-1.7148	0.3293	0.8931	0.3245	0.2373	1.5489
42	-1.5606	1.3678	0.9616	0.3121	0.3309	1.5924
43	-0.6162	0.2443	1.3816	0.2420	0.8924	1.8707
44	-2.6173	0.2700	0.4918	0.4002	-0.3169	1.3006
45	-2.5639	0.4383	0.5155	0.3956	-0.2839	1.3150
46	2.1282	3.4045	2.6018	0.1955	2.2066	2.9969
47	0.6931	4.6240	1.9637	0.1781	1.6038	2.3236
48	0.0953	3.9973	1.6979	0.2002	1.2932	2.1026
49	3.6687	3.1739	3.2867	0.2951	2.6903	3.8831
50	3.5467	2.6810	3.2325	0.2857	2.6550	3.8099
51	1.7047	3.6019	2.4135	0.1800	2.0497	2.7773

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	5.5013	3.3429	4.1015	1.2039	1.6684	6.5346
11	1.7918	3.1384	2.4522	1.1318	0.1647	4.7396
12	3.8480	2.3888	3.3664	1.1590	1.0241	5.7088
13	0.1823	2.7007	1.7366	1.1341	-0.5554	4.0286
14	3.6788	2.8094	3.2912	1.1555	0.9558	5.6266
15	1.4110	0.9555	2.2829	1.1304	-0.0018	4.5676
16	-0.3425	2.4592	1.5032	1.1393	-0.7994	3.8059
17	1.6292	0.7308	2.3799	1.1311	0.0939	4.6659
18	-1.0498	1.0225	1.1888	1.1498	-1.1351	3.5126
19	1.2809	0.7467	2.2251	1.1303	-0.0593	4.5094
20	0.9555	0.6881	2.0804	1.1304	-0.2042	4.3649
21	-0.4155	-0.1165	1.4708	1.1402	-0.8337	3.7752
22	3.8199	3.4372	3.3539	1.1584	1.0127	5.6951
23	1.5041	2.0541	2.3243	1.1307	0.0391	4.6094
24	1.7579	3.6055	2.4371	1.1316	0.1500	4.7242
25	1.9169	3.4144	2.5078	1.1325	0.2190	4.7967
26	2.2192	3.6055	2.6422	1.1347	0.3489	4.9355
27	2.0015	3.9782	2.5454	1.1330	0.2555	4.8354
28	2.3795	3.5056	2.7135	1.1362	0.4172	5.0098
29	1.2809	3.9964	2.2251	1.1303	-0.0593	4.5094
30	2.8959	3.1506	2.9431	1.1423	0.6345	5.2517
31	3.7589	2.9481	3.3268	1.1571	0.9882	5.6654
32	0.6419	1.8050	1.9409	1.1313	-0.3455	4.2273
33	1.3863	3.8774	2.2719	1.1304	-0.0127	4.5565
34	-0.7765	1.3995	1.3103	1.1453	-1.0044	3.6250
35	0.4055	1.0942	1.8358	1.1325	-0.4531	4.1247
36	0.5878	0.6098	1.9169	1.1315	-0.3700	4.2038
37	1.9169	1.0886	2.5078	1.1325	0.2190	4.7967
38	0.3365	1.1663	1.8051	1.1329	-0.4846	4.0949
39	-0.4005	1.0784	1.4775	1.1400	-0.8266	3.7815
40	-0.0619	0.4187	1.6280	1.1362	-0.6684	3.9244
41	-1.7148	0.3293	0.8931	1.1631	-1.4577	3.2439
42	-1.5606	1.3678	0.9616	1.1598	-1.3823	3.3056
43	-0.6162	0.2443	1.3816	1.1429	-0.9283	3.6914
44	-2.6173	0.2700	0.4918	1.1865	-1.9062	2.8898
45	-2.5639	0.4383	0.5155	1.1850	-1.8793	2.9104
46	2.1282	3.4045	2.6018	1.1340	0.3100	4.8936
47	0.6931	4.6240	1.9637	1.1311	-0.3223	4.2497
48	0.0953	3.9973	1.6979	1.1348	-0.5956	3.9914
49	3.6687	3.1739	3.2867	1.1553	0.9517	5.6216
50	3.5467	2.6810	3.2325	1.1529	0.9023	5.5627
51	1.7047	3.6019	2.4135	1.1314	0.1269	4.7001

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	5.5013	3.3429	4.1015	0.4490	2.8233	5.3796
11	1.7918	3.1384	2.4522	0.1826	1.9325	2.9718
12	3.8480	2.3888	3.3664	0.3092	2.4864	4.2464
13	0.1823	2.7007	1.7366	0.1961	1.1783	2.2949
14	3.6788	2.8094	3.2912	0.2959	2.4490	4.1334
15	1.4110	0.9555	2.2829	0.1740	1.7876	2.7781
16	-0.3425	2.4592	1.5032	0.2244	0.8644	2.1421
17	1.6292	0.7308	2.3799	0.1780	1.8731	2.8867
18	-1.0498	1.0225	1.1888	0.2727	0.4125	1.9650
19	1.2809	0.7467	2.2251	0.1727	1.7334	2.7167
20	0.9555	0.6881	2.0804	0.1735	1.5866	2.5742
21	-0.4155	-0.1165	1.4708	0.2290	0.8190	2.1225
22	3.8199	3.4372	3.3539	0.3069	2.4803	4.2276
23	1.5041	2.0541	2.3243	0.1754	1.8249	2.8236
24	1.7579	3.6055	2.4371	0.1815	1.9204	2.9538
25	1.9169	3.4144	2.5078	0.1868	1.9760	3.0396
26	2.2192	3.6055	2.6422	0.1998	2.0736	3.2109
27	2.0015	3.9782	2.5454	0.1901	2.0043	3.0865
28	2.3795	3.5056	2.7135	0.2079	2.1216	3.3054
29	1.2809	3.9964	2.2251	0.1727	1.7334	2.7167
30	2.8959	3.1506	2.9431	0.2391	2.2626	3.6236
31	3.7589	2.9481	3.3268	0.3021	2.4668	4.1868
32	0.6419	1.8050	1.9409	0.1794	1.4303	2.4515
33	1.3863	3.8774	2.2719	0.1737	1.7775	2.7663
34	-0.7765	1.3995	1.3103	0.2530	0.5901	2.0305
35	0.4055	1.0942	1.8358	0.1869	1.3038	2.3678
36	0.5878	0.6098	1.9169	0.1809	1.4020	2.4317
37	1.9169	1.0886	2.5078	0.1868	1.9760	3.0396
38	0.3365	1.1663	1.8051	0.1895	1.2656	2.3447
39	-0.4005	1.0784	1.4775	0.2280	0.8284	2.1265
40	-0.0619	0.4187	1.6280	0.2083	1.0351	2.2209
41	-1.7148	0.3293	0.8931	0.3245	-0.0305	1.8166
42	-1.5606	1.3678	0.9616	0.3121	0.0733	1.8499
43	-0.6162	0.2443	1.3816	0.2420	0.6926	2.0705
44	-2.6173	0.2700	0.4918	0.4002	-0.6472	1.6308
45	-2.5639	0.4383	0.5155	0.3956	-0.6104	1.6415
46	2.1282	3.4045	2.6018	0.1955	2.0452	3.1583
47	0.6931	4.6240	1.9637	0.1781	1.4568	2.4706
48	0.0953	3.9973	1.6979	0.2002	1.1279	2.2679
49	3.6687	3.1739	3.2867	0.2951	2.4467	4.1266
50	3.5467	2.6810	3.2325	0.2857	2.4192	4.0457
51	1.7047	3.6019	2.4135	0.1800	1.9012	2.9258

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	5.5013	3.3429	4.1015	-0.7586	-0.7418	22.6939
11	1.7918	3.1384	2.4522	0.6862	0.6227	21.8651
12	3.8480	2.3888	3.3664	-0.9777	-0.9109	40.9276
13	0.1823	2.7007	1.7366	0.9641	0.8768	35.6983
14	3.6788	2.8094	3.2912	-0.4818	-0.4473	17.1495
15	1.4110	0.9555	2.2829	-1.3274	-1.2030	138.9168
16	-0.3425	2.4592	1.5032	0.9559	0.8736	38.8715
17	1.6292	0.7308	2.3799	-1.6492	-1.4956	225.6751
18	-1.0498	1.0225	1.1888	-0.1663	-0.1535	16.2654
19	1.2809	0.7467	2.2251	-1.4784	-1.3397	197.9897
20	0.9555	0.6881	2.0804	-1.3922	-1.2617	202.3194
21	-0.4155	-0.1165	1.4708	-1.5873	-1.4519	1362.1062
22	3.8199	3.4372	3.3539	0.0833	0.0775	2.4229
23	1.5041	2.0541	2.3243	-0.2701	-0.2449	13.1513
24	1.7579	3.6055	2.4371	1.1684	1.0601	32.4059
25	1.9169	3.4144	2.5078	0.9066	0.8233	26.5524
26	2.2192	3.6055	2.6422	0.9633	0.8765	26.7168
27	2.0015	3.9782	2.5454	1.4328	1.3018	36.0165
28	2.3795	3.5056	2.7135	0.7920	0.7217	22.5939
29	1.2809	3.9964	2.2251	1.7713	1.6051	44.3231
30	2.8959	3.1506	2.9431	0.2075	0.1902	6.5859
31	3.7589	2.9481	3.3268	-0.3787	-0.3521	12.8446
32	0.6419	1.8050	1.9409	-0.1359	-0.1233	7.5292
33	1.3863	3.8774	2.2719	1.6055	1.4551	41.4071
34	-0.7765	1.3995	1.3103	0.0893	0.0821	6.3787
35	0.4055	1.0942	1.8358	-0.7416	-0.6735	67.7823
36	0.5878	0.6098	1.9169	-1.3071	-1.1859	214.3613
37	1.9169	1.0886	2.5078	-1.4193	-1.2888	130.3797
38	0.3365	1.1663	1.8051	-0.6389	-0.5804	54.7778
39	-0.4005	1.0784	1.4775	-0.3991	-0.3650	37.0042
40	-0.0619	0.4187	1.6280	-1.2093	-1.1020	288.8166
41	-1.7148	0.3293	0.8931	-0.5638	-0.5275	171.2072
42	-1.5606	1.3678	0.9616	0.4062	0.3787	29.6944
43	-0.6162	0.2443	1.3816	-1.1373	-1.0430	465.6272
44	-2.6173	0.2700	0.4918	-0.2218	-0.2127	82.1405
45	-2.5639	0.4383	0.5155	-0.0773	-0.0740	17.6364
46	2.1282	3.4045	2.6018	0.8027	0.7299	23.5789
47	0.6931	4.6240	1.9637	2.6603	2.4125	57.5321
48	0.0953	3.9973	1.6979	2.2994	2.0925	57.5236
49	3.6687	3.1739	3.2867	-0.1128	-0.1047	3.5543
50	3.5467	2.6810	3.2325	-0.5515	-0.5107	20.5687
51	1.7047	3.6019	2.4135	1.1884	1.0780	32.9934

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	5.5013	-0.7586	*-0.7375	0.1616	0.0530	1.2620
11	1.7918	0.6862	0.6179	0.0267	0.0053	1.2672
12	3.8480	-0.9777	-0.9089	0.0766	0.0344	1.2531
13	0.1823	0.9641	0.8742	0.0308	0.0122	1.2550
14	3.6788	-0.4818	-0.4428	0.0702	0.0075	1.2732
15	1.4110	-1.3274	-1.2100	0.0243	0.0180	1.2333
16	-0.3425	0.9559	0.8710	0.0404	0.0161	1.2552
17	1.6292	-1.6492	-1.5199	0.0254	0.0292	1.2081
18	-1.0498	-0.1663	-0.1516	0.0596	0.0007	1.2789
19	1.2809	-1.4784	-1.3535	0.0239	0.0220	1.2222
20	0.9555	-1.3922	-1.2714	0.0241	0.0197	1.2287
21	-0.4155	-1.5873	-1.4730	0.0420	0.0462	1.2122
22	3.8199	0.0833	0.0766	0.0755	0.0002	1.2794
23	1.5041	-0.2701	-0.2420	0.0247	0.0008	1.2777
24	1.7579	1.1684	1.0618	0.0264	0.0152	1.2437
25	1.9169	0.9066	0.8199	0.0280	0.0098	1.2579
26	2.2192	0.9633	0.8739	0.0320	0.0127	1.2551
27	2.0015	1.4328	1.3135	0.0290	0.0253	1.2254
28	2.3795	0.7920	0.7173	0.0347	0.0094	1.2630
29	1.2809	1.7713	1.6386	0.0239	0.0316	1.1972
30	2.8959	0.2075	0.1879	0.0458	0.0009	1.2785
31	3.7589	-0.3787	-0.3483	0.0732	0.0049	1.2757
32	0.6419	-0.1359	-0.1217	0.0258	0.0002	1.2791
33	1.3863	1.6055	1.4764	0.0242	0.0262	1.2119
34	-0.7765	0.0893	0.0810	0.0513	0.0002	1.2794
35	0.4055	-0.7416	-0.6688	0.0280	0.0065	1.2651
36	0.5878	-1.3071	-1.1921	0.0262	0.0189	1.2346
37	1.9169	-1.4193	-1.2998	0.0280	0.0239	1.2265
38	0.3365	-0.6389	-0.5755	0.0288	0.0050	1.2689
39	-0.4005	-0.3991	-0.3610	0.0417	0.0029	1.2754
40	-0.0619	-1.2093	-1.1050	0.0348	0.0219	1.2408
41	-1.7148	-0.5638	-0.5227	0.0844	0.0128	1.2707
42	-1.5606	0.4062	0.3746	0.0781	0.0061	1.2750
43	-0.6162	-1.1373	-1.0442	0.0470	0.0268	1.2448
44	-2.6173	-0.2218	*-0.2101	0.1283	0.0033	1.2782
45	-2.5639	-0.0773	*-0.0731	0.1254	0.0004	1.2795
46	2.1282	0.8027	0.7256	0.0306	0.0084	1.2626
47	0.6931	2.6603	*2.5770	0.0254	0.0759	1.0934
48	0.0953	2.2994	*2.1895	0.0321	0.0727	1.1396
49	3.6687	-0.1128	-0.1034	0.0698	0.0004	1.2793
50	3.5467	-0.5515	-0.5059	0.0654	0.0091	1.2713
51	1.7047	1.1884	1.0803	0.0260	0.0155	1.2425

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.7375	-0.3238	0.0530	* 1.2204	0.0575	-0.2990
11	0.6179	0.1024	0.0053	1.0600	0.0630	0.0337
12	-0.9089	-0.2618	0.0344	1.0924	-0.0050	-0.2173
13	0.8742	0.1559	0.0122	1.0441	0.1555	-0.0744
14	-0.4428	-0.1216	0.0075	1.1200	-0.0060	-0.0989
15	-1.2100	-0.1908	0.0180	1.0015	-0.1448	-0.0261
16	0.8710	0.1787	0.0161	1.0548	0.1773	-0.1144
17	-1.5199	-0.2454	0.0292	0.9620	-0.1664	-0.0615
18	-0.1516	-0.0382	0.0007	1.1173	-0.0363	0.0296
19	-1.3535	-0.2119	0.0220	0.9832	-0.1702	-0.0139
20	-1.2714	-0.1999	0.0197	0.9938	-0.1793	0.0227
21	-1.4730	-0.3085	0.0462	0.9854	-0.3052	0.2031
22	0.0766	0.0219	0.0002	1.1375	0.0005	0.0181
23	-0.2420	-0.0385	0.0008	1.0753	-0.0279	-0.0072
24	1.0618	0.1749	0.0152	1.0206	0.1099	0.0549
25	0.8199	0.1391	0.0098	1.0459	0.0788	0.0537
26	0.8739	0.1589	0.0127	1.0454	0.0717	0.0803
27	1.3135	0.2269	0.0253	0.9935	0.1211	0.0957
28	0.7173	0.1359	0.0094	1.0615	0.0535	0.0760
29	1.6386	0.2565	0.0316	0.9434	0.2060	0.0169
30	0.1879	0.0412	0.0009	1.1005	0.0095	0.0285
31	-0.3483	-0.0978	0.0049	1.1280	-0.0034	-0.0804
32	-0.1217	-0.0198	0.0002	1.0790	-0.0190	0.0055
33	1.4764	0.2324	0.0262	0.9669	0.1783	0.0287
34	0.0810	0.0188	0.0002	1.1085	0.0183	-0.0138
35	-0.6688	-0.1135	0.0065	1.0578	-0.1118	0.0439
36	-1.1921	-0.1956	0.0189	1.0056	-0.1888	0.0593
37	-1.2998	-0.2205	0.0239	0.9942	-0.1249	-0.0851
38	-0.5755	-0.0991	0.0050	1.0650	-0.0981	0.0412
39	-0.3610	-0.0753	0.0029	1.0904	-0.0745	0.0493
40	-1.1050	-0.2097	0.0219	1.0247	-0.2097	0.1178
41	-0.5227	-0.1587	0.0128	1.1330	-0.1437	0.1344
42	0.3746	0.1090	0.0061	1.1328	0.0998	-0.0909
43	-1.0442	-0.2318	0.0268	1.0445	-0.2269	0.1627
44	-0.2101	-0.0806	0.0033	* 1.2041	-0.0686	0.0728
45	-0.0731	-0.0277	0.0004	* 1.2025	-0.0236	0.0249
46	0.7256	0.1290	0.0084	1.0565	0.0626	0.0609
47	* 2.5770	0.4162	0.0759	0.7881	0.3953	-0.1047
48	* 2.1895	0.3990	0.0727	0.8620	0.3987	-0.2031
49	-0.1034	-0.0283	0.0004	1.1302	-0.0015	-0.0230
50	-0.5059	-0.1339	0.0091	1.1110	-0.0101	-0.1068
51	1.0803	0.1764	0.0155	1.0181	0.1145	0.0508

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
10	5.5013	-0.7586	|||.....	-0.7418	||||.....	-0.7375	|||.....
11	1.7918	0.6862	|||.....	0.6227	|||.....	0.6179	|||.....
12	3.8480	-0.9777	|||||.....	-0.9109	|||||.....	-0.9089	|||||.....
13	0.1823	0.9641	|||||.....	0.8768	|||||.....	0.8742	||||.....
14	3.6788	-0.4818	||.....	-0.4473	||.....	-0.4428	||.....
15	1.4110	-1.3274	|||||||.....	-1.2030	|||||||.....	-1.2100	||||||.....
16	-0.3425	0.9559	|||||.....	0.8736	|||||.....	0.8710	||||.....
17	1.6292	-1.6492	||||||||.....	-1.4956	||||||||.....	-1.5199	|||||||.....
18	-1.0498	-0.1663	|.....	-0.1535	|.....	-0.1516	|.....
19	1.2809	-1.4784	|||||||.....	-1.3397	|||||||.....	-1.3535	||||||.....
20	0.9555	-1.3922	|||||||.....	-1.2617	|||||||.....	-1.2714	||||||.....
21	-0.4155	-1.5873	|||||||.....	-1.4519	|||||||.....	-1.4730	|||||||.....
22	3.8199	0.0833	|.....	0.0775	|.....	0.0766	|.....
23	1.5041	-0.2701	|.....	-0.2449	|.....	-0.2420	|.....
24	1.7579	1.1684	|||||.....	1.0601	|||||.....	1.0618	||||.....
25	1.9169	0.9066	||||.....	0.8233	||||.....	0.8199	||||.....
26	2.2192	0.9633	|||||.....	0.8765	|||||.....	0.8739	||||.....
27	2.0015	1.4328	|||||||.....	1.3018	|||||||.....	1.3135	|||||||.....
28	2.3795	0.7920	||||.....	0.7217	||||.....	0.7173	|||.....
29	1.2809	1.7713	||||||||.....	1.6051	||||||||.....	1.6386	||||||||.....
30	2.8959	0.2075	|.....	0.1902	|.....	0.1879	|.....
31	3.7589	-0.3787	|.....	-0.3521	|.....	-0.3483	|.....
32	0.6419	-0.1359	|.....	-0.1233	|.....	-0.1217	|.....
33	1.3863	1.6055	|||||||.....	1.4551	|||||||.....	1.4764	|||||||.....
34	-0.7765	0.0893	|.....	0.0821	|.....	0.0810	|.....
35	0.4055	-0.7416	|||.....	-0.6735	|||.....	-0.6688	|||.....
36	0.5878	-1.3071	|||||||.....	-1.1859	|||||||.....	-1.1921	||||||.....
37	1.9169	-1.4193	|||||||.....	-1.2888	|||||||.....	-1.2998	|||||||.....
38	0.3365	-0.6389	|||.....	-0.5804	|||.....	-0.5755	|||.....
39	-0.4005	-0.3991	|.....	-0.3650	|.....	-0.3610	|.....
40	-0.0619	-1.2093	||||||.....	-1.1020	||||||.....	-1.1050	||||||.....
41	-1.7148	-0.5638	||.....	-0.5275	||.....	-0.5227	||.....
42	-1.5606	0.4062	|.....	0.3787	|.....	0.3746	|.....
43	-0.6162	-1.1373	||||||.....	-1.0430	||||||.....	-1.0442	|||||.....
44	-2.6173	-0.2218	|.....	-0.2127	|.....	-0.2101	|.....
45	-2.5639	-0.0773	|.....	-0.0740	|.....	-0.0731	|.....
46	2.1282	0.8027	||||.....	0.7299	||||.....	0.7256	|||.....
47	0.6931	2.6603	|||||||||||||||	2.4125	||||||||||||||	* 2.5770	||||||||||||||
48	0.0953	2.2994	|||||||||||...	2.0925	|||||||||||...	* 2.1895	|||||||||||...
49	3.6687	-0.1128	|.....	-0.1047	|.....	-0.1034	|.....
50	3.5467	-0.5515	||.....	-0.5107	||.....	-0.5059	||.....
51	1.7047	1.1884	||||||.....	1.0780	||||||.....	1.0803	||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
10	5.5013	-0.3238	||||||||||....	0.0530	|||||||||.....	-0.2990	|||||||||||||
11	1.7918	0.1024	|||.....	0.0053	|.....	0.0337	|.....
12	3.8480	-0.2618	||||||||.....	0.0344	||||||.....	-0.2173	|||||||||.....
13	0.1823	0.1559	|||||.....	0.0122	||.....	-0.0744	|||.....
14	3.6788	-0.1216	|||.....	0.0075	|.....	-0.0989	||||.....
15	1.4110	-0.1908	||||||.....	0.0180	|||.....	-0.0261	|.....
16	-0.3425	0.1787	||||||.....	0.0161	|||.....	-0.1144	|||||.....
17	1.6292	-0.2454	|||||||.....	0.0292	|||||.....	-0.0615	||.....
18	-1.0498	-0.0382	|.....	0.0007	|.....	0.0296	|.....
19	1.2809	-0.2119	|||||||.....	0.0220	||||.....	-0.0139	|.....
20	0.9555	-0.1999	||||||.....	0.0197	|||.....	0.0227	|.....
21	-0.4155	-0.3085	|||||||||.....	0.0462	||||||||.....	0.2031	|||||||||.....
22	3.8199	0.0219	|.....	0.0002	|.....	0.0181	|.....
23	1.5041	-0.0385	|.....	0.0008	|.....	-0.0072	|.....
24	1.7579	0.1749	|||||.....	0.0152	||.....	0.0549	||.....
25	1.9169	0.1391	||||.....	0.0098	|.....	0.0537	||.....
26	2.2192	0.1589	|||||.....	0.0127	||.....	0.0803	|||.....
27	2.0015	0.2269	|||||||.....	0.0253	||||.....	0.0957	||||.....
28	2.3795	0.1359	||||.....	0.0094	|.....	0.0760	|||.....
29	1.2809	0.2565	|||||||.....	0.0316	||||||.....	0.0169	|.....
30	2.8959	0.0412	|.....	0.0009	|.....	0.0285	|.....
31	3.7589	-0.0978	||.....	0.0049	|.....	-0.0804	|||.....
32	0.6419	-0.0198	|.....	0.0002	|.....	0.0055	|.....
33	1.3863	0.2324	|||||||.....	0.0262	|||||.....	0.0287	|.....
34	-0.7765	0.0188	|.....	0.0002	|.....	-0.0138	|.....
35	0.4055	-0.1135	|||.....	0.0065	|.....	0.0439	|.....
36	0.5878	-0.1956	||||||.....	0.0189	|||.....	0.0593	||.....
37	1.9169	-0.2205	|||||||.....	0.0239	||||.....	-0.0851	||||.....
38	0.3365	-0.0991	|||.....	0.0050	|.....	0.0412	|.....
39	-0.4005	-0.0753	||.....	0.0029	|.....	0.0493	||.....
40	-0.0619	-0.2097	|||||||.....	0.0219	||||.....	0.1178	|||||.....
41	-1.7148	-0.1587	|||||.....	0.0128	||.....	0.1344	||||||.....
42	-1.5606	0.1090	|||.....	0.0061	|.....	-0.0909	||||.....
43	-0.6162	-0.2318	||||||||.....	0.0268	|||||.....	0.1627	||||||||.....
44	-2.6173	-0.0806	||.....	0.0033	|.....	0.0728	|||.....
45	-2.5639	-0.0277	|.....	0.0004	|.....	0.0249	|.....
46	2.1282	0.1290	||||.....	0.0084	|.....	0.0609	||.....
47	0.6931	0.4162	|||||||||||||||	0.0759	|||||||||||||||	-0.1047	|||||.....
48	0.0953	0.3990	||||||||||||||.	0.0727	||||||||||||||.	-0.2031	|||||||||.....
49	3.6687	-0.0283	|.....	0.0004	|.....	-0.0230	|.....
50	3.5467	-0.1339	||||.....	0.0091	|.....	-0.1068	|||||.....
51	1.7047	0.1764	|||||.....	0.0155	|||.....	0.0508	||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	5.5013	-0.7375	|||.....	0.0530	|||||||||.....	0.1616	||||||||||||||
11	1.7918	0.6179	|||.....	0.0053	|.....	0.0267	|.....
12	3.8480	-0.9089	|||||.....	0.0344	|||||.....	0.0766	|||||.....
13	0.1823	0.8742	||||.....	0.0122	||.....	0.0308	|.....
14	3.6788	-0.4428	||.....	0.0075	|.....	0.0702	|||||.....
15	1.4110	-1.2100	||||||.....	0.0180	|||.....	0.0243	|.....
16	-0.3425	0.8710	||||.....	0.0161	|||.....	0.0404	|.....
17	1.6292	-1.5199	||||||||.....	0.0292	|||||.....	0.0254	|.....
18	-1.0498	-0.1516	|.....	0.0007	|.....	0.0596	|||.....
19	1.2809	-1.3535	|||||||.....	0.0220	||||.....	0.0239	|.....
20	0.9555	-1.2714	|||||||.....	0.0197	|||.....	0.0241	|.....
21	-0.4155	-1.4730	||||||||.....	0.0462	||||||||.....	0.0420	|.....
22	3.8199	0.0766	|.....	0.0002	|.....	0.0755	|||||.....
23	1.5041	-0.2420	|.....	0.0008	|.....	0.0247	|.....
24	1.7579	1.0618	|||||.....	0.0152	||.....	0.0264	|.....
25	1.9169	0.8199	||||.....	0.0098	|.....	0.0280	|.....
26	2.2192	0.8739	||||.....	0.0127	||.....	0.0320	|.....
27	2.0015	1.3135	|||||||.....	0.0253	||||.....	0.0290	|.....
28	2.3795	0.7173	|||.....	0.0094	|.....	0.0347	|.....
29	1.2809	1.6386	|||||||||.....	0.0316	||||||.....	0.0239	|.....
30	2.8959	0.1879	|.....	0.0009	|.....	0.0458	||.....
31	3.7589	-0.3483	|.....	0.0049	|.....	0.0732	|||||.....
32	0.6419	-0.1217	|.....	0.0002	|.....	0.0258	|.....
33	1.3863	1.4764	||||||||.....	0.0262	|||||.....	0.0242	|.....
34	-0.7765	0.0810	|.....	0.0002	|.....	0.0513	||.....
35	0.4055	-0.6688	|||.....	0.0065	|.....	0.0280	|.....
36	0.5878	-1.1921	||||||.....	0.0189	|||.....	0.0262	|.....
37	1.9169	-1.2998	|||||||.....	0.0239	||||.....	0.0280	|.....
38	0.3365	-0.5755	|||.....	0.0050	|.....	0.0288	|.....
39	-0.4005	-0.3610	|.....	0.0029	|.....	0.0417	|.....
40	-0.0619	-1.1050	||||||.....	0.0219	||||.....	0.0348	|.....
41	-1.7148	-0.5227	||.....	0.0128	||.....	0.0844	||||||.....
42	-1.5606	0.3746	|.....	0.0061	|.....	0.0781	|||||.....
43	-0.6162	-1.0442	|||||.....	0.0268	|||||.....	0.0470	||.....
44	-2.6173	-0.2101	|.....	0.0033	|.....	0.1283	||||||||||....
45	-2.5639	-0.0731	|.....	0.0004	|.....	0.1254	||||||||||....
46	2.1282	0.7256	|||.....	0.0084	|.....	0.0306	|.....
47	0.6931	* 2.5770	||||||||||||||	0.0759	||||||||||||||	0.0254	|.....
48	0.0953	* 2.1895	|||||||||||...	0.0727	|||||||||||||.	0.0321	|.....
49	3.6687	-0.1034	|.....	0.0004	|.....	0.0698	||||.....
50	3.5467	-0.5059	||.....	0.0091	|.....	0.0654	||||.....
51	1.7047	1.0803	||||||.....	0.0155	|||.....	0.0260	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Means

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.3429	5.5013	3.7950	1.7062	2.7509	6.0637
11	3.1384	1.7918	3.3351	-1.5434	2.3879	5.2931
12	2.3888	3.8480	1.6491	2.1989	0.8544	2.6705
13	2.7007	0.1823	2.3507	-2.1684	1.5494	3.7049
14	2.8094	3.6788	2.5952	1.0836	1.7686	4.0884
15	0.9555	1.4110	-1.5744	2.9854	-3.9146	-0.5070
16	2.4592	-0.3425	1.8075	-2.1500	1.0216	2.8935
17	0.7308	1.6292	-2.0799	3.7091	-4.7752	-0.8924
18	1.0225	-1.0498	-1.4239	0.3740	-3.6602	-0.3902
19	0.7467	1.2809	-2.0441	3.3250	-4.7140	-0.8654
20	0.6881	0.9555	-2.1758	3.1313	-4.9394	-0.9646
21	-0.1165	-0.4155	-3.9856	3.5701	-8.0726	-2.2927
22	3.4372	3.8199	4.0072	-0.1873	2.9148	6.4230
23	2.0541	1.5041	0.8965	0.6076	-0.0466	1.7161
24	3.6055	1.7579	4.3857	-2.6279	3.2027	7.0681
25	3.4144	1.9169	3.9560	-2.0391	2.8754	6.3361
26	3.6055	2.2192	4.3857	-2.1665	3.2027	7.0681
27	3.9782	2.0015	5.2241	-3.2226	3.8265	8.5109
28	3.5056	2.3795	4.1609	-1.7814	3.0323	6.6844
29	3.9964	1.2809	5.2648	-3.9839	3.8564	8.5814
30	3.1506	2.8959	3.3626	-0.4667	2.4099	5.3388
31	2.9481	3.7589	2.9072	0.8517	2.0365	4.5895
32	1.8050	0.6419	0.3362	0.3057	-0.8316	1.1199
33	3.8774	1.3863	4.9973	-3.6110	3.6593	8.1192
34	1.3995	-0.7765	-0.5757	-0.2008	-2.2535	0.2938
35	1.0942	0.4055	-1.2626	1.6681	-3.3890	-0.2639
36	0.6098	0.5878	-2.3520	2.9398	-5.2420	-1.0965
37	1.0886	1.9169	-1.2752	3.1921	-3.4101	-0.2738
38	1.1663	0.3365	-1.1004	1.4369	-3.1177	-0.1353
39	1.0784	-0.4005	-1.2980	0.8975	-3.4484	-0.2917
40	0.4187	-0.0619	-2.7817	2.7199	-5.9824	-1.4153
41	0.3293	-1.7148	-2.9828	1.2680	-6.3302	-1.5633
42	1.3678	-1.5606	-0.6472	-0.9135	-2.3697	0.2339
43	0.2443	-0.6162	-3.1741	2.5579	-6.6616	-1.7034
44	0.2700	-2.6173	-3.1162	0.4989	-6.5611	-1.6610
45	0.4383	-2.5639	-2.7378	0.1738	-5.9065	-1.3829
46	3.4045	2.1282	3.9337	-1.8055	2.8582	6.2983
47	4.6240	0.6931	6.6764	-5.9833	4.8811	11.0366
48	3.9973	0.0953	5.2669	-5.1716	3.8580	8.5850
49	3.1739	3.6687	3.4150	0.2537	2.4518	5.4260
50	2.6810	3.5467	2.3065	1.2403	1.5087	3.6365
51	3.6019	1.7047	4.3776	-2.6728	3.1966	7.0541

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Individuals

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.3429	5.5013	3.7950	1.7062	-1.4679	10.2826
11	3.1384	1.7918	3.3351	-1.5434	-1.9806	9.6616
12	2.3888	3.8480	1.6491	2.1989	-3.9472	7.4720
13	2.7007	0.1823	2.3507	-2.1684	-3.1119	8.3662
14	2.8094	3.6788	2.5952	1.0836	-2.8265	8.6835
15	0.9555	1.4110	-1.5744	2.9854	-8.0996	3.6780
16	2.4592	-0.3425	1.8075	-2.1500	-3.7565	7.6717
17	0.7308	1.6292	-2.0799	3.7091	-8.7957	3.1281
18	1.0225	-1.0498	-1.4239	0.3740	-7.8945	3.8440
19	0.7467	1.2809	-2.0441	3.3250	-8.7460	3.1666
20	0.6881	0.9555	-2.1758	3.1313	-8.9290	3.0250
21	-0.1165	-0.4155	-3.9856	3.5701	-11.5172	1.1519
22	3.4372	3.8199	4.0072	-0.1873	-1.2347	10.5724
23	2.0541	1.5041	0.8965	0.6076	-4.8707	6.5401
24	3.6055	1.7579	4.3857	-2.6279	-0.8236	11.0944
25	3.4144	1.9169	3.9560	-2.0391	-1.2908	10.5023
26	3.6055	2.2192	4.3857	-2.1665	-0.8236	11.0944
27	3.9782	2.0015	5.2241	-3.2226	0.0645	12.2729
28	3.5056	2.3795	4.1609	-1.7814	-1.0670	10.7836
29	3.9964	1.2809	5.2648	-3.9839	0.1070	12.3309
30	3.1506	2.8959	3.3626	-0.4667	-1.9497	9.6984
31	2.9481	3.7589	2.9072	0.8517	-2.4666	9.0927
32	1.8050	0.6419	0.3362	0.3057	-5.5766	5.8649
33	3.8774	1.3863	4.9973	-3.6110	-0.1727	11.9512
34	1.3995	-0.7765	-0.5757	-0.2008	-6.7589	4.7991
35	1.0942	0.4055	-1.2626	1.6681	-7.6759	4.0231
36	0.6098	0.5878	-2.3520	2.9398	-9.1752	2.8367
37	1.0886	1.9169	-1.2752	3.1921	-7.6929	4.0090
38	1.1663	0.3365	-1.1004	1.4369	-7.4574	4.2043
39	1.0784	-0.4005	-1.2980	0.8975	-7.7238	3.9836
40	0.4187	-0.0619	-2.7817	2.7199	-9.7808	2.3830
41	0.3293	-1.7148	-2.9828	1.2680	-10.0668	2.1734
42	1.3678	-1.5606	-0.6472	-0.9135	-6.8532	4.7174
43	0.2443	-0.6162	-3.1741	2.5579	-10.3405	1.9755
44	0.2700	-2.6173	-3.1162	0.4989	-10.2574	2.0353
45	0.4383	-2.5639	-2.7378	0.1738	-9.7185	2.4291
46	3.4045	2.1282	3.9337	-1.8055	-1.3152	10.4718
47	4.6240	0.6931	6.6764	-5.9833	1.5364	14.3812
48	3.9973	0.0953	5.2669	-5.1716	0.1091	12.3339
49	3.1739	3.6687	3.4150	0.2537	-1.8909	9.7687
50	2.6810	3.5467	2.3065	1.2403	-3.1639	8.3090
51	3.6019	1.7047	4.3776	-2.6728	-0.8324	11.0831

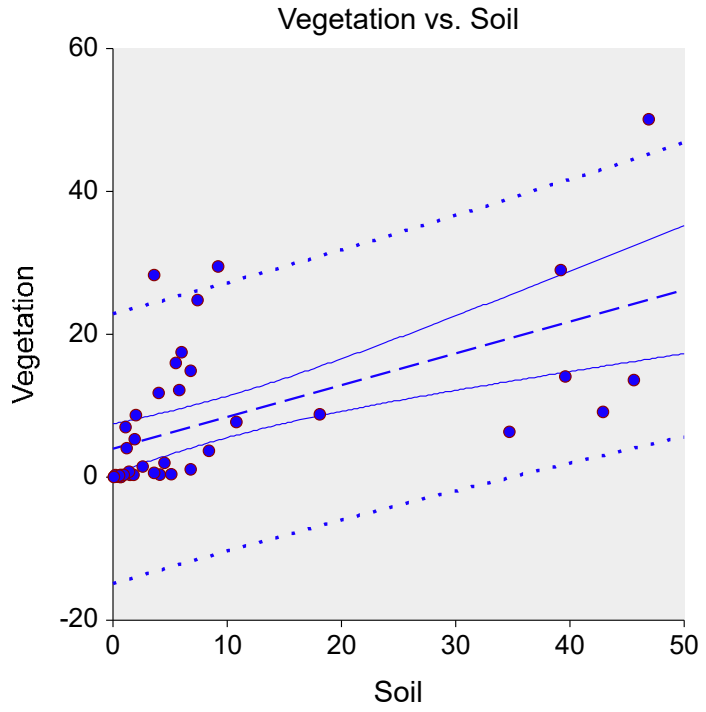
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
No Transformation – APL10 Excluded

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Vegetation	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	3.9966	Rows Prediction Only	0
Slope	0.4457	Sum of Frequencies	41
R-Squared	0.3245	Sum of Weights	41.0000
Correlation	0.5697	Coefficient of Variation	1.1336
Mean Square Error	84.20187	Square Root of MSE	9.176158

Linear Regression Report

Y = Vegetation X = Soil

Summary Statement

The equation of the straight line relating Vegetation and Soil is estimated as: Vegetation = (3.9966) + (0.4457) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Vegetation when Soil is zero, is 3.9966 with a standard error of 1.7176. The slope, the estimated change in Vegetation per unit change in Soil, is 0.4457 with a standard error of 0.1030. The value of R-Squared, the proportion of the variation in Vegetation that can be accounted for by variation in Soil, is 0.3245. The correlation between Vegetation and Soil is 0.5697.

A significance test that the slope is zero resulted in a t-value of 4.3288. The significance level of this t-test is 0.0001. Since 0.0001 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.4457. The lower limit of the 95% confidence interval for the slope is 0.2375 and the upper limit is 0.6540. The estimated intercept is 3.9966. The lower limit of the 95% confidence interval for the intercept is 0.5225 and the upper limit is 7.4707.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Vegetation	Soil
Count	41	41
Mean	8.0949	9.1944
Standard Deviation	11.0246	14.0901
Minimum	0.0300	0.0730
Maximum	50.1000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	3.9966	0.4457
Lower 95% Confidence Limit	0.5225	0.2375
Upper 95% Confidence Limit	7.4707	0.6540
Standard Error	1.7176	0.1030
Standardized Coefficient	0.0000	0.5697
T Value	2.3269	4.3288
Prob Level (T Test)	0.0253	0.0001
Prob Level (Randomization Test N =1000)		0.0030
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.6215	0.9881
Regression of Y on X	3.9966	0.4457
Inverse Regression from X on Y	-4.5332	1.3735
Orthogonal Regression of Y and X	2.0678	0.6555

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(3.99657676301078) + (0.44573932333225) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Section

---------- Estimation Results	----------	Bootstrap Confidence Limits	----------	
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	3.9966	0.9000	1.4657	6.1541
Bootstrap Mean	4.0460	0.9500	0.9851	6.4960
Bias (BM - OV)	0.0494	0.9900	-0.0970	7.1531
Bias Corrected	3.9471			
Standard Error	1.4214			
Slope				
Original Value	0.4457	0.9000	0.1592	0.6881
Bootstrap Mean	0.4446	0.9500	0.1000	0.7107
Bias (BM - OV)	-0.0011	0.9900	-0.0933	0.7573
Bias Corrected	0.4469			
Standard Error	0.1638			
Correlation				
Original Value	0.5697	0.9000	0.3788	0.8323
Bootstrap Mean	0.5548	0.9500	0.3471	0.8837
Bias (BM - OV)	-0.0149	0.9900	0.2867	0.9467
Bias Corrected	0.5846			
Standard Error	0.1380			
R-Squared				
Original Value	0.3245	0.9000	0.0706	0.5548
Bootstrap Mean	0.3268	0.9500	0.0214	0.5837
Bias (BM - OV)	0.0023	0.9900	0.0000	0.6119
Bias Corrected	0.3222			
Standard Error	0.1483			
Standard Error of Estimate				
Original Value	9.1762	0.9000	7.5295	12.0055
Bootstrap Mean	8.6805	0.9500	7.2085	12.5424
Bias (BM - OV)	-0.4957	0.9900	6.5290	13.7257
Bias Corrected	9.6718			
Standard Error	1.3613			
Orthogonal Intercept				
Original Value	2.0678	0.9000	-0.5738	4.0871
Bootstrap Mean	2.1724	0.9500	-1.0539	4.4571
Bias (BM - OV)	0.1046	0.9900	-2.1255	6.0485
Bias Corrected	1.9632			
Standard Error	1.4859			
Orthogonal Slope				
Original Value	0.6555	0.9000	0.2223	1.0115
Bootstrap Mean	0.6679	0.9500	0.0939	1.0588
Bias (BM - OV)	0.0124	0.9900	-0.6052	1.1233
Bias Corrected	0.6432			
Standard Error	0.2886			

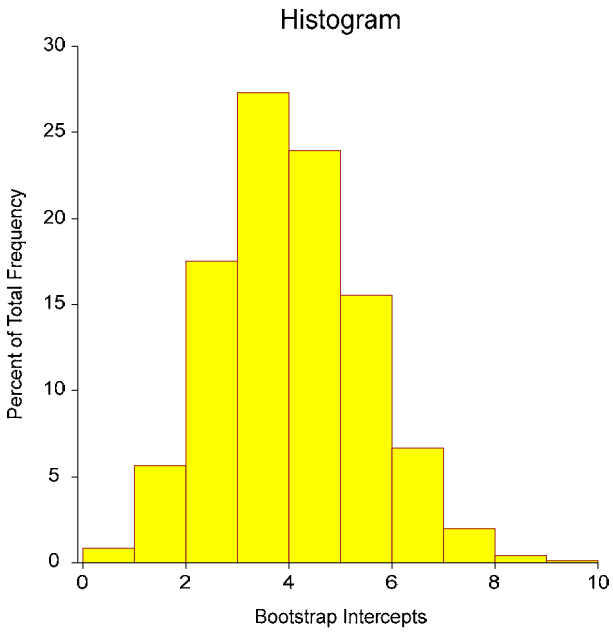
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

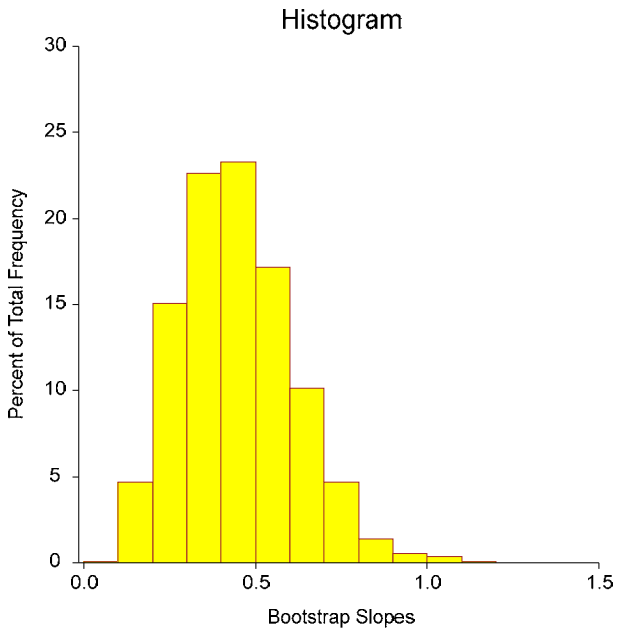
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

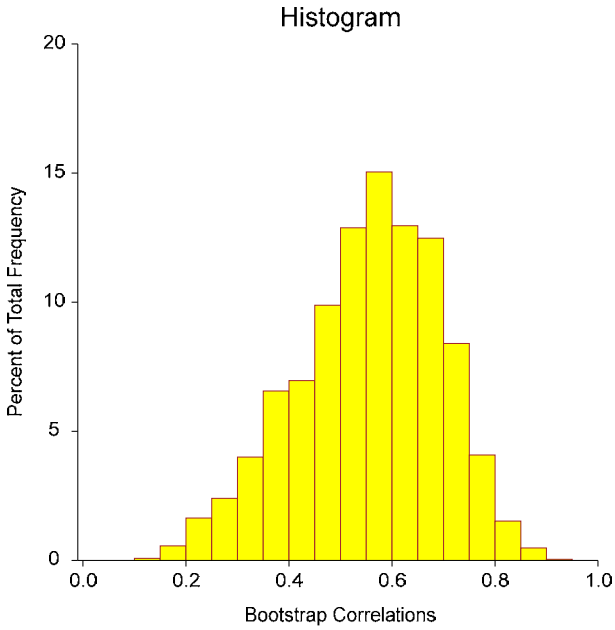
Linear Regression Report

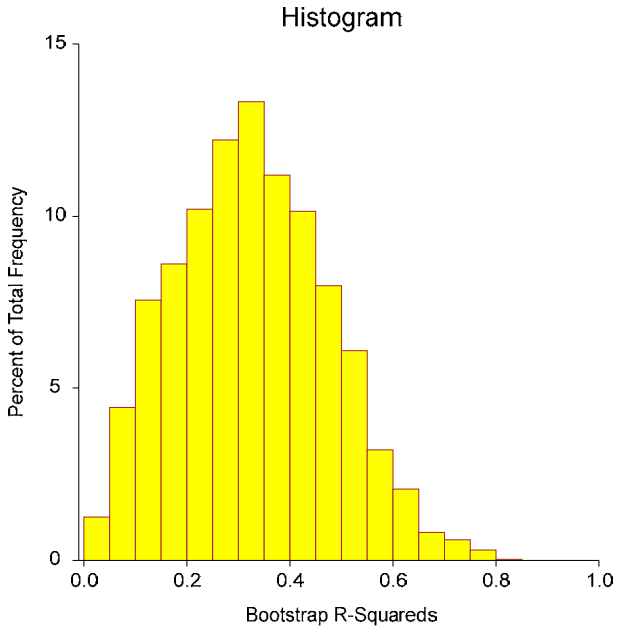
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Histograms Section



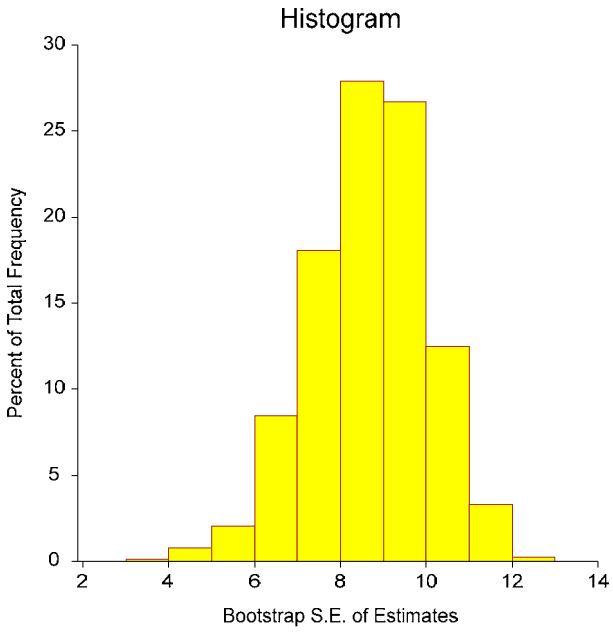


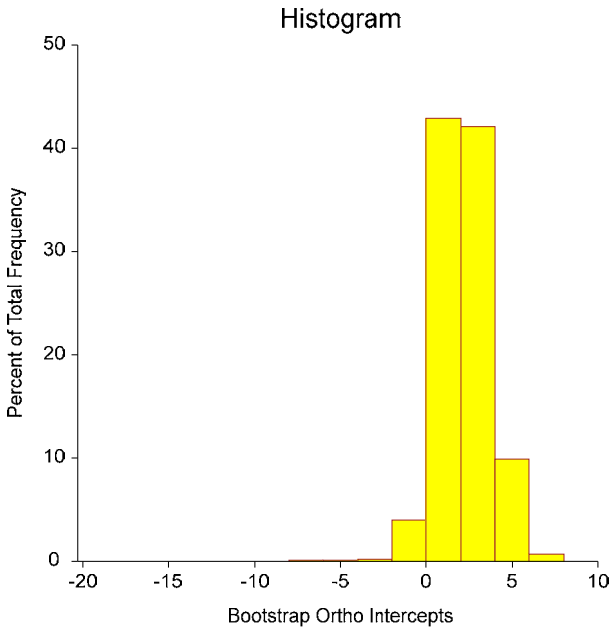


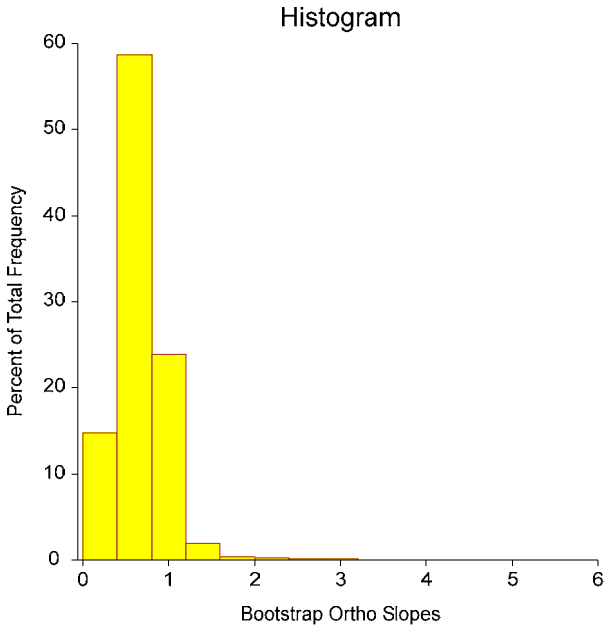


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.5697	0.3245	0.8200
Lower 95% Conf. Limit (r dist'n)	0.3138		
Upper 95% Conf. Limit (r dist'n)	0.7419		
Lower 95% Conf. Limit (Fisher's z)	0.3177		0.6852
Upper 95% Conf. Limit (Fisher's z)	0.7465		0.9005
Adjusted (Rbar)		0.3072	
T-Value for H0: Rho = 0	4.3288	4.3288	8.9470
Prob Level for H0: Rho = 0	0.0001	0.0001	0.0000
Prob Level (Randomization Test N =1000)	0.0030		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	2686.609	2686.609			
Slope	1	1577.803	1577.803	18.7383	0.0001	0.9881
Error	39	3283.873	84.20187			
Lack of Fit	37	2805.7	75.82972	0.3172	0.9456	
Pure Error	2	478.1732	239.0866			
Adj. Total	40	4861.676	121.5419			
Total	41	7548.285				

s = Square Root(84.20187) = 9.176158

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	331.89	0.03503547	-0.001157796
1	376.97	11407.3	6591.27	-0.001157796	0.0001259242
2 (Y'Y)			7548.285		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	2.950052	-0.0974886
1	-0.0974886	0.01060305

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.8300	0.000025	No
Anderson Darling	3.1227	0.000000	No
D'Agostino Skewness	3.2081	0.001336	No
D'Agostino Kurtosis	1.7450	0.080984	No
D'Agostino Omnibus	13.3367	0.001270	No
Constant Residual Variance?			
Modified Levene Test	10.3146	0.002645	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.3172	0.945598	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

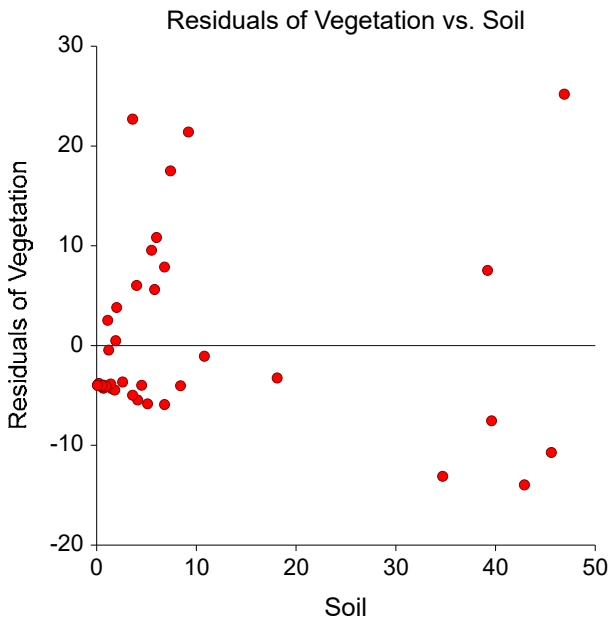
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

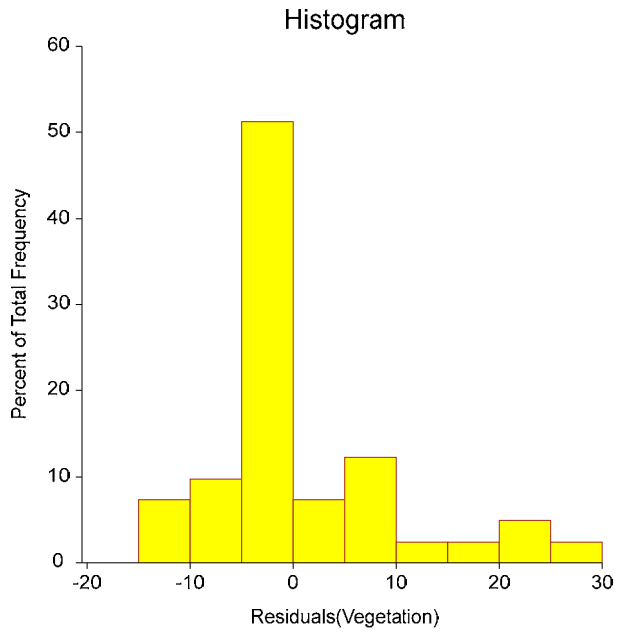
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

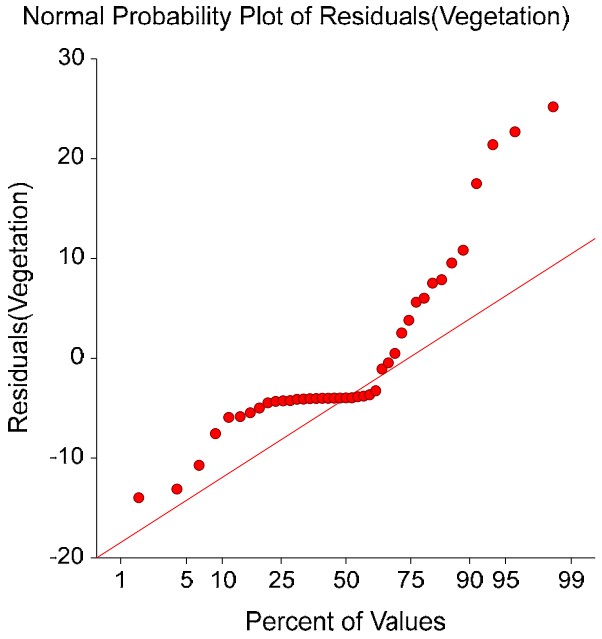
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Original Data Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual
11	6.0000	17.5000	6.6710	10.8290
12	46.9000	50.1000	24.9018	25.1982
13	1.2000	4.0800	4.5315	-0.4515
14	39.6000	14.1000	21.6479	-7.5479
15	4.1000	0.3700	5.8241	-5.4541
16	0.7100	0.0800	4.3131	-4.2331
17	5.1000	0.4300	6.2698	-5.8398
18	0.3500	0.1100	4.1526	-4.0426
19	3.6000	0.6200	5.6012	-4.9812
20	2.6000	1.5000	5.1555	-3.6555
21	0.6600	0.0300	4.2908	-4.2608
22	45.6000	13.6000	24.3223	-10.7223
23	4.5000	2.0200	6.0024	-3.9824
24	5.8000	12.2000	6.5819	5.6181
25	6.8000	14.9000	7.0276	7.8724
26	9.2000	29.5000	8.0974	21.4026
27	7.4000	24.8000	7.2950	17.5050
28	10.8000	7.7400	8.8106	-1.0706
29	3.6000	28.3000	5.6012	22.6988
30	18.1000	8.8100	12.0645	-3.2545
31	42.9000	9.1500	23.1188	-13.9688
32	1.9000	5.3300	4.8435	0.4865
33	4.0000	11.8000	5.7795	6.0205
34	0.4600	0.0900	4.2016	-4.1116
35	1.5000	0.3500	4.6652	-4.3152
36	1.8000	0.3400	4.7989	-4.4589
37	6.8000	1.1100	7.0276	-5.9176
38	1.4000	0.7700	4.6206	-3.8506
39	0.6700	0.3300	4.2952	-3.9652
40	0.9400	0.3300	4.4156	-4.0856
41	0.1800	0.0700	4.0768	-4.0068
42	0.2100	0.3000	4.0902	-3.7902
43	0.5400	0.2300	4.2373	-4.0073
44	0.0730	0.0700	4.0291	-3.9591
45	0.0770	0.0400	4.0309	-3.9909
46	8.4000	3.7100	7.7408	-4.0308
47	2.0000	8.7000	4.8881	3.8119
48	1.1000	7.0200	4.4869	2.5331
49	39.2000	29.0000	21.4696	7.5304
50	34.7000	6.3600	19.4637	-13.1037
51	5.5000	16.0000	6.4481	9.5519

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	17.5000	6.6710	1.4703	3.6970	9.6451
12	46.9000	50.1000	24.9018	4.1386	16.5306	33.2729
13	1.2000	4.0800	4.5315	1.6527	1.1886	7.8743
14	39.6000	14.1000	21.6479	3.4433	14.6831	28.6126
15	4.1000	0.3700	5.8241	1.5261	2.7373	8.9109
16	0.7100	0.0800	4.3131	1.6784	0.9182	7.7079
17	5.1000	0.4300	6.2698	1.4938	3.2483	9.2914
18	0.3500	0.1100	4.1526	1.6980	0.7181	7.5871
19	3.6000	0.6200	5.6012	1.5445	2.4771	8.7253
20	2.6000	1.5000	5.1555	1.5858	1.9479	8.3631
21	0.6600	0.0300	4.2908	1.6811	0.8905	7.6910
22	45.6000	13.6000	24.3223	4.0133	16.2046	32.4400
23	4.5000	2.0200	6.0024	1.5124	2.9433	9.0615
24	5.8000	12.2000	6.5819	1.4751	3.5982	9.5655
25	6.8000	14.9000	7.0276	1.4541	4.0863	9.9689
26	9.2000	29.5000	8.0974	1.4331	5.1987	10.9960
27	7.4000	24.8000	7.2950	1.4449	4.3724	10.2177
28	10.8000	7.7400	8.8106	1.4426	5.8927	11.7285
29	3.6000	28.3000	5.6012	1.5445	2.4771	8.7253
30	18.1000	8.8100	12.0645	1.7014	8.6231	15.5058
31	42.9000	9.1500	23.1188	3.7549	15.5237	30.7139
32	1.9000	5.3300	4.8435	1.6180	1.5708	8.1162
33	4.0000	11.8000	5.7795	1.5296	2.6855	8.8735
34	0.4600	0.0900	4.2016	1.6919	0.7794	7.6239
35	1.5000	0.3500	4.6652	1.6375	1.3530	7.9774
36	1.8000	0.3400	4.7989	1.6228	1.5165	8.0813
37	6.8000	1.1100	7.0276	1.4541	4.0863	9.9689
38	1.4000	0.7700	4.6206	1.6425	1.2983	7.9429
39	0.6700	0.3300	4.2952	1.6805	0.8960	7.6944
40	0.9400	0.3300	4.4156	1.6662	1.0454	7.7857
41	0.1800	0.0700	4.0768	1.7074	0.6232	7.5304
42	0.2100	0.3000	4.0902	1.7057	0.6400	7.5404
43	0.5400	0.2300	4.2373	1.6876	0.8239	7.6507
44	0.0730	0.0700	4.0291	1.7134	0.5634	7.4949
45	0.0770	0.0400	4.0309	1.7132	0.5656	7.4962
46	8.4000	3.7100	7.7408	1.4354	4.8374	10.6442
47	2.0000	8.7000	4.8881	1.6132	1.6250	8.1511
48	1.1000	7.0200	4.4869	1.6578	1.1336	7.8402
49	39.2000	29.0000	21.4696	3.4059	14.5805	28.3586
50	34.7000	6.3600	19.4637	2.9919	13.4121	25.5154
51	5.5000	16.0000	6.4481	1.4827	3.4491	9.4472

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	17.5000	6.6710	9.2932	-12.1263	25.4683
12	46.9000	50.1000	24.9018	10.0663	4.5408	45.2627
13	1.2000	4.0800	4.5315	9.3238	-14.3277	23.3906
14	39.6000	14.1000	21.6479	9.8009	1.8236	41.4721
15	4.1000	0.3700	5.8241	9.3022	-12.9913	24.6396
16	0.7100	0.0800	4.3131	9.3284	-14.5554	23.1815
17	5.1000	0.4300	6.2698	9.2970	-12.5350	25.0747
18	0.3500	0.1100	4.1526	9.3319	-14.7230	23.0282
19	3.6000	0.6200	5.6012	9.3052	-13.2204	24.4229
20	2.6000	1.5000	5.1555	9.3122	-13.6802	23.9912
21	0.6600	0.0300	4.2908	9.3289	-14.5787	23.1602
22	45.6000	13.6000	24.3223	10.0154	4.0642	44.5804
23	4.5000	2.0200	6.0024	9.3000	-12.8085	24.8133
24	5.8000	12.2000	6.5819	9.2940	-12.2169	25.3807
25	6.8000	14.9000	7.0276	9.2907	-11.7645	25.8197
26	9.2000	29.5000	8.0974	9.2874	-10.6881	26.8829
27	7.4000	24.8000	7.2950	9.2892	-11.4942	26.0843
28	10.8000	7.7400	8.8106	9.2889	-9.9779	27.5991
29	3.6000	28.3000	5.6012	9.3052	-13.2204	24.4229
30	18.1000	8.8100	12.0645	9.3326	-6.8124	30.9413
31	42.9000	9.1500	23.1188	9.9147	3.0644	43.1732
32	1.9000	5.3300	4.8435	9.3177	-14.0034	23.6903
33	4.0000	11.8000	5.7795	9.3028	-13.0371	24.5962
34	0.4600	0.0900	4.2016	9.3308	-14.6718	23.0750
35	1.5000	0.3500	4.6652	9.3211	-14.1886	23.5189
36	1.8000	0.3400	4.7989	9.3185	-14.0496	23.6474
37	6.8000	1.1100	7.0276	9.2907	-11.7645	25.8197
38	1.4000	0.7700	4.6206	9.3220	-14.2349	23.4761
39	0.6700	0.3300	4.2952	9.3288	-14.5740	23.1645
40	0.9400	0.3300	4.4156	9.3262	-14.4484	23.2796
41	0.1800	0.0700	4.0768	9.3337	-14.8023	22.9559
42	0.2100	0.3000	4.0902	9.3334	-14.7883	22.9687
43	0.5400	0.2300	4.2373	9.3300	-14.6345	23.1091
44	0.0730	0.0700	4.0291	9.3348	-14.8522	22.9105
45	0.0770	0.0400	4.0309	9.3347	-14.8504	22.9121
46	8.4000	3.7100	7.7408	9.2877	-11.0455	26.5270
47	2.0000	8.7000	4.8881	9.3169	-13.9571	23.7332
48	1.1000	7.0200	4.4869	9.3247	-14.3741	23.3479
49	39.2000	29.0000	21.4696	9.7878	1.6718	41.2673
50	34.7000	6.3600	19.4637	9.6516	-0.0585	38.9859
51	5.5000	16.0000	6.4481	9.2952	-12.3531	25.2494

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	17.5000	6.6710	1.4703	2.4807	10.8613
12	46.9000	50.1000	24.9018	4.1386	13.1072	36.6963
13	1.2000	4.0800	4.5315	1.6527	-0.1785	9.2414
14	39.6000	14.1000	21.6479	3.4433	11.8349	31.4608
15	4.1000	0.3700	5.8241	1.5261	1.4750	10.1732
16	0.7100	0.0800	4.3131	1.6784	-0.4701	9.0962
17	5.1000	0.4300	6.2698	1.4938	2.0127	10.5270
18	0.3500	0.1100	4.1526	1.6980	-0.6864	8.9916
19	3.6000	0.6200	5.6012	1.5445	1.1995	10.0029
20	2.6000	1.5000	5.1555	1.5858	0.6362	9.6748
21	0.6600	0.0300	4.2908	1.6811	-0.5001	9.0816
22	45.6000	13.6000	24.3223	4.0133	12.8849	35.7597
23	4.5000	2.0200	6.0024	1.5124	1.6922	10.3126
24	5.8000	12.2000	6.5819	1.4751	2.3781	10.7857
25	6.8000	14.9000	7.0276	1.4541	2.8835	11.1717
26	9.2000	29.5000	8.0974	1.4331	4.0133	12.1815
27	7.4000	24.8000	7.2950	1.4449	3.1772	11.4129
28	10.8000	7.7400	8.8106	1.4426	4.6994	12.9217
29	3.6000	28.3000	5.6012	1.5445	1.1995	10.0029
30	18.1000	8.8100	12.0645	1.7014	7.2158	16.9131
31	42.9000	9.1500	23.1188	3.7549	12.4177	33.8199
32	1.9000	5.3300	4.8435	1.6180	0.2324	9.4545
33	4.0000	11.8000	5.7795	1.5296	1.4203	10.1388
34	0.4600	0.0900	4.2016	1.6919	-0.6201	9.0234
35	1.5000	0.3500	4.6652	1.6375	-0.0015	9.3319
36	1.8000	0.3400	4.7989	1.6228	0.1742	9.4236
37	6.8000	1.1100	7.0276	1.4541	2.8835	11.1717
38	1.4000	0.7700	4.6206	1.6425	-0.0604	9.3016
39	0.6700	0.3300	4.2952	1.6805	-0.4941	9.0845
40	0.9400	0.3300	4.4156	1.6662	-0.3328	9.1640
41	0.1800	0.0700	4.0768	1.7074	-0.7891	8.9428
42	0.2100	0.3000	4.0902	1.7057	-0.7710	8.9513
43	0.5400	0.2300	4.2373	1.6876	-0.5720	9.0466
44	0.0730	0.0700	4.0291	1.7134	-0.8540	8.9122
45	0.0770	0.0400	4.0309	1.7132	-0.8515	8.9133
46	8.4000	3.7100	7.7408	1.4354	3.6501	11.8315
47	2.0000	8.7000	4.8881	1.6132	0.2906	9.4856
48	1.1000	7.0200	4.4869	1.6578	-0.2377	9.2115
49	39.2000	29.0000	21.4696	3.4059	11.7632	31.1759
50	34.7000	6.3600	19.4637	2.9919	10.9372	27.9902
51	5.5000	16.0000	6.4481	1.4827	2.2226	10.6737

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	17.5000	6.6710	10.8290	1.1956	61.8799
12	46.9000	50.1000	24.9018	25.1982	3.0768	50.2959
13	1.2000	4.0800	4.5315	-0.4515	-0.0500	11.0653
14	39.6000	14.1000	21.6479	-7.5479	-0.8874	53.5309
15	4.1000	0.3700	5.8241	-5.4541	-0.6028	1474.0832
16	0.7100	0.0800	4.3131	-4.2331	-0.4692	5291.3146
17	5.1000	0.4300	6.2698	-5.8398	-0.6450	1358.1040
18	0.3500	0.1100	4.1526	-4.0426	-0.4483	3675.0778
19	3.6000	0.6200	5.6012	-4.9812	-0.5507	803.4255
20	2.6000	1.5000	5.1555	-3.6555	-0.4045	243.6999
21	0.6600	0.0300	4.2908	-4.2608	-0.4723	14202.5491
22	45.6000	13.6000	24.3223	-10.7223	-1.2994	78.8404
23	4.5000	2.0200	6.0024	-3.9824	-0.4400	197.1487
24	5.8000	12.2000	6.5819	5.6181	0.6203	46.0503
25	6.8000	14.9000	7.0276	7.8724	0.8689	52.8349
26	9.2000	29.5000	8.0974	21.4026	2.3614	72.5513
27	7.4000	24.8000	7.2950	17.5050	1.9318	70.5845
28	10.8000	7.7400	8.8106	-1.0706	-0.1181	13.8315
29	3.6000	28.3000	5.6012	22.6988	2.5095	80.2076
30	18.1000	8.8100	12.0645	-3.2545	-0.3609	36.9405
31	42.9000	9.1500	23.1188	-13.9688	-1.6684	152.6644
32	1.9000	5.3300	4.8435	0.4865	0.0539	9.1279
33	4.0000	11.8000	5.7795	6.0205	0.6654	51.0209
34	0.4600	0.0900	4.2016	-4.1116	-0.4559	4568.4632
35	1.5000	0.3500	4.6652	-4.3152	-0.4779	1232.9102
36	1.8000	0.3400	4.7989	-4.4589	-0.4937	1311.4434
37	6.8000	1.1100	7.0276	-5.9176	-0.6531	533.1175
38	1.4000	0.7700	4.6206	-3.8506	-0.4265	500.0795
39	0.6700	0.3300	4.2952	-3.9652	-0.4396	1201.5825
40	0.9400	0.3300	4.4156	-4.0856	-0.4528	1238.0520
41	0.1800	0.0700	4.0768	-4.0068	-0.4444	5724.0141
42	0.2100	0.3000	4.0902	-3.7902	-0.4204	1263.3940
43	0.5400	0.2300	4.2373	-4.0073	-0.4443	1742.2939
44	0.0730	0.0700	4.0291	-3.9591	-0.4392	5655.8796
45	0.0770	0.0400	4.0309	-3.9909	-0.4427	9977.2467
46	8.4000	3.7100	7.7408	-4.0308	-0.4447	108.6466
47	2.0000	8.7000	4.8881	3.8119	0.4220	43.8155
48	1.1000	7.0200	4.4869	2.5331	0.2807	36.0842
49	39.2000	29.0000	21.4696	7.5304	0.8838	25.9670
50	34.7000	6.3600	19.4637	-13.1037	-1.5106	206.0335
51	5.5000	16.0000	6.4481	9.5519	1.0548	59.6991

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	10.8290	1.2024	0.0257	0.0188	83.2504
12	46.9000	25.1982	**3.4900	0.2034	*1.2087	65.4415
13	1.2000	-0.4515	-0.0494	0.0324	0.0000	86.4122
14	39.6000	-7.5479	*-0.8849	0.1408	0.0645	84.6728
15	4.1000	-5.4541	-0.5978	0.0277	0.0052	85.6126
16	0.7100	-4.2331	-0.4645	0.0335	0.0038	85.9298
17	5.1000	-5.8398	-0.6401	0.0265	0.0057	85.4958
18	0.3500	-4.0426	-0.4437	0.0342	0.0036	85.9724
19	3.6000	-4.9812	-0.5457	0.0283	0.0044	85.7457
20	2.6000	-3.6555	-0.4001	0.0299	0.0025	86.0552
21	0.6600	-4.2608	-0.4676	0.0336	0.0039	85.9234
22	45.6000	-10.7223	*-1.3113	0.1913	0.1997	82.6766
23	4.5000	-3.9824	-0.4354	0.0272	0.0027	85.9887
24	5.8000	5.6181	0.6154	0.0258	0.0051	85.5651
25	6.8000	7.8724	0.8661	0.0251	0.0097	84.7448
26	9.2000	21.4026	*2.5179	0.0244	0.0697	74.0618
27	7.4000	17.5050	*2.0052	0.0248	0.0474	78.1489
28	10.8000	-1.0706	-0.1166	0.0247	0.0002	86.3868
29	3.6000	22.6988	*2.7051	0.0283	0.0918	72.4636
30	18.1000	-3.2545	-0.3569	0.0344	0.0023	86.1291
31	42.9000	-13.9688	*-1.7090	0.1674	0.2799	80.2500
32	1.9000	0.4865	0.0532	0.0311	0.0000	86.4113
33	4.0000	6.0205	0.6606	0.0278	0.0063	85.4366
34	0.4600	-4.1116	-0.4512	0.0340	0.0037	85.9572
35	1.5000	-4.3152	-0.4732	0.0318	0.0038	85.9116
36	1.8000	-4.4589	-0.4889	0.0313	0.0039	85.8776
37	6.8000	-5.9176	-0.6483	0.0251	0.0055	85.4724
38	1.4000	-3.8506	-0.4220	0.0320	0.0030	86.0146
39	0.6700	-3.9652	-0.4350	0.0335	0.0034	85.9896
40	0.9400	-4.0856	-0.4481	0.0330	0.0035	85.9635
41	0.1800	-4.0068	-0.4398	0.0346	0.0035	85.9801
42	0.2100	-3.7902	-0.4159	0.0346	0.0032	86.0261
43	0.5400	-4.0073	-0.4397	0.0338	0.0035	85.9803
44	0.0730	-3.9591	-0.4346	0.0349	0.0035	85.9903
45	0.0770	-3.9909	-0.4381	0.0349	0.0035	85.9834
46	8.4000	-4.0308	-0.4401	0.0245	0.0025	85.9794
47	2.0000	3.8119	0.4175	0.0309	0.0028	86.0231
48	1.1000	2.5331	0.2773	0.0326	0.0013	86.2432
49	39.2000	7.5304	*0.8813	0.1378	0.0624	84.6870
50	34.7000	-13.1037	*-1.5367	0.1063	0.1357	81.3616
51	5.5000	9.5519	1.0564	0.0261	0.0149	83.9523

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	1.2024	0.1952	0.0188	1.0033	0.1828	-0.0437
12	* 3.4900	1.7636	** 1.2087	0.7583	-0.4025	1.6545
13	-0.0494	-0.0090	0.0000	1.0885	-0.0090	0.0045
14	-0.8849	-0.3582	0.0645	* 1.1769	0.0552	-0.3257
15	-0.5978	-0.1008	0.0052	1.0632	-0.0981	0.0347
16	-0.4645	-0.0864	0.0038	1.0775	-0.0864	0.0450
17	-0.6401	-0.1056	0.0057	1.0590	-0.1010	0.0298
18	-0.4437	-0.0835	0.0036	1.0795	-0.0835	0.0448
19	-0.5457	-0.0932	0.0044	1.0672	-0.0913	0.0348
20	-0.4001	-0.0702	0.0025	1.0767	-0.0695	0.0301
21	-0.4676	-0.0871	0.0039	1.0775	-0.0871	0.0455
22	-1.3113	-0.6377	0.1997	* 1.1921	0.1384	-0.5957
23	-0.4354	-0.0728	0.0027	1.0720	-0.0703	0.0233
24	0.6154	0.1002	0.0051	1.0600	0.0943	-0.0237
25	0.8661	0.1390	0.0097	1.0390	0.1273	-0.0236
26	* 2.5179	0.3981	0.0697	0.7930	0.3321	0.0002
27	* 2.0052	0.3197	0.0474	0.8833	0.2871	-0.0409
28	-0.1166	-0.0186	0.0002	1.0792	-0.0142	-0.0021
29	* 2.7051	0.4619	0.0918	0.7622	0.4526	-0.1723
30	-0.3569	-0.0673	0.0023	1.0835	-0.0273	-0.0363
31	-1.7090	-0.7664	0.2799	1.0910	0.1464	-0.7084
32	0.0532	0.0095	0.0000	1.0870	0.0095	-0.0044
33	0.6606	0.1117	0.0063	1.0590	0.1088	-0.0391
34	-0.4512	-0.0846	0.0037	1.0788	-0.0846	0.0450
35	-0.4732	-0.0858	0.0038	1.0753	-0.0855	0.0415
36	-0.4889	-0.0878	0.0039	1.0738	-0.0874	0.0412
37	-0.6483	-0.1040	0.0055	1.0569	-0.0953	0.0176
38	-0.4220	-0.0768	0.0030	1.0781	-0.0766	0.0375
39	-0.4350	-0.0810	0.0034	1.0791	-0.0810	0.0423
40	-0.4481	-0.0827	0.0035	1.0778	-0.0826	0.0422
41	-0.4398	-0.0833	0.0035	1.0801	-0.0833	0.0453
42	-0.4159	-0.0787	0.0032	1.0812	-0.0787	0.0427
43	-0.4397	-0.0823	0.0035	1.0792	-0.0822	0.0434
44	-0.4346	-0.0826	0.0035	1.0806	-0.0826	0.0453
45	-0.4381	-0.0833	0.0035	1.0804	-0.0833	0.0456
46	-0.4401	-0.0697	0.0025	1.0688	-0.0603	0.0040
47	0.4175	0.0746	0.0028	1.0770	0.0741	-0.0342
48	0.2773	0.0509	0.0013	1.0845	0.0509	-0.0256
49	0.8813	0.3523	0.0624	* 1.1732	-0.0525	0.3196
50	-1.5367	-0.5300	0.1357	1.0447	0.0446	-0.4653
51	1.0564	0.1730	0.0149	1.0207	0.1639	-0.0444

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	10.8290	||||||.....	1.1956	|||||.....	1.2024	|||||.....
12	46.9000	25.1982	||||||||||||||	3.0768	||||||||||||||	* 3.4900	||||||||||||||
13	1.2000	-0.4515	|.....	-0.0500	|.....	-0.0494	|.....
14	39.6000	-7.5479	||||.....	-0.8874	||||.....	-0.8849	|||.....
15	4.1000	-5.4541	|||.....	-0.6028	||.....	-0.5978	||.....
16	0.7100	-4.2331	||.....	-0.4692	||.....	-0.4645	|.....
17	5.1000	-5.8398	|||.....	-0.6450	||.....	-0.6401	||.....
18	0.3500	-4.0426	||.....	-0.4483	|.....	-0.4437	|.....
19	3.6000	-4.9812	||.....	-0.5507	||.....	-0.5457	||.....
20	2.6000	-3.6555	|.....	-0.4045	|.....	-0.4001	|.....
21	0.6600	-4.2608	||.....	-0.4723	||.....	-0.4676	|.....
22	45.6000	-10.7223	||||||.....	-1.2994	||||||.....	-1.3113	|||||.....
23	4.5000	-3.9824	||.....	-0.4400	|.....	-0.4354	|.....
24	5.8000	5.6181	|||.....	0.6203	||.....	0.6154	||.....
25	6.8000	7.8724	||||.....	0.8689	||||.....	0.8661	|||.....
26	9.2000	21.4026	|||||||||||...	2.3614	||||||||||....	* 2.5179	|||||||||.....
27	7.4000	17.5050	|||||||||.....	1.9318	||||||||.....	* 2.0052	|||||||.....
28	10.8000	-1.0706	|.....	-0.1181	|.....	-0.1166	|.....
29	3.6000	22.6988	||||||||||||..	2.5095	|||||||||||...	* 2.7051	||||||||||....
30	18.1000	-3.2545	|.....	-0.3609	|.....	-0.3569	|.....
31	42.9000	-13.9688	|||||||.....	-1.6684	|||||||.....	-1.7090	||||||.....
32	1.9000	0.4865	|.....	0.0539	|.....	0.0532	|.....
33	4.0000	6.0205	|||.....	0.6654	|||.....	0.6606	||.....
34	0.4600	-4.1116	||.....	-0.4559	||.....	-0.4512	|.....
35	1.5000	-4.3152	||.....	-0.4779	||.....	-0.4732	|.....
36	1.8000	-4.4589	||.....	-0.4937	||.....	-0.4889	|.....
37	6.8000	-5.9176	|||.....	-0.6531	||.....	-0.6483	||.....
38	1.4000	-3.8506	||.....	-0.4265	|.....	-0.4220	|.....
39	0.6700	-3.9652	||.....	-0.4396	|.....	-0.4350	|.....
40	0.9400	-4.0856	||.....	-0.4528	|.....	-0.4481	|.....
41	0.1800	-4.0068	||.....	-0.4444	|.....	-0.4398	|.....
42	0.2100	-3.7902	||.....	-0.4204	|.....	-0.4159	|.....
43	0.5400	-4.0073	||.....	-0.4443	|.....	-0.4397	|.....
44	0.0730	-3.9591	||.....	-0.4392	|.....	-0.4346	|.....
45	0.0770	-3.9909	||.....	-0.4427	|.....	-0.4381	|.....
46	8.4000	-4.0308	||.....	-0.4447	|.....	-0.4401	|.....
47	2.0000	3.8119	||.....	0.4220	|.....	0.4175	|.....
48	1.1000	2.5331	|.....	0.2807	|.....	0.2773	|.....
49	39.2000	7.5304	||||.....	0.8838	||||.....	0.8813	|||.....
50	34.7000	-13.1037	|||||||.....	-1.5106	|||||||.....	-1.5367	||||||.....
51	5.5000	9.5519	|||||.....	1.0548	||||.....	1.0564	||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.1952	|.....	0.0188	|.....	-0.0437	|.....
12	46.9000	1.7636	|||||||||||||||	** 1.2087	||||||||||||||	1.6545	||||||||||||||
13	1.2000	-0.0090	|.....	0.0000	|.....	0.0045	|.....
14	39.6000	-0.3582	||.....	0.0645	|.....	-0.3257	||.....
15	4.1000	-0.1008	|.....	0.0052	|.....	0.0347	|.....
16	0.7100	-0.0864	|.....	0.0038	|.....	0.0450	|.....
17	5.1000	-0.1056	|.....	0.0057	|.....	0.0298	|.....
18	0.3500	-0.0835	|.....	0.0036	|.....	0.0448	|.....
19	3.6000	-0.0932	|.....	0.0044	|.....	0.0348	|.....
20	2.6000	-0.0702	|.....	0.0025	|.....	0.0301	|.....
21	0.6600	-0.0871	|.....	0.0039	|.....	0.0455	|.....
22	45.6000	-0.6377	|||||.....	0.1997	||.....	-0.5957	|||||.....
23	4.5000	-0.0728	|.....	0.0027	|.....	0.0233	|.....
24	5.8000	0.1002	|.....	0.0051	|.....	-0.0237	|.....
25	6.8000	0.1390	|.....	0.0097	|.....	-0.0236	|.....
26	9.2000	0.3981	|||.....	0.0697	|.....	0.0002	|.....
27	7.4000	0.3197	||.....	0.0474	|.....	-0.0409	|.....
28	10.8000	-0.0186	|.....	0.0002	|.....	-0.0021	|.....
29	3.6000	0.4619	|||.....	0.0918	|.....	-0.1723	|.....
30	18.1000	-0.0673	|.....	0.0023	|.....	-0.0363	|.....
31	42.9000	-0.7664	||||||.....	0.2799	|||.....	-0.7084	||||||.....
32	1.9000	0.0095	|.....	0.0000	|.....	-0.0044	|.....
33	4.0000	0.1117	|.....	0.0063	|.....	-0.0391	|.....
34	0.4600	-0.0846	|.....	0.0037	|.....	0.0450	|.....
35	1.5000	-0.0858	|.....	0.0038	|.....	0.0415	|.....
36	1.8000	-0.0878	|.....	0.0039	|.....	0.0412	|.....
37	6.8000	-0.1040	|.....	0.0055	|.....	0.0176	|.....
38	1.4000	-0.0768	|.....	0.0030	|.....	0.0375	|.....
39	0.6700	-0.0810	|.....	0.0034	|.....	0.0423	|.....
40	0.9400	-0.0827	|.....	0.0035	|.....	0.0422	|.....
41	0.1800	-0.0833	|.....	0.0035	|.....	0.0453	|.....
42	0.2100	-0.0787	|.....	0.0032	|.....	0.0427	|.....
43	0.5400	-0.0823	|.....	0.0035	|.....	0.0434	|.....
44	0.0730	-0.0826	|.....	0.0035	|.....	0.0453	|.....
45	0.0770	-0.0833	|.....	0.0035	|.....	0.0456	|.....
46	8.4000	-0.0697	|.....	0.0025	|.....	0.0040	|.....
47	2.0000	0.0746	|.....	0.0028	|.....	-0.0342	|.....
48	1.1000	0.0509	|.....	0.0013	|.....	-0.0256	|.....
49	39.2000	0.3523	||.....	0.0624	|.....	0.3196	||.....
50	34.7000	-0.5300	||||.....	0.1357	|.....	-0.4653	||||.....
51	5.5000	0.1730	|.....	0.0149	|.....	-0.0444	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	1.2024	|||||.....	0.0188	|.....	0.0257	|.....
12	46.9000	* 3.4900	||||||||||||||	** 1.2087	||||||||||||||	0.2034	||||||||||||||
13	1.2000	-0.0494	|.....	0.0000	|.....	0.0324	|.....
14	39.6000	-0.8849	|||.....	0.0645	|.....	0.1408	||||||||.....
15	4.1000	-0.5978	||.....	0.0052	|.....	0.0277	|.....
16	0.7100	-0.4645	|.....	0.0038	|.....	0.0335	|.....
17	5.1000	-0.6401	||.....	0.0057	|.....	0.0265	|.....
18	0.3500	-0.4437	|.....	0.0036	|.....	0.0342	|.....
19	3.6000	-0.5457	||.....	0.0044	|.....	0.0283	|.....
20	2.6000	-0.4001	|.....	0.0025	|.....	0.0299	|.....
21	0.6600	-0.4676	|.....	0.0039	|.....	0.0336	|.....
22	45.6000	-1.3113	|||||.....	0.1997	||.....	0.1913	||||||||||||..
23	4.5000	-0.4354	|.....	0.0027	|.....	0.0272	|.....
24	5.8000	0.6154	||.....	0.0051	|.....	0.0258	|.....
25	6.8000	0.8661	|||.....	0.0097	|.....	0.0251	|.....
26	9.2000	* 2.5179	|||||||||.....	0.0697	|.....	0.0244	|.....
27	7.4000	* 2.0052	|||||||.....	0.0474	|.....	0.0248	|.....
28	10.8000	-0.1166	|.....	0.0002	|.....	0.0247	|.....
29	3.6000	* 2.7051	||||||||||....	0.0918	|.....	0.0283	|.....
30	18.1000	-0.3569	|.....	0.0023	|.....	0.0344	|.....
31	42.9000	-1.7090	||||||.....	0.2799	|||.....	0.1674	||||||||||....
32	1.9000	0.0532	|.....	0.0000	|.....	0.0311	|.....
33	4.0000	0.6606	||.....	0.0063	|.....	0.0278	|.....
34	0.4600	-0.4512	|.....	0.0037	|.....	0.0340	|.....
35	1.5000	-0.4732	|.....	0.0038	|.....	0.0318	|.....
36	1.8000	-0.4889	|.....	0.0039	|.....	0.0313	|.....
37	6.8000	-0.6483	||.....	0.0055	|.....	0.0251	|.....
38	1.4000	-0.4220	|.....	0.0030	|.....	0.0320	|.....
39	0.6700	-0.4350	|.....	0.0034	|.....	0.0335	|.....
40	0.9400	-0.4481	|.....	0.0035	|.....	0.0330	|.....
41	0.1800	-0.4398	|.....	0.0035	|.....	0.0346	|.....
42	0.2100	-0.4159	|.....	0.0032	|.....	0.0346	|.....
43	0.5400	-0.4397	|.....	0.0035	|.....	0.0338	|.....
44	0.0730	-0.4346	|.....	0.0035	|.....	0.0349	|.....
45	0.0770	-0.4381	|.....	0.0035	|.....	0.0349	|.....
46	8.4000	-0.4401	|.....	0.0025	|.....	0.0245	|.....
47	2.0000	0.4175	|.....	0.0028	|.....	0.0309	|.....
48	1.1000	0.2773	|.....	0.0013	|.....	0.0326	|.....
49	39.2000	0.8813	|||.....	0.0624	|.....	0.1378	||||||||.....
50	34.7000	-1.5367	||||||.....	0.1357	|.....	0.1063	||||||.....
51	5.5000	1.0564	||||.....	0.0149	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Means

Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	17.5000	6.0000	30.2944	-24.2944	21.5869	50.7895
12	50.1000	46.9000	103.4314	-56.5314	72.9425	186.5656
13	4.0800	1.2000	0.1872	1.0128	-11.4444	6.7868
14	14.1000	39.6000	22.6667	16.9333	15.5229	37.3367
15	0.3700	4.1000	-8.1361	12.2361	-25.6824	-0.2714
16	0.0800	0.7100	-8.7867	9.4967	-26.8338	-0.7847
17	0.4300	5.1000	-8.0015	13.1015	-25.4447	-0.1647
18	0.1100	0.3500	-8.7194	9.0694	-26.7145	-0.7318
19	0.6200	3.6000	-7.5752	11.1752	-24.6930	0.1742
20	1.5000	2.6000	-5.6010	8.2010	-21.2370	1.7696
21	0.0300	0.6600	-8.8989	9.5589	-27.0327	-0.8728
22	13.6000	45.6000	21.5449	24.0551	14.5731	35.4164
23	2.0200	4.5000	-4.4344	8.9344	-19.2174	2.7350
24	12.2000	5.8000	18.4041	-12.6041	11.7890	30.1642
25	14.9000	6.8000	24.4614	-17.6614	17.0044	40.4474
26	29.5000	9.2000	57.2160	-48.0160	40.9957	100.2635
27	24.8000	7.4000	46.6717	-39.2717	33.5601	80.7200
28	7.7400	10.8000	8.3982	2.4018	0.8050	15.5467
29	28.3000	3.6000	54.5238	-50.9238	39.1077	95.2633
30	8.8100	18.1000	10.7987	7.3013	3.8292	18.6646
31	9.1500	42.9000	11.5615	31.3385	4.7324	19.7130
32	5.3300	1.9000	2.9915	-1.0915	-6.9783	9.4961
33	11.8000	4.0000	17.5067	-13.5067	10.9520	28.7051
34	0.0900	0.4600	-8.7643	9.2243	-26.7941	-0.7670
35	0.3500	1.5000	-8.1810	9.6810	-25.7617	-0.3069
36	0.3400	1.8000	-8.2034	10.0034	-25.8013	-0.3247
37	1.1100	6.8000	-6.4759	13.2759	-22.7632	1.0571
38	0.7700	1.4000	-7.2387	8.6387	-24.1009	0.4431
39	0.3300	0.6700	-8.2258	8.8958	-25.8410	-0.3424
40	0.3300	0.9400	-8.2258	9.1658	-25.8410	-0.3424
41	0.0700	0.1800	-8.8091	8.9891	-26.8736	-0.8023
42	0.3000	0.2100	-8.2931	8.5031	-25.9600	-0.3957
43	0.2300	0.5400	-8.4502	8.9902	-26.2378	-0.5197
44	0.0700	0.0730	-8.8091	8.8821	-26.8736	-0.8023
45	0.0400	0.0770	-8.8764	8.9534	-26.9929	-0.8552
46	3.7100	8.4000	-0.6429	9.0429	-12.8079	6.0265
47	8.7000	2.0000	10.5520	-8.5520	3.5311	18.3312
48	7.0200	1.1000	6.7829	-5.6829	-1.3860	13.6047
49	29.0000	39.2000	56.0943	-16.8943	40.2097	98.1794
50	6.3600	34.7000	5.3023	29.3977	-3.4996	11.9297
51	16.0000	5.5000	26.9292	-21.4292	18.9797	44.7864

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Individuals

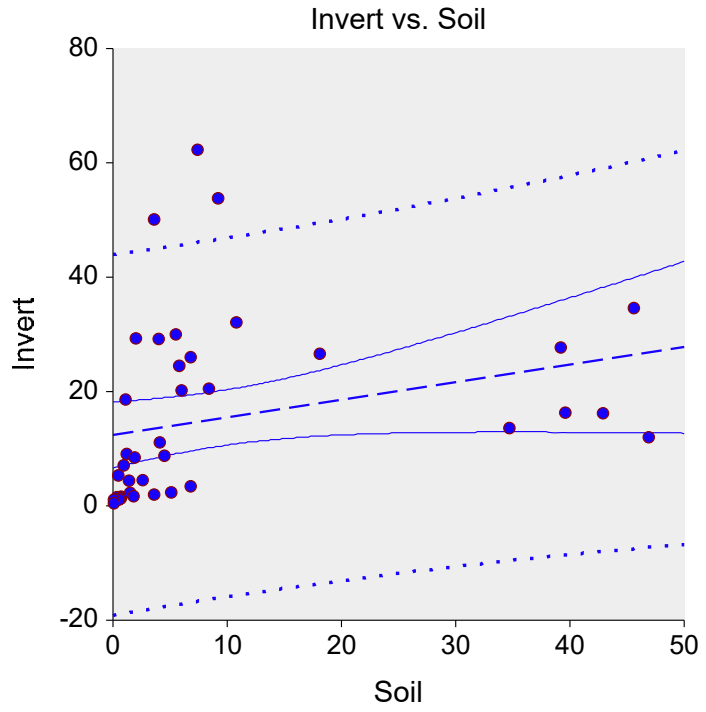
Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	17.5000	6.0000	30.2944	-24.2944	-13.1209	85.4973
12	50.1000	46.9000	103.4314	-56.5314	55.9587	203.5493
13	4.0800	1.2000	0.1872	1.0128	-50.3005	45.6430
14	14.1000	39.6000	22.6667	16.9333	-21.9143	74.7739
15	0.3700	4.1000	-8.1361	12.2361	-61.7583	35.8045
16	0.0800	0.7100	-8.7867	9.4967	-62.6747	35.0562
17	0.4300	5.1000	-8.0015	13.1015	-61.5691	35.9597
18	0.1100	0.3500	-8.7194	9.0694	-62.5798	35.1335
19	0.6200	3.6000	-7.5752	11.1752	-60.9707	36.4519
20	1.5000	2.6000	-5.6010	8.2010	-58.2159	38.7485
21	0.0300	0.6600	-8.8989	9.5589	-62.8330	34.9275
22	13.6000	45.6000	21.5449	24.0551	-23.2422	73.2317
23	2.0200	4.5000	-4.4344	8.9344	-56.6010	40.1186
24	12.2000	5.8000	18.4041	-12.6041	-27.0089	68.9620
25	14.9000	6.8000	24.4614	-17.6614	-19.8085	77.2603
26	29.5000	9.2000	57.2160	-48.0160	14.9846	126.2746
27	24.8000	7.4000	46.6717	-39.2717	4.4693	109.8108
28	7.7400	10.8000	8.3982	2.4018	-39.4951	55.8468
29	28.3000	3.6000	54.5238	-50.9238	12.3534	122.0175
30	8.8100	18.1000	10.7987	7.3013	-36.4314	58.9251
31	9.1500	42.9000	11.5615	31.3385	-35.4669	59.9123
32	5.3300	1.9000	2.9915	-1.0915	-46.5537	49.0715
33	11.8000	4.0000	17.5067	-13.5067	-28.0984	67.7554
34	0.0900	0.4600	-8.7643	9.2243	-62.6431	35.0820
35	0.3500	1.5000	-8.1810	9.6810	-61.8214	35.7528
36	0.3400	1.8000	-8.2034	10.0034	-61.8530	35.7269
37	1.1100	6.8000	-6.4759	13.2759	-59.4333	37.7273
38	0.7700	1.4000	-7.2387	8.6387	-60.4992	36.8414
39	0.3300	0.6700	-8.2258	8.8958	-61.8845	35.7011
40	0.3300	0.9400	-8.2258	9.1658	-61.8845	35.7011
41	0.0700	0.1800	-8.8091	8.9891	-62.7064	35.0305
42	0.3000	0.2100	-8.2931	8.5031	-61.9792	35.6236
43	0.2300	0.5400	-8.4502	8.9902	-62.2003	35.4429
44	0.0700	0.0730	-8.8091	8.8821	-62.7064	35.0305
45	0.0400	0.0770	-8.8764	8.9534	-62.8013	34.9532
46	3.7100	8.4000	-0.6429	9.0429	-51.4207	44.6392
47	8.7000	2.0000	10.5520	-8.5520	-36.7444	58.6067
48	7.0200	1.1000	6.7829	-5.6829	-41.5810	53.7998
49	29.0000	39.2000	56.0943	-16.8943	13.8925	124.4966
50	6.3600	34.7000	5.3023	29.3977	-43.5103	51.9404
51	16.0000	5.5000	26.9292	-21.4292	-16.9503	80.7163

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Invert	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	12.4203	Rows Prediction Only	0
Slope	0.3056	Sum of Frequencies	41
R-Squared	0.0749	Sum of Weights	41.0000
Correlation	0.2736	Coefficient of Variation	1.0067
Mean Square Error	235.0882	Square Root of MSE	15.33259

Linear Regression Report

Y = Invert X = Soil

Summary Statement

The equation of the straight line relating Invert and Soil is estimated as: Invert = (12.4203) + (0.3056) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Invert when Soil is zero, is 12.4203 with a standard error of 2.8699. The slope, the estimated change in Invert per unit change in Soil, is 0.3056 with a standard error of 0.1721. The value of R-Squared, the proportion of the variation in Invert that can be accounted for by variation in Soil, is 0.0749. The correlation between Invert and Soil is 0.2736.

A significance test that the slope is zero resulted in a t-value of 1.7764. The significance level of this t-test is 0.0835. Since 0.0835 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.3056. The lower limit of the 95% confidence interval for the slope is -0.0424 and the upper limit is 0.6537. The estimated intercept is 12.4203. The lower limit of the 95% confidence interval for the intercept is 6.6153 and the upper limit is 18.2252.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Invert	Soil
Count	41	41
Mean	15.2305	9.1944
Standard Deviation	15.7403	14.0901
Minimum	0.4500	0.0730
Maximum	62.3000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	12.4203	0.3056
Lower 95% Confidence Limit	6.6153	-0.0424
Upper 95% Confidence Limit	18.2252	0.6537
Standard Error	2.8699	0.1721
Standardized Coefficient	0.0000	0.2736
T Value	4.3277	1.7764
Prob Level (T Test)	0.0001	0.0835
Prob Level (Randomization Test N =1000)		0.0940
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9881	0.4102
Regression of Y on X	12.4203	0.3056
Inverse Regression from X on Y	-22.3101	4.0830
Orthogonal Regression of Y and X	1.5792	1.4847

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(12.4202591360387) + (0.305646007434053) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	12.4203	0.9000	7.6982	16.6992
Bootstrap Mean	12.3514	0.9500	6.7076	17.4345
Bias (BM - OV)	-0.0688	0.9900	4.0755	18.8331
Bias Corrected	12.4891			
Standard Error	2.7563			
Slope				
Original Value	0.3056	0.9000	0.0455	0.4783
Bootstrap Mean	0.3305	0.9500	-0.0469	0.5105
Bias (BM - OV)	0.0248	0.9900	-0.3809	0.5830
Bias Corrected	0.2808			
Standard Error	0.1560			
Correlation				
Original Value	0.2736	0.9000	0.0737	0.4283
Bootstrap Mean	0.2903	0.9500	0.0298	0.4603
Bias (BM - OV)	0.0167	0.9900	-0.0696	0.5232
Bias Corrected	0.2569			
Standard Error	0.1110			
R-Squared				
Original Value	0.0749	0.9000	0.0000	0.1356
Bootstrap Mean	0.0966	0.9500	0.0000	0.1421
Bias (BM - OV)	0.0218	0.9900	0.0000	0.1489
Bias Corrected	0.0531			
Standard Error	0.0695			
Standard Error of Estimate				
Original Value	15.3326	0.9000	12.0649	19.8926
Bootstrap Mean	14.8293	0.9500	11.3461	20.5997
Bias (BM - OV)	-0.5033	0.9900	10.4025	22.1638
Bias Corrected	15.8359			
Standard Error	2.3837			
Orthogonal Intercept				
Original Value	1.5792	0.9000	-5.5938	25.8911
Bootstrap Mean	-1.9135	0.9500	-6.9482	38.6138
Bias (BM - OV)	-3.4927	0.9900	-10.1249	89.5612
Bias Corrected	5.0719			
Standard Error	24.0286			
Orthogonal Slope				
Original Value	1.4847	0.9000	-2.4982	2.4942
Bootstrap Mean	2.0588	0.9500	-4.2029	2.5769
Bias (BM - OV)	0.5740	0.9900	-9.3481	2.7352
Bias Corrected	0.9107			
Standard Error	2.6862			

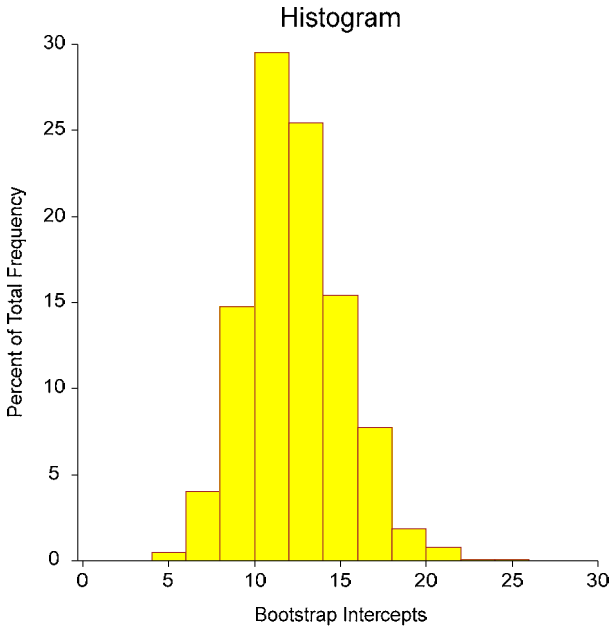
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

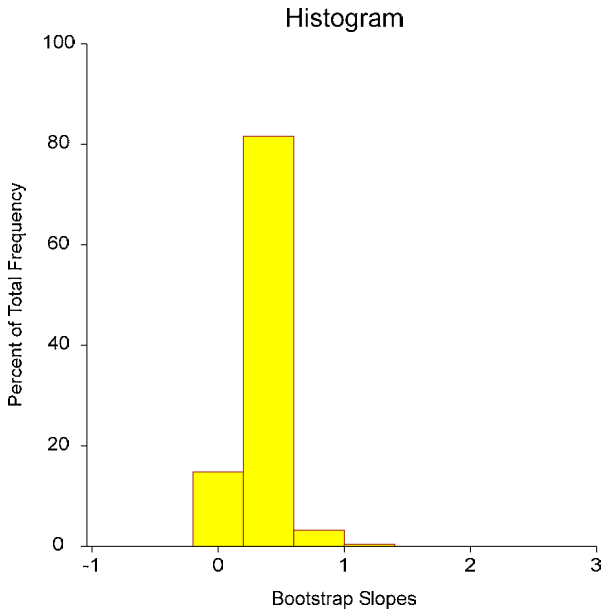
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

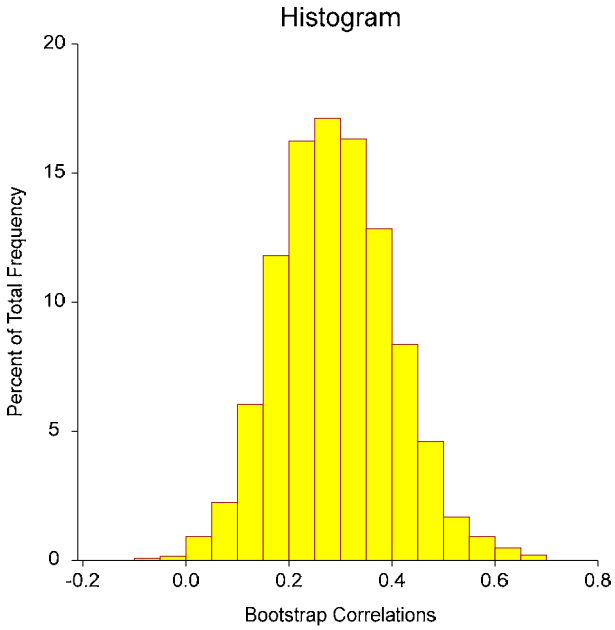
Linear Regression Report

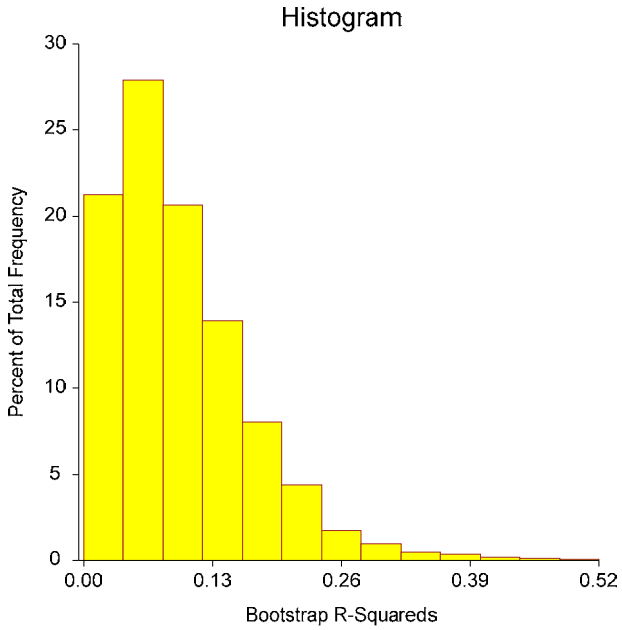
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Histograms Section



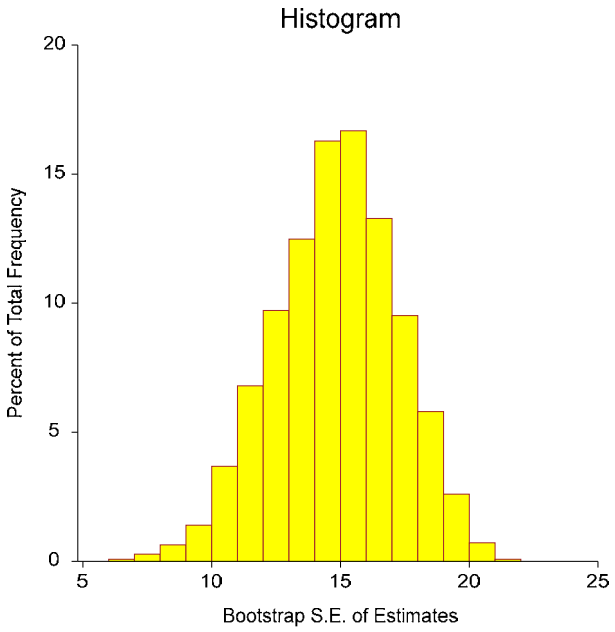


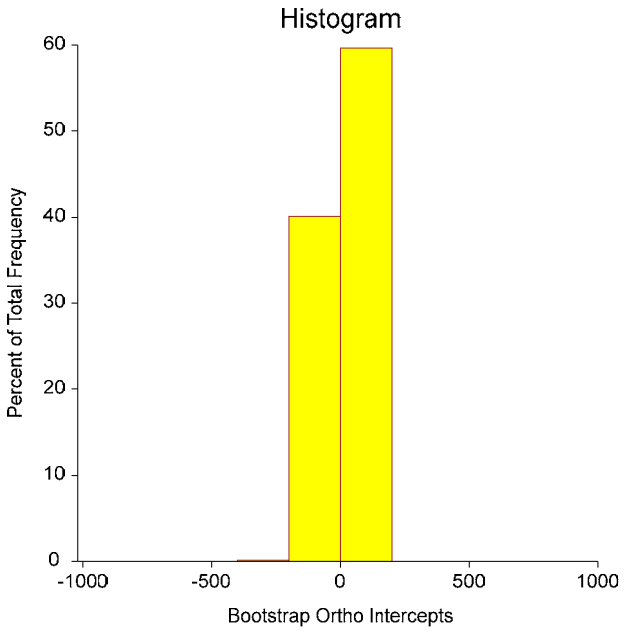


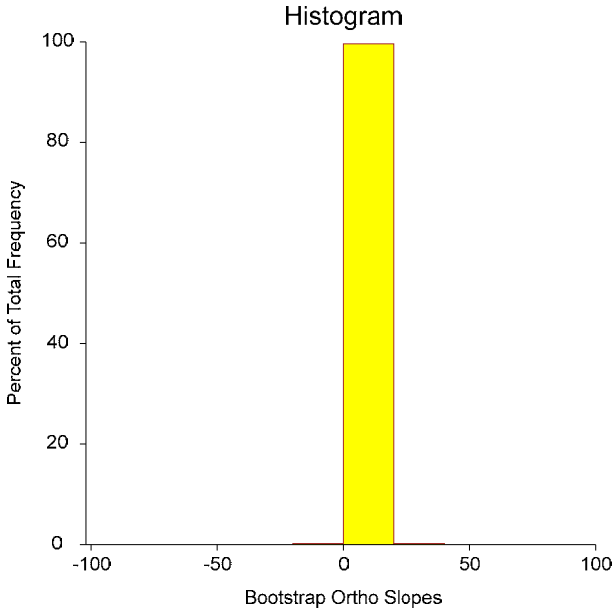


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.2736	0.0749	0.7444
Lower 95% Conf. Limit (r dist'n)	-0.0372		
Upper 95% Conf. Limit (r dist'n)	0.5312		
Lower 95% Conf. Limit (Fisher's z)	-0.0372		0.5665
Upper 95% Conf. Limit (Fisher's z)	0.5361		0.8560
Adjusted (Rbar)		0.0511	
T-Value for H0: Rho = 0	1.7764	1.7764	6.9621
Prob Level for H0: Rho = 0	0.0835	0.0835	0.0000
Prob Level (Randomization Test N =1000)	0.0940		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	9510.678	9510.678			
Slope	1	741.8708	741.8708	3.1557	0.0835	0.4102
Error	39	9168.439	235.0882			
Lack of Fit	37	7755.263	209.6017	0.2966	0.9548	
Pure Error	2	1413.177	706.5883			
Adj. Total	40	9910.311	247.7578			
Total	41	19420.99				

s = Square Root(235.0882) = 15.33259

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	624.45	0.03503547	-0.001157796
1	376.97	11407.3	8168.66	-0.001157796	0.0001259242
2 (Y'Y)			19420.99		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	8.236426	-0.2721842
1	-0.2721842	0.02960329

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7907	0.000004	No
Anderson Darling	3.0181	0.000000	No
D'Agostino Skewness	3.6012	0.000317	No
D'Agostino Kurtosis	2.1723	0.029836	No
D'Agostino Omnibus	17.6876	0.000144	No
Constant Residual Variance?			
Modified Levene Test	3.1567	0.083416	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2966	0.954807	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

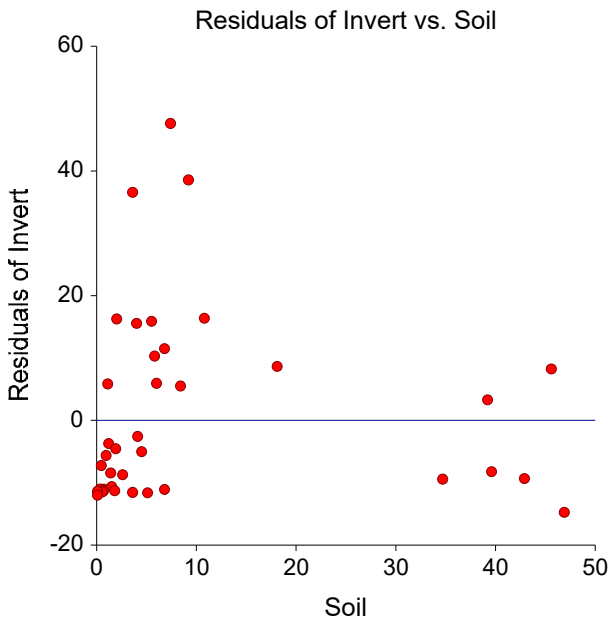
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

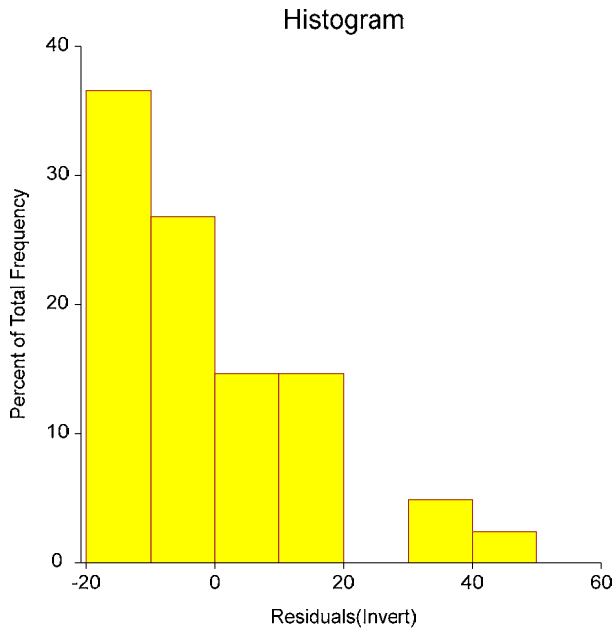
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

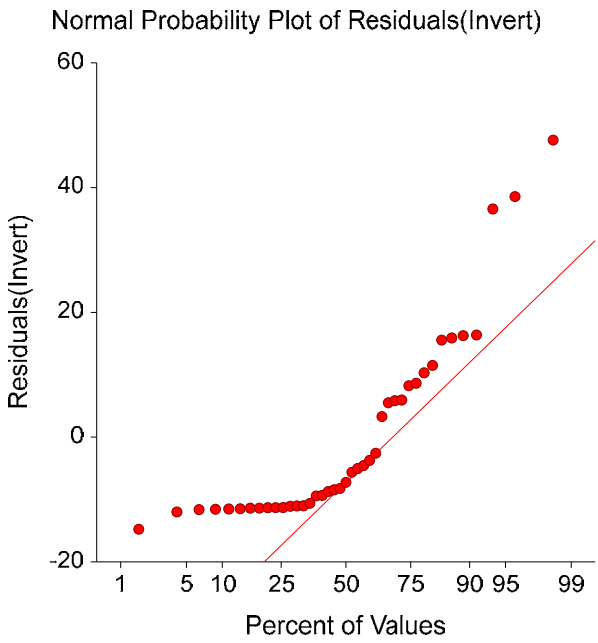
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Original Data Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual
11	6.0000	20.2000	14.2541	5.9459
12	46.9000	12.0000	26.7551	-14.7551
13	1.2000	9.0700	12.7870	-3.7170
14	39.6000	16.3000	24.5238	-8.2238
15	4.1000	11.1000	13.6734	-2.5734
16	0.7100	1.6100	12.6373	-11.0273
17	5.1000	2.3600	13.9791	-11.6191
18	0.3500	1.5200	12.5272	-11.0072
19	3.6000	1.9700	13.5206	-11.5506
20	2.6000	4.5000	13.2149	-8.7149
21	0.6600	1.3200	12.6220	-11.3020
22	45.6000	34.6000	26.3577	8.2423
23	4.5000	8.7700	13.7957	-5.0257
24	5.8000	24.5000	14.1930	10.3070
25	6.8000	26.0000	14.4987	11.5013
26	9.2000	53.8000	15.2322	38.5678
27	7.4000	62.3000	14.6820	47.6180
28	10.8000	32.1000	15.7212	16.3788
29	3.6000	50.1000	13.5206	36.5794
30	18.1000	26.6000	17.9525	8.6475
31	42.9000	16.2000	25.5325	-9.3325
32	1.9000	8.4500	13.0010	-4.5510
33	4.0000	29.2000	13.6428	15.5572
34	0.4600	5.3200	12.5609	-7.2409
35	1.5000	2.2700	12.8787	-10.6087
36	1.8000	1.6800	12.9704	-11.2904
37	6.8000	3.4200	14.4987	-11.0787
38	1.4000	4.4100	12.8482	-8.4382
39	0.6700	1.3100	12.6250	-11.3150
40	0.9400	7.0800	12.7076	-5.6276
41	0.1800	1.0900	12.4753	-11.3853
42	0.2100	0.9700	12.4844	-11.5144
43	0.5400	1.1100	12.5853	-11.4753
44	0.0730	1.0700	12.4426	-11.3726
45	0.0770	0.4500	12.4438	-11.9938
46	8.4000	20.5000	14.9877	5.5123
47	2.0000	29.3000	13.0316	16.2684
48	1.1000	18.6000	12.7565	5.8435
49	39.2000	27.7000	24.4016	3.2984
50	34.7000	13.6000	23.0262	-9.4262
51	5.5000	30.0000	14.1013	15.8987

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	20.2000	14.2541	2.4568	9.2848	19.2235
12	46.9000	12.0000	26.7551	6.9153	12.7676	40.7426
13	1.2000	9.0700	12.7870	2.7615	7.2014	18.3727
14	39.6000	16.3000	24.5238	5.7534	12.8864	36.1613
15	4.1000	11.1000	13.6734	2.5499	8.5157	18.8311
16	0.7100	1.6100	12.6373	2.8044	6.9648	18.3098
17	5.1000	2.3600	13.9791	2.4960	8.9304	19.0277
18	0.3500	1.5200	12.5272	2.8372	6.7885	18.2659
19	3.6000	1.9700	13.5206	2.5808	8.3005	18.7407
20	2.6000	4.5000	13.2149	2.6498	7.8553	18.5746
21	0.6600	1.3200	12.6220	2.8089	6.9404	18.3036
22	45.6000	34.6000	26.3577	6.7059	12.7937	39.9217
23	4.5000	8.7700	13.7957	2.5271	8.6841	18.9072
24	5.8000	24.5000	14.1930	2.4647	9.2076	19.1784
25	6.8000	26.0000	14.4987	2.4297	9.5841	19.4132
26	9.2000	53.8000	15.2322	2.3945	10.3888	20.0756
27	7.4000	62.3000	14.6820	2.4144	9.7985	19.5656
28	10.8000	32.1000	15.7212	2.4104	10.8457	20.5968
29	3.6000	50.1000	13.5206	2.5808	8.3005	18.7407
30	18.1000	26.6000	17.9525	2.8428	12.2023	23.7026
31	42.9000	16.2000	25.5325	6.2742	12.8418	38.2232
32	1.9000	8.4500	13.0010	2.7035	7.5326	18.4694
33	4.0000	29.2000	13.6428	2.5559	8.4731	18.8126
34	0.4600	5.3200	12.5609	2.8271	6.8426	18.2791
35	1.5000	2.2700	12.8787	2.7361	7.3444	18.4131
36	1.8000	1.6800	12.9704	2.7115	7.4858	18.4550
37	6.8000	3.4200	14.4987	2.4297	9.5841	19.4132
38	1.4000	4.4100	12.8482	2.7445	7.2969	18.3995
39	0.6700	1.3100	12.6250	2.8080	6.9453	18.3048
40	0.9400	7.0800	12.7076	2.7840	7.0763	18.3388
41	0.1800	1.0900	12.4753	2.8530	6.7046	18.2459
42	0.2100	0.9700	12.4844	2.8502	6.7195	18.2494
43	0.5400	1.1100	12.5853	2.8198	6.8818	18.2888
44	0.0730	1.0700	12.4426	2.8630	6.6516	18.2336
45	0.0770	0.4500	12.4438	2.8626	6.6536	18.2340
46	8.4000	20.5000	14.9877	2.3984	10.1364	19.8390
47	2.0000	29.3000	13.0316	2.6956	7.5792	18.4839
48	1.1000	18.6000	12.7565	2.7701	7.1534	18.3595
49	39.2000	27.7000	24.4016	5.6909	12.8906	35.9126
50	34.7000	13.6000	23.0262	4.9992	12.9144	33.1380
51	5.5000	30.0000	14.1013	2.4775	9.0901	19.1125

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	20.2000	14.2541	15.5282	-17.1546	45.6628
12	46.9000	12.0000	26.7551	16.8199	-7.2664	60.7765
13	1.2000	9.0700	12.7870	15.5793	-18.7250	44.2991
14	39.6000	16.3000	24.5238	16.3765	-8.6008	57.6485
15	4.1000	11.1000	13.6734	15.5432	-17.7656	45.1125
16	0.7100	1.6100	12.6373	15.5870	-18.8903	44.1649
17	5.1000	2.3600	13.9791	15.5344	-17.4423	45.4004
18	0.3500	1.5200	12.5272	15.5929	-19.0123	44.0668
19	3.6000	1.9700	13.5206	15.5483	-17.9288	44.9699
20	2.6000	4.5000	13.2149	15.5599	-18.2579	44.6877
21	0.6600	1.3200	12.6220	15.5878	-18.9072	44.1512
22	45.6000	34.6000	26.3577	16.7349	-7.4918	60.2073
23	4.5000	8.7700	13.7957	15.5394	-17.6358	45.2272
24	5.8000	24.5000	14.1930	15.5294	-17.2182	45.6042
25	6.8000	26.0000	14.4987	15.5239	-16.9014	45.8987
26	9.2000	53.8000	15.2322	15.5184	-16.1568	46.6212
27	7.4000	62.3000	14.6820	15.5215	-16.7132	46.0773
28	10.8000	32.1000	15.7212	15.5209	-15.6728	47.1152
29	3.6000	50.1000	13.5206	15.5483	-17.9288	44.9699
30	18.1000	26.6000	17.9525	15.5939	-13.5892	49.4941
31	42.9000	16.2000	25.5325	16.5666	-7.9767	59.0417
32	1.9000	8.4500	13.0010	15.5691	-18.4905	44.4925
33	4.0000	29.2000	13.6428	15.5442	-17.7982	45.0839
34	0.4600	5.3200	12.5609	15.5910	-18.9750	44.0967
35	1.5000	2.2700	12.8787	15.5748	-18.6243	44.3818
36	1.8000	1.6800	12.9704	15.5705	-18.5239	44.4647
37	6.8000	3.4200	14.4987	15.5239	-16.9014	45.8987
38	1.4000	4.4100	12.8482	15.5763	-18.6578	44.3542
39	0.6700	1.3100	12.6250	15.5876	-18.9038	44.1539
40	0.9400	7.0800	12.7076	15.5833	-18.8126	44.2278
41	0.1800	1.0900	12.4753	15.5958	-19.0701	44.0207
42	0.2100	0.9700	12.4844	15.5952	-19.0599	44.0288
43	0.5400	1.1100	12.5853	15.5897	-18.9479	44.1185
44	0.0730	1.0700	12.4426	15.5976	-19.1065	43.9917
45	0.0770	0.4500	12.4438	15.5975	-19.1052	43.9928
46	8.4000	20.5000	14.9877	15.5190	-16.4025	46.3779
47	2.0000	29.3000	13.0316	15.5677	-18.4572	44.5203
48	1.1000	18.6000	12.7565	15.5808	-18.7587	44.2716
49	39.2000	27.7000	24.4016	16.3547	-8.6788	57.4820
50	34.7000	13.6000	23.0262	16.1270	-9.5938	55.6461
51	5.5000	30.0000	14.1013	15.5315	-17.3140	45.5166

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	20.2000	14.2541	2.4568	7.2525	21.2557
12	46.9000	12.0000	26.7551	6.9153	7.0474	46.4627
13	1.2000	9.0700	12.7870	2.7615	4.9172	20.6569
14	39.6000	16.3000	24.5238	5.7534	8.1273	40.9204
15	4.1000	11.1000	13.6734	2.5499	6.4064	20.9404
16	0.7100	1.6100	12.6373	2.8044	4.6450	20.6295
17	5.1000	2.3600	13.9791	2.4960	6.8657	21.0924
18	0.3500	1.5200	12.5272	2.8372	4.4417	20.6128
19	3.6000	1.9700	13.5206	2.5808	6.1657	20.8754
20	2.6000	4.5000	13.2149	2.6498	5.6635	20.7664
21	0.6600	1.3200	12.6220	2.8089	4.6169	20.6270
22	45.6000	34.6000	26.3577	6.7059	7.2468	45.4687
23	4.5000	8.7700	13.7957	2.5271	6.5938	20.9976
24	5.8000	24.5000	14.1930	2.4647	7.1688	21.2172
25	6.8000	26.0000	14.4987	2.4297	7.5742	21.4231
26	9.2000	53.8000	15.2322	2.3945	8.4081	22.0564
27	7.4000	62.3000	14.6820	2.4144	7.8014	21.5627
28	10.8000	32.1000	15.7212	2.4104	8.8518	22.5907
29	3.6000	50.1000	13.5206	2.5808	6.1657	20.8754
30	18.1000	26.6000	17.9525	2.8428	9.8507	26.0542
31	42.9000	16.2000	25.5325	6.2742	7.6519	43.4130
32	1.9000	8.4500	13.0010	2.7035	5.2963	20.7057
33	4.0000	29.2000	13.6428	2.5559	6.3589	20.9268
34	0.4600	5.3200	12.5609	2.8271	4.5041	20.6176
35	1.5000	2.2700	12.8787	2.7361	5.0811	20.6764
36	1.8000	1.6800	12.9704	2.7115	5.2429	20.6980
37	6.8000	3.4200	14.4987	2.4297	7.5742	21.4231
38	1.4000	4.4100	12.8482	2.7445	5.0267	20.6697
39	0.6700	1.3100	12.6250	2.8080	4.6225	20.6275
40	0.9400	7.0800	12.7076	2.7840	4.7734	20.6417
41	0.1800	1.0900	12.4753	2.8530	4.3447	20.6059
42	0.2100	0.9700	12.4844	2.8502	4.3619	20.6070
43	0.5400	1.1100	12.5853	2.8198	4.5493	20.6213
44	0.0730	1.0700	12.4426	2.8630	4.2834	20.6018
45	0.0770	0.4500	12.4438	2.8626	4.2857	20.6019
46	8.4000	20.5000	14.9877	2.3984	8.1524	21.8229
47	2.0000	29.3000	13.0316	2.6956	5.3495	20.7136
48	1.1000	18.6000	12.7565	2.7701	4.8620	20.6509
49	39.2000	27.7000	24.4016	5.6909	8.1831	40.6200
50	34.7000	13.6000	23.0262	4.9992	8.7791	37.2732
51	5.5000	30.0000	14.1013	2.4775	7.0408	21.1618

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	20.2000	14.2541	5.9459	0.3929	29.4350
12	46.9000	12.0000	26.7551	-14.7551	-1.0782	122.9588
13	1.2000	9.0700	12.7870	-3.7170	-0.2465	40.9816
14	39.6000	16.3000	24.5238	-8.2238	-0.5786	50.4530
15	4.1000	11.1000	13.6734	-2.5734	-0.1702	23.1839
16	0.7100	1.6100	12.6373	-11.0273	-0.7315	684.9235
17	5.1000	2.3600	13.9791	-11.6191	-0.7680	492.3328
18	0.3500	1.5200	12.5272	-11.0072	-0.7305	724.1602
19	3.6000	1.9700	13.5206	-11.5506	-0.7642	586.3241
20	2.6000	4.5000	13.2149	-8.7149	-0.5771	193.6653
21	0.6600	1.3200	12.6220	-11.3020	-0.7498	856.2110
22	45.6000	34.6000	26.3577	8.2423	0.5978	23.8216
23	4.5000	8.7700	13.7957	-5.0257	-0.3323	57.3052
24	5.8000	24.5000	14.1930	10.3070	0.6811	42.0694
25	6.8000	26.0000	14.4987	11.5013	0.7597	44.2360
26	9.2000	53.8000	15.2322	38.5678	2.5467	71.6874
27	7.4000	62.3000	14.6820	47.6180	3.1449	76.4333
28	10.8000	32.1000	15.7212	16.3788	1.0817	51.0242
29	3.6000	50.1000	13.5206	36.5794	2.4203	73.0128
30	18.1000	26.6000	17.9525	8.6475	0.5739	32.5096
31	42.9000	16.2000	25.5325	-9.3325	-0.6671	57.6079
32	1.9000	8.4500	13.0010	-4.5510	-0.3015	53.8578
33	4.0000	29.2000	13.6428	15.5572	1.0290	53.2779
34	0.4600	5.3200	12.5609	-7.2409	-0.4805	136.1063
35	1.5000	2.2700	12.8787	-10.6087	-0.7032	467.3449
36	1.8000	1.6800	12.9704	-11.2904	-0.7482	672.0489
37	6.8000	3.4200	14.4987	-11.0787	-0.7318	323.9372
38	1.4000	4.4100	12.8482	-8.4382	-0.5594	191.3416
39	0.6700	1.3100	12.6250	-11.3150	-0.7507	863.7437
40	0.9400	7.0800	12.7076	-5.6276	-0.3732	79.4854
41	0.1800	1.0900	12.4753	-11.3853	-0.7558	1044.5207
42	0.2100	0.9700	12.4844	-11.5144	-0.7643	1187.0562
43	0.5400	1.1100	12.5853	-11.4753	-0.7614	1033.8115
44	0.0730	1.0700	12.4426	-11.3726	-0.7550	1062.8571
45	0.0770	0.4500	12.4438	-11.9938	-0.7962	2665.2875
46	8.4000	20.5000	14.9877	5.5123	0.3640	26.8893
47	2.0000	29.3000	13.0316	16.2684	1.0778	55.5237
48	1.1000	18.6000	12.7565	5.8435	0.3875	31.4168
49	39.2000	27.7000	24.4016	3.2984	0.2317	11.9076
50	34.7000	13.6000	23.0262	-9.4262	-0.6503	69.3101
51	5.5000	30.0000	14.1013	15.8987	1.0507	52.9956

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	5.9459	0.3886	0.0257	0.0020	240.3199
12	46.9000	-14.7551	*-1.0805	0.2034	0.1484	234.0824
13	1.2000	-3.7170	-0.2435	0.0324	0.0010	240.8990
14	39.6000	-8.2238	*-0.5736	0.1408	0.0274	239.2033
15	4.1000	-2.5734	-0.1681	0.0277	0.0004	241.0955
16	0.7100	-11.0273	-0.7271	0.0335	0.0093	237.9640
17	5.1000	-11.6191	-0.7639	0.0265	0.0080	237.6253
18	0.3500	-11.0072	-0.7261	0.0342	0.0095	237.9733
19	3.6000	-11.5506	-0.7601	0.0283	0.0085	237.6614
20	2.6000	-8.7149	-0.5721	0.0299	0.0051	239.2145
21	0.6600	-11.3020	-0.7455	0.0336	0.0098	237.7966
22	45.6000	8.2423	*0.5928	0.1913	0.0423	239.0641
23	4.5000	-5.0257	-0.3285	0.0272	0.0015	240.5915
24	5.8000	10.3070	0.6763	0.0258	0.0062	238.4049
25	6.8000	11.5013	0.7555	0.0251	0.0074	237.7040
26	9.2000	38.5678	*2.7531	0.0244	0.0811	201.1521
27	7.4000	47.6180	*3.5932	0.0248	0.1257	180.0873
28	10.8000	16.3788	1.0841	0.0247	0.0148	234.0363
29	3.6000	36.5794	*2.5916	0.0283	0.0854	205.0361
30	18.1000	8.6475	0.5690	0.0344	0.0059	239.2368
31	42.9000	-9.3325	*-0.6623	0.1674	0.0447	238.5218
32	1.9000	-4.5510	-0.2980	0.0311	0.0015	240.7122
33	4.0000	15.5572	1.0298	0.0278	0.0151	234.7236
34	0.4600	-7.2409	-0.4757	0.0340	0.0041	239.8464
35	1.5000	-10.6087	-0.6986	0.0318	0.0081	238.2156
36	1.8000	-11.2904	-0.7439	0.0313	0.0090	237.8119
37	6.8000	-11.0787	-0.7274	0.0251	0.0069	237.9616
38	1.4000	-8.4382	-0.5544	0.0320	0.0052	239.3390
39	0.6700	-11.3150	-0.7464	0.0335	0.0098	237.7886
40	0.9400	-5.6276	-0.3691	0.0330	0.0024	240.4129
41	0.1800	-11.3853	-0.7515	0.0346	0.0102	237.7412
42	0.2100	-11.5144	-0.7602	0.0346	0.0105	237.6608
43	0.5400	-11.4753	-0.7572	0.0338	0.0101	237.6881
44	0.0730	-11.3726	-0.7508	0.0349	0.0103	237.7482
45	0.0770	-11.9938	-0.7924	0.0349	0.0114	237.3525
46	8.4000	5.5123	0.3599	0.0245	0.0017	240.4551
47	2.0000	16.2684	1.0801	0.0309	0.0185	234.0878
48	1.1000	5.8435	0.3832	0.0326	0.0025	240.3458
49	39.2000	3.2984	*0.2288	0.1378	0.0043	240.9427
50	34.7000	-9.4262	*-0.6454	0.1063	0.0252	238.6584
51	5.5000	15.8987	1.0522	0.0261	0.0148	234.4446

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.3886	0.0631	0.0020	1.0725	0.0591	-0.0141
12	-1.0805	-0.5460	0.1484	* 1.2446	0.1246	-0.5123
13	-0.2435	-0.0446	0.0010	1.0852	-0.0445	0.0222
14	-0.5736	-0.2322	0.0274	* 1.2050	0.0358	-0.2112
15	-0.1681	-0.0283	0.0004	1.0817	-0.0276	0.0097
16	-0.7271	-0.1353	0.0093	1.0601	-0.1352	0.0704
17	-0.7639	-0.1260	0.0080	1.0495	-0.1205	0.0356
18	-0.7261	-0.1367	0.0095	1.0610	-0.1367	0.0733
19	-0.7601	-0.1298	0.0085	1.0518	-0.1272	0.0484
20	-0.5721	-0.1004	0.0051	1.0673	-0.0994	0.0430
21	-0.7455	-0.1389	0.0098	1.0587	-0.1389	0.0726
22	0.5928	0.2883	0.0423	* 1.2787	-0.0625	0.2693
23	-0.3285	-0.0549	0.0015	1.0766	-0.0531	0.0175
24	0.6763	0.1102	0.0062	1.0557	0.1037	-0.0261
25	0.7555	0.1213	0.0074	1.0487	0.1110	-0.0206
26	* 2.7531	0.4353	0.0811	0.7504	0.3631	0.0002
27	* 3.5932	0.5730	0.1257	0.6017	0.5145	-0.0733
28	1.0841	0.1726	0.0148	1.0162	0.1321	0.0198
29	* 2.5916	0.4425	0.0854	0.7829	0.4336	-0.1650
30	0.5690	0.1074	0.0059	1.0725	0.0436	0.0579
31	-0.6623	-0.2970	0.0447	* 1.2365	0.0567	-0.2745
32	-0.2980	-0.0534	0.0015	1.0821	-0.0531	0.0248
33	1.0298	0.1741	0.0151	1.0254	0.1697	-0.0609
34	-0.4757	-0.0892	0.0041	1.0775	-0.0892	0.0474
35	-0.6986	-0.1267	0.0081	1.0606	-0.1263	0.0613
36	-0.7439	-0.1337	0.0090	1.0563	-0.1330	0.0627
37	-0.7274	-0.1167	0.0069	1.0510	-0.1069	0.0198
38	-0.5544	-0.1009	0.0052	1.0708	-0.1006	0.0493
39	-0.7464	-0.1390	0.0098	1.0586	-0.1390	0.0726
40	-0.3691	-0.0681	0.0024	1.0815	-0.0681	0.0348
41	-0.7515	-0.1423	0.0102	1.0594	-0.1423	0.0774
42	-0.7602	-0.1438	0.0105	1.0586	-0.1438	0.0780
43	-0.7572	-0.1417	0.0101	1.0580	-0.1416	0.0748
44	-0.7508	-0.1427	0.0103	1.0597	-0.1427	0.0782
45	-0.7924	-0.1506	0.0114	1.0562	-0.1506	0.0825
46	0.3599	0.0570	0.0017	1.0724	0.0493	-0.0032
47	1.0801	0.1929	0.0185	1.0231	0.1918	-0.0886
48	0.3832	0.0704	0.0025	1.0805	0.0703	-0.0354
49	0.2288	0.0915	0.0043	* 1.2183	-0.0136	0.0830
50	-0.6454	-0.2226	0.0252	* 1.1532	0.0187	-0.1954
51	1.0522	0.1723	0.0148	1.0212	0.1633	-0.0442

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	5.9459	|.....	0.3929	|.....	0.3886	|.....
12	46.9000	-14.7551	||||.....	-1.0782	||||.....	-1.0805	|||.....
13	1.2000	-3.7170	|.....	-0.2465	|.....	-0.2435	|.....
14	39.6000	-8.2238	|.....	-0.5786	||.....	-0.5736	|.....
15	4.1000	-2.5734	|.....	-0.1702	|.....	-0.1681	|.....
16	0.7100	-11.0273	||.....	-0.7315	||.....	-0.7271	||.....
17	5.1000	-11.6191	|||.....	-0.7680	|||.....	-0.7639	||.....
18	0.3500	-11.0072	||.....	-0.7305	||.....	-0.7261	||.....
19	3.6000	-11.5506	||.....	-0.7642	||.....	-0.7601	||.....
20	2.6000	-8.7149	||.....	-0.5771	||.....	-0.5721	|.....
21	0.6600	-11.3020	||.....	-0.7498	||.....	-0.7455	||.....
22	45.6000	8.2423	|.....	0.5978	||.....	0.5928	|.....
23	4.5000	-5.0257	|.....	-0.3323	|.....	-0.3285	|.....
24	5.8000	10.3070	||.....	0.6811	||.....	0.6763	||.....
25	6.8000	11.5013	||.....	0.7597	||.....	0.7555	||.....
26	9.2000	38.5678	||||||||||....	2.5467	||||||||||....	* 2.7531	||||||||||....
27	7.4000	47.6180	||||||||||||||	3.1449	||||||||||||||	* 3.5932	||||||||||||||
28	10.8000	16.3788	||||.....	1.0817	||||.....	1.0841	||||.....
29	3.6000	36.5794	||||||||||....	2.4203	||||||||||....	* 2.5916	|||||||||.....
30	18.1000	8.6475	||.....	0.5739	||.....	0.5690	|.....
31	42.9000	-9.3325	||.....	-0.6671	||.....	-0.6623	||.....
32	1.9000	-4.5510	|.....	-0.3015	|.....	-0.2980	|.....
33	4.0000	15.5572	||||.....	1.0290	||||.....	1.0298	|||.....
34	0.4600	-7.2409	|.....	-0.4805	|.....	-0.4757	|.....
35	1.5000	-10.6087	||.....	-0.7032	||.....	-0.6986	||.....
36	1.8000	-11.2904	||.....	-0.7482	||.....	-0.7439	||.....
37	6.8000	-11.0787	||.....	-0.7318	||.....	-0.7274	||.....
38	1.4000	-8.4382	|.....	-0.5594	|.....	-0.5544	|.....
39	0.6700	-11.3150	||.....	-0.7507	||.....	-0.7464	||.....
40	0.9400	-5.6276	|.....	-0.3732	|.....	-0.3691	|.....
41	0.1800	-11.3853	||.....	-0.7558	||.....	-0.7515	||.....
42	0.2100	-11.5144	||.....	-0.7643	||.....	-0.7602	||.....
43	0.5400	-11.4753	||.....	-0.7614	||.....	-0.7572	||.....
44	0.0730	-11.3726	||.....	-0.7550	||.....	-0.7508	||.....
45	0.0770	-11.9938	|||.....	-0.7962	|||.....	-0.7924	||.....
46	8.4000	5.5123	|.....	0.3640	|.....	0.3599	|.....
47	2.0000	16.2684	||||.....	1.0778	||||.....	1.0801	|||.....
48	1.1000	5.8435	|.....	0.3875	|.....	0.3832	|.....
49	39.2000	3.2984	|.....	0.2317	|.....	0.2288	|.....
50	34.7000	-9.4262	||.....	-0.6503	||.....	-0.6454	||.....
51	5.5000	15.8987	||||.....	1.0507	||||.....	1.0522	|||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.0631	|.....	0.0020	|.....	-0.0141	|.....
12	46.9000	-0.5460	|||||||||||||.	0.1484	|||||||||||||	-0.5123	|||||||||||||
13	1.2000	-0.0446	|.....	0.0010	|.....	0.0222	|.....
14	39.6000	-0.2322	|||||.....	0.0274	||.....	-0.2112	|||||.....
15	4.1000	-0.0283	|.....	0.0004	|.....	0.0097	|.....
16	0.7100	-0.1353	||.....	0.0093	|.....	0.0704	||.....
17	5.1000	-0.1260	||.....	0.0080	|.....	0.0356	|.....
18	0.3500	-0.1367	||.....	0.0095	|.....	0.0733	||.....
19	3.6000	-0.1298	||.....	0.0085	|.....	0.0484	|.....
20	2.6000	-0.1004	|.....	0.0051	|.....	0.0430	|.....
21	0.6600	-0.1389	|||.....	0.0098	|.....	0.0726	||.....
22	45.6000	0.2883	|||||||.....	0.0423	||||.....	0.2693	|||||||.....
23	4.5000	-0.0549	|.....	0.0015	|.....	0.0175	|.....
24	5.8000	0.1102	||.....	0.0062	|.....	-0.0261	|.....
25	6.8000	0.1213	||.....	0.0074	|.....	-0.0206	|.....
26	9.2000	0.4353	||||||||||....	0.0811	|||||||.....	0.0002	|.....
27	7.4000	0.5730	||||||||||||||	0.1257	||||||||||...	-0.0733	||.....
28	10.8000	0.1726	|||.....	0.0148	|.....	0.0198	|.....
29	3.6000	0.4425	||||||||||....	0.0854	|||||||.....	-0.1650	||||.....
30	18.1000	0.1074	||.....	0.0059	|.....	0.0579	|.....
31	42.9000	-0.2970	|||||||.....	0.0447	||||.....	-0.2745	|||||||.....
32	1.9000	-0.0534	|.....	0.0015	|.....	0.0248	|.....
33	4.0000	0.1741	||||.....	0.0151	|.....	-0.0609	|.....
34	0.4600	-0.0892	|.....	0.0041	|.....	0.0474	|.....
35	1.5000	-0.1267	||.....	0.0081	|.....	0.0613	|.....
36	1.8000	-0.1337	||.....	0.0090	|.....	0.0627	|.....
37	6.8000	-0.1167	||.....	0.0069	|.....	0.0198	|.....
38	1.4000	-0.1009	|.....	0.0052	|.....	0.0493	|.....
39	0.6700	-0.1390	|||.....	0.0098	|.....	0.0726	||.....
40	0.9400	-0.0681	|.....	0.0024	|.....	0.0348	|.....
41	0.1800	-0.1423	|||.....	0.0102	|.....	0.0774	||.....
42	0.2100	-0.1438	|||.....	0.0105	|.....	0.0780	||.....
43	0.5400	-0.1417	|||.....	0.0101	|.....	0.0748	||.....
44	0.0730	-0.1427	|||.....	0.0103	|.....	0.0782	||.....
45	0.0770	-0.1506	|||.....	0.0114	|.....	0.0825	||.....
46	8.4000	0.0570	|.....	0.0017	|.....	-0.0032	|.....
47	2.0000	0.1929	||||.....	0.0185	|.....	-0.0886	||.....
48	1.1000	0.0704	|.....	0.0025	|.....	-0.0354	|.....
49	39.2000	0.0915	|.....	0.0043	|.....	0.0830	||.....
50	34.7000	-0.2226	|||||.....	0.0252	||.....	-0.1954	|||||.....
51	5.5000	0.1723	|||.....	0.0148	|.....	-0.0442	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	0.3886	|.....	0.0020	|.....	0.0257	|.....
12	46.9000	-1.0805	|||.....	0.1484	||||||||||||||	0.2034	||||||||||||||
13	1.2000	-0.2435	|.....	0.0010	|.....	0.0324	|.....
14	39.6000	-0.5736	|.....	0.0274	||.....	0.1408	||||||||.....
15	4.1000	-0.1681	|.....	0.0004	|.....	0.0277	|.....
16	0.7100	-0.7271	||.....	0.0093	|.....	0.0335	|.....
17	5.1000	-0.7639	||.....	0.0080	|.....	0.0265	|.....
18	0.3500	-0.7261	||.....	0.0095	|.....	0.0342	|.....
19	3.6000	-0.7601	||.....	0.0085	|.....	0.0283	|.....
20	2.6000	-0.5721	|.....	0.0051	|.....	0.0299	|.....
21	0.6600	-0.7455	||.....	0.0098	|.....	0.0336	|.....
22	45.6000	0.5928	|.....	0.0423	||||.....	0.1913	||||||||||||..
23	4.5000	-0.3285	|.....	0.0015	|.....	0.0272	|.....
24	5.8000	0.6763	||.....	0.0062	|.....	0.0258	|.....
25	6.8000	0.7555	||.....	0.0074	|.....	0.0251	|.....
26	9.2000	* 2.7531	|||||||||||....	0.0811	|||||||.....	0.0244	|.....
27	7.4000	* 3.5932	||||||||||||||	0.1257	|||||||||||...	0.0248	|.....
28	10.8000	1.0841	||||.....	0.0148	|.....	0.0247	|.....
29	3.6000	* 2.5916	||||||||||.....	0.0854	|||||||.....	0.0283	|.....
30	18.1000	0.5690	|.....	0.0059	|.....	0.0344	|.....
31	42.9000	-0.6623	||.....	0.0447	||||.....	0.1674	||||||||||....
32	1.9000	-0.2980	|.....	0.0015	|.....	0.0311	|.....
33	4.0000	1.0298	|||.....	0.0151	|.....	0.0278	|.....
34	0.4600	-0.4757	|.....	0.0041	|.....	0.0340	|.....
35	1.5000	-0.6986	||.....	0.0081	|.....	0.0318	|.....
36	1.8000	-0.7439	||.....	0.0090	|.....	0.0313	|.....
37	6.8000	-0.7274	||.....	0.0069	|.....	0.0251	|.....
38	1.4000	-0.5544	|.....	0.0052	|.....	0.0320	|.....
39	0.6700	-0.7464	||.....	0.0098	|.....	0.0335	|.....
40	0.9400	-0.3691	|.....	0.0024	|.....	0.0330	|.....
41	0.1800	-0.7515	||.....	0.0102	|.....	0.0346	|.....
42	0.2100	-0.7602	||.....	0.0105	|.....	0.0346	|.....
43	0.5400	-0.7572	||.....	0.0101	|.....	0.0338	|.....
44	0.0730	-0.7508	||.....	0.0103	|.....	0.0349	|.....
45	0.0770	-0.7924	||.....	0.0114	|.....	0.0349	|.....
46	8.4000	0.3599	|.....	0.0017	|.....	0.0245	|.....
47	2.0000	1.0801	|||.....	0.0185	|.....	0.0309	|.....
48	1.1000	0.3832	|.....	0.0025	|.....	0.0326	|.....
49	39.2000	0.2288	|.....	0.0043	|.....	0.1378	||||||||.....
50	34.7000	-0.6454	||.....	0.0252	||.....	0.1063	|||||.....
51	5.5000	1.0522	|||.....	0.0148	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Means

Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	20.2000	6.0000	25.4534	-19.4534	-100.8966	9.6002
12	12.0000	46.9000	-1.3750	48.2750	16.5472	73.1437
13	9.0700	1.2000	-10.9612	12.1612	5.4491	148.9117
14	16.3000	39.6000	12.6936	26.9064	-28.4234	23.2063
15	11.1000	4.1000	-4.3196	8.4196	11.8029	97.7525
16	1.6100	0.7100	-35.3686	36.0786	-9.1502	328.1653
17	2.3600	5.1000	-32.9147	38.0147	-7.8552	310.3166
18	1.5200	0.3500	-35.6630	36.0130	-9.3045	330.3061
19	1.9700	3.6000	-34.1907	37.7907	-8.5307	319.6001
20	4.5000	2.6000	-25.9132	28.5132	-4.0432	259.2713
21	1.3200	0.6600	-36.3174	36.9774	-9.6465	335.0625
22	34.6000	45.6000	72.5668	-26.9668	-446.2083	37.0804
23	8.7700	4.5000	-11.9428	16.4428	4.7071	156.2752
24	24.5000	5.8000	39.5220	-33.7220	-205.8852	19.6807
25	26.0000	6.8000	44.4296	-37.6296	-241.8154	22.5035
26	53.8000	9.2000	135.3845	-126.1845	-900.2283	67.3250
27	62.3000	7.4000	163.1945	-155.7945	-1100.9990	80.4868
28	32.1000	10.8000	64.3874	-53.5874	-386.9435	32.9947
29	50.1000	3.6000	123.2790	-119.6790	-812.8098	61.5716
30	26.6000	18.1000	46.3927	-28.2927	-256.1471	23.5922
31	16.2000	42.9000	12.3664	30.5336	-27.9360	24.9261
32	8.4500	1.9000	-12.9897	14.8897	3.9461	164.0991
33	29.2000	4.0000	54.8993	-50.8993	-318.0772	28.1361
34	5.3200	0.4600	-23.2303	23.6903	-2.5185	239.6480
35	2.2700	1.5000	-33.2092	34.7092	-8.0115	312.4594
36	1.6800	1.8000	-35.1395	36.9395	-9.0300	326.5002
37	3.4200	6.8000	-29.4467	36.2467	-5.9921	285.0576
38	4.4100	1.4000	-26.2076	27.6076	-4.2079	261.4225
39	1.3100	0.6700	-36.3501	37.0201	-9.6636	335.3003
40	7.0800	0.9400	-17.4720	18.4120	0.9476	197.3357
41	1.0900	0.1800	-37.0699	37.2499	-10.0386	340.5311
42	0.9700	0.2100	-37.4625	37.6725	-10.2427	343.3837
43	1.1100	0.5400	-37.0044	37.5444	-10.0046	340.0556
44	1.0700	0.0730	-37.1353	37.2083	-10.0727	341.0065
45	0.4500	0.0770	-39.1638	39.2408	-11.1230	355.7412
46	20.5000	8.4000	26.4350	-18.0350	-108.4350	10.5170
47	29.3000	2.0000	55.2264	-53.2264	-320.4549	28.3066
48	18.6000	1.1000	20.2186	-19.1186	-58.7427	2.7608
49	27.7000	39.2000	49.9916	-10.7916	-282.3779	25.5442
50	13.6000	34.7000	3.8598	30.8402	6.5181	47.8582
51	30.0000	5.5000	57.5167	-52.0167	-337.0917	29.4932

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Individuals

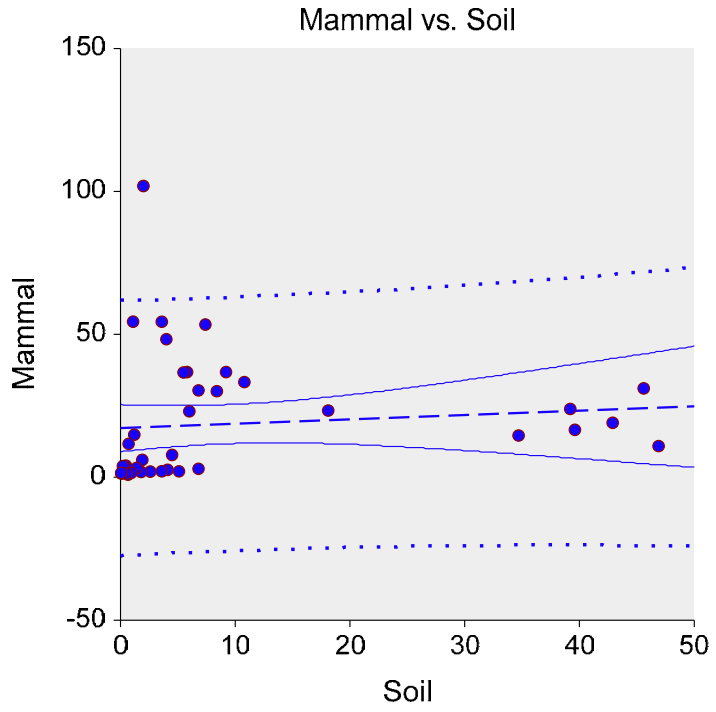
Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	20.2000	6.0000	25.4534	-19.4534	-223.6237	132.3273
12	12.0000	46.9000	-1.3750	48.2750	-139.3470	229.0380
13	9.0700	1.2000	-10.9612	12.1612	-94.8146	249.1754
14	16.3000	39.6000	12.6936	26.9064	-190.7417	185.5246
15	11.1000	4.1000	-4.3196	8.4196	-126.5530	236.1084
16	1.6100	0.7100	-35.3686	36.0786	80.2471	238.7681
17	2.3600	5.1000	-32.9147	38.0147	54.1775	248.2840
18	1.5200	0.3500	-35.6630	36.0130	83.7295	237.2721
19	1.9700	3.6000	-34.1907	37.7907	67.1593	243.9101
20	4.5000	2.6000	-25.9132	28.5132	-4.2724	259.5005
21	1.3200	0.6600	-36.3174	36.9774	91.8448	233.5711
22	34.6000	45.6000	72.5668	-26.9668	-358.3961	-50.7318
23	8.7700	4.5000	-11.9428	16.4428	-89.7570	250.7393
24	24.5000	5.8000	39.5220	-33.7220	-241.4521	55.2476
25	26.0000	6.8000	44.4296	-37.6296	-241.0392	21.7273
26	53.8000	9.2000	135.3845	-126.1845	-862.8956	29.9923
27	62.3000	7.4000	163.1945	-155.7945	-1070.8357	50.3236
28	32.1000	10.8000	64.3874	-53.5874	-273.7182	-80.2306
29	50.1000	3.6000	123.2790	-119.6790	-771.1037	19.8655
30	26.6000	18.1000	46.3927	-28.2927	-239.4203	6.8654
31	16.2000	42.9000	12.3664	30.5336	-189.7236	186.7137
32	8.4500	1.9000	-12.9897	14.8897	-84.2493	252.2945
33	29.2000	4.0000	54.8993	-50.8993	-213.9761	-75.9651
34	5.3200	0.4600	-23.2303	23.6903	-23.0916	260.2210
35	2.2700	1.5000	-33.2092	34.7092	57.0806	247.3673
36	1.6800	1.8000	-35.1395	36.9395	77.6022	239.8679
37	3.4200	6.8000	-29.4467	36.2467	23.1275	255.9380
38	4.4100	1.4000	-26.2076	27.6076	-2.1129	259.3275
39	1.3100	0.6700	-36.3501	37.0201	92.2659	233.3708
40	7.0800	0.9400	-17.4720	18.4120	-59.2427	257.5260
41	1.0900	0.1800	-37.0699	37.2499	101.9778	228.5146
42	0.9700	0.2100	-37.4625	37.6725	107.7083	225.4327
43	1.1100	0.5400	-37.0044	37.5444	101.0557	228.9953
44	1.0700	0.0730	-37.1353	37.2083	102.9088	228.0250
45	0.4500	0.0770	-39.1638	39.2408	139.4407	205.1775
46	20.5000	8.4000	26.4350	-18.0350	-225.5667	127.6487
47	29.3000	2.0000	55.2264	-53.2264	-211.7935	-80.3548
48	18.6000	1.1000	20.2186	-19.1186	-211.7897	155.8079
49	27.7000	39.2000	49.9916	-10.7916	-233.4105	-23.4232
50	13.6000	34.7000	3.8598	30.8402	-160.3083	214.6846
51	30.0000	5.5000	57.5167	-52.0167	-187.4376	-120.1608

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	17.1934	Rows Prediction Only	0
Slope	0.1488	Sum of Frequencies	41
R-Squared	0.0095	Sum of Weights	41.0000
Correlation	0.0974	Coefficient of Variation	1.1683
Mean Square Error	470.2239	Square Root of MSE	21.68465

Linear Regression Report

Y = Mammal X = Soil

Summary Statement
The equation of the straight line relating Mammal and Soil is estimated as: Mammal = (17.1934) + (0.1488) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Mammal when Soil is zero, is 17.1934 with a standard error of 4.0589. The slope, the estimated change in Mammal per unit change in Soil, is 0.1488 with a standard error of 0.2433. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Soil, is 0.0095. The correlation between Mammal and Soil is 0.0974.

A significance test that the slope is zero resulted in a t-value of 0.6114. The significance level of this t-test is 0.5445. Since 0.5445 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.1488. The lower limit of the 95% confidence interval for the slope is -0.3434 and the upper limit is 0.6410. The estimated intercept is 17.1934. The lower limit of the 95% confidence interval for the intercept is 8.9836 and the upper limit is 25.4033.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Soil
Count	41	41
Mean	18.5613	9.1944
Standard Deviation	21.5142	14.0901
Minimum	0.8900	0.0730
Maximum	101.9000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	17.1934	0.1488
Lower 95% Confidence Limit	8.9836	-0.3434
Upper 95% Confidence Limit	25.4033	0.6410
Standard Error	4.0589	0.2433
Standardized Coefficient	0.0000	0.0974
T Value	4.2360	0.6114
Prob Level (T Test)	0.0001	0.5445
Prob Level (Randomization Test N =1000)		0.5390
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9850	0.0916
Regression of Y on X	17.1934	0.1488
Inverse Regression from X on Y	-125.5308	15.6717
Orthogonal Regression of Y and X	-64.7412	9.0601

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(17.1934476825897) + (0.148765980530249) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	17.1934	0.9000	9.5978	23.9403
Bootstrap Mean	17.1540	0.9500	7.7286	24.7563
Bias (BM - OV)	-0.0395	0.9900	4.3809	26.3971
Bias Corrected	17.2329			
Standard Error	4.3642			
Slope				
Original Value	0.1488	0.9000	-0.1161	0.3870
Bootstrap Mean	0.1703	0.9500	-0.1878	0.4364
Bias (BM - OV)	0.0215	0.9900	-0.4918	0.5397
Bias Corrected	0.1273			
Standard Error	0.1839			
Correlation				
Original Value	0.0974	0.9000	-0.1236	0.2480
Bootstrap Mean	0.1184	0.9500	-0.1733	0.2756
Bias (BM - OV)	0.0210	0.9900	-0.2530	0.3315
Bias Corrected	0.0764			
Standard Error	0.1116			
R-Squared				
Original Value	0.0095	0.9000	0.0000	0.0189
Bootstrap Mean	0.0265	0.9500	0.0000	0.0190
Bias (BM - OV)	0.0170	0.9900	0.0000	0.0190
Bias Corrected	-0.0075			
Standard Error	0.0366			
Standard Error of Estimate				
Original Value	21.6846	0.9000	15.3243	29.0661
Bootstrap Mean	20.8787	0.9500	14.3411	29.8388
Bias (BM - OV)	-0.8060	0.9900	12.4884	31.3913
Bias Corrected	22.4906			
Standard Error	4.1650			
Orthogonal Intercept				
Original Value	-64.7412	0.9000	-553.6402	372.7975
Bootstrap Mean	-119.2628	0.9500	-937.4990	952.3407
Bias (BM - OV)	-54.5216	0.9900	-9149.6189	8081.2406
Bias Corrected	-10.2196			
Standard Error	9895.8517			
Orthogonal Slope				
Original Value	9.0601	0.9000	-47.2086	62.1134
Bootstrap Mean	14.7059	0.9500	-106.1062	108.9818
Bias (BM - OV)	5.6458	0.9900	-945.9856	928.5713
Bias Corrected	3.4144			
Standard Error	987.9544			

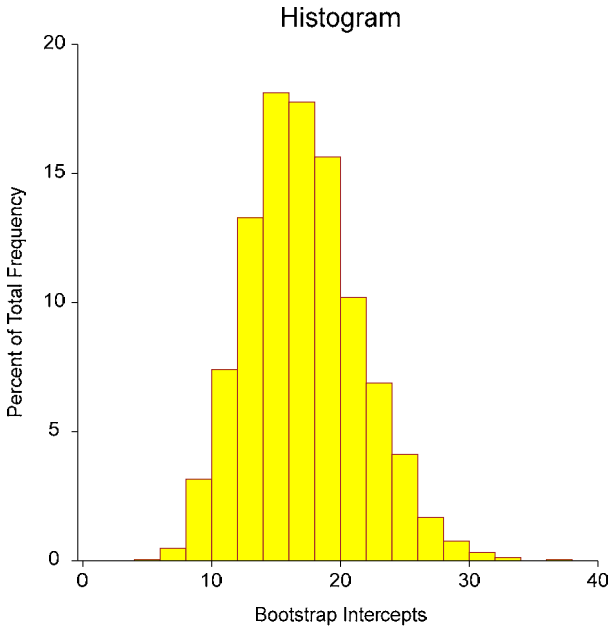
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

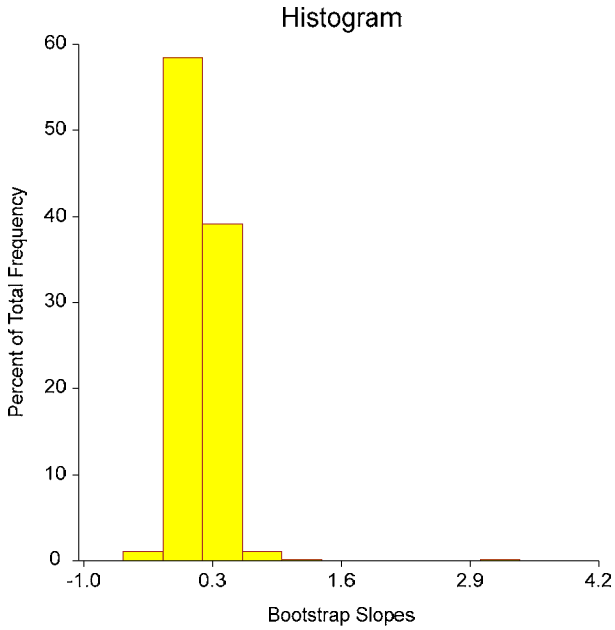
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

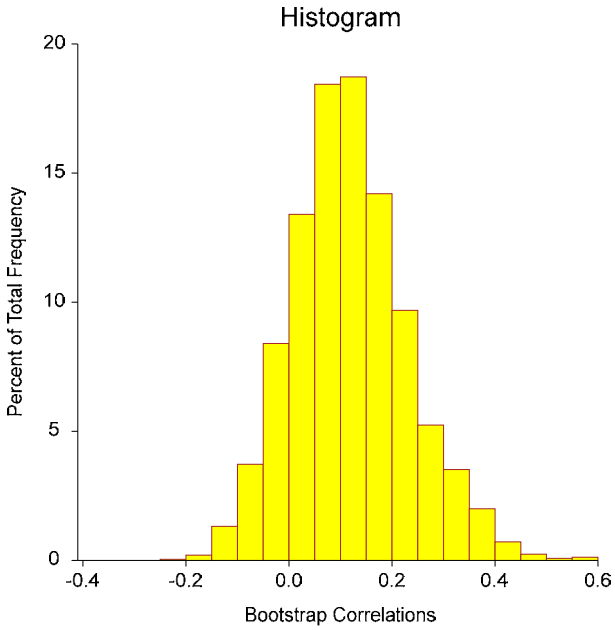
Linear Regression Report

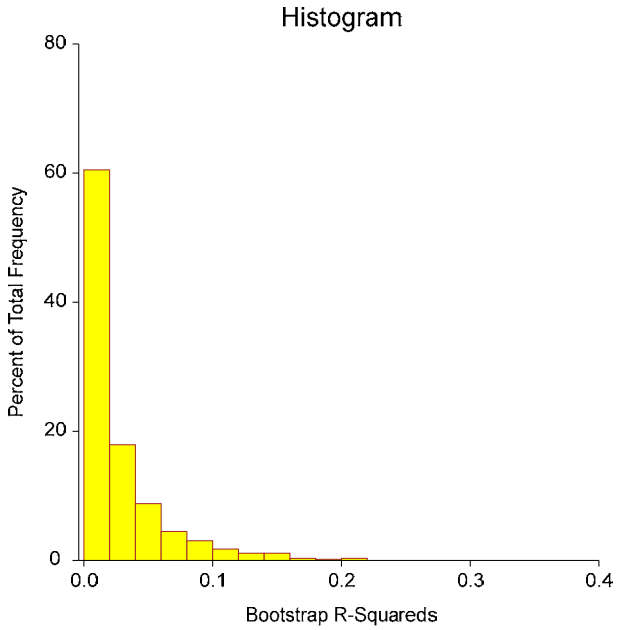
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Histograms Section



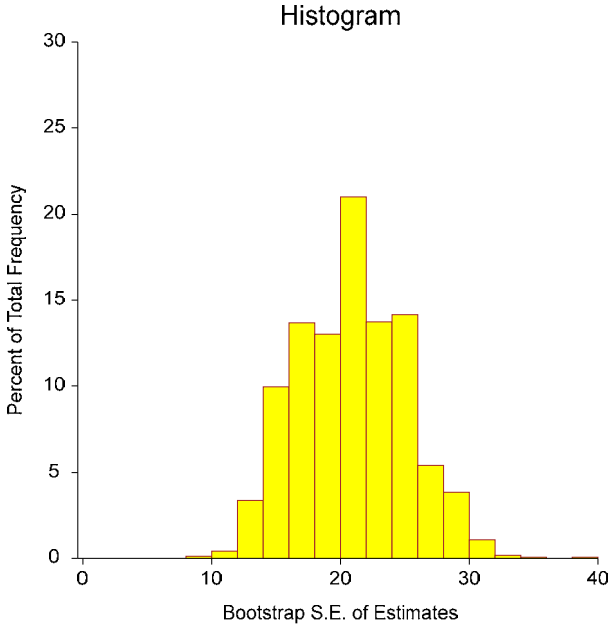


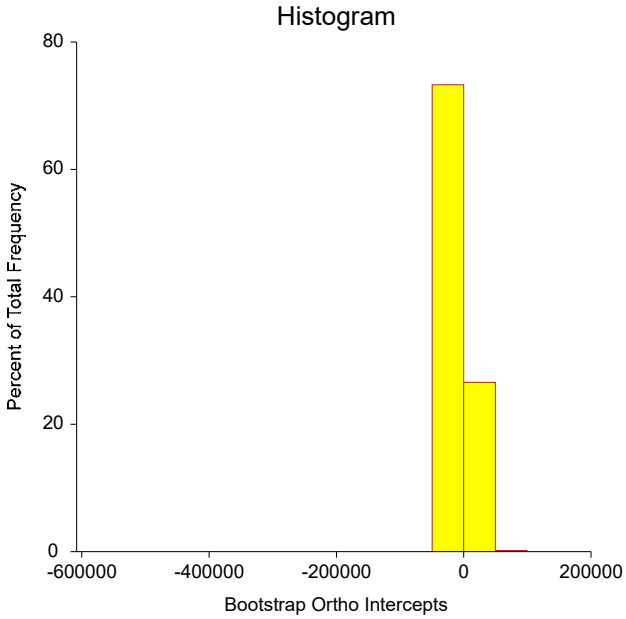


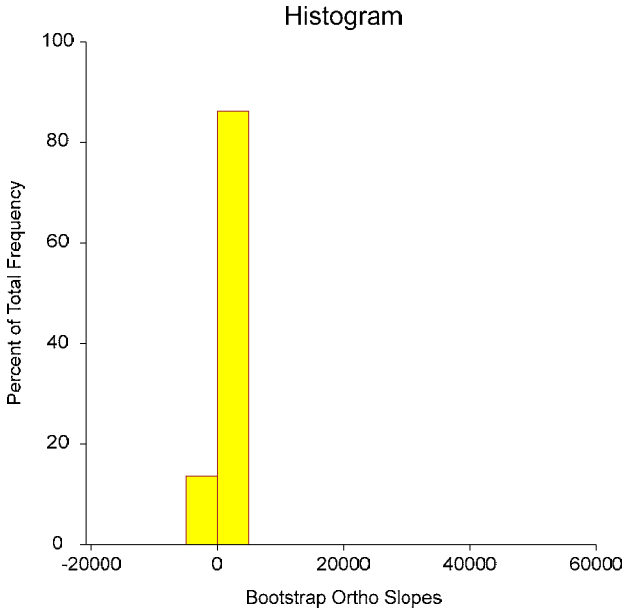


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.0974	0.0095	0.5719
Lower 95% Conf. Limit (r dist'n)	-0.2145		
Upper 95% Conf. Limit (r dist'n)	0.3892		
Lower 95% Conf. Limit (Fisher's z)	-0.2167		0.3206
Upper 95% Conf. Limit (Fisher's z)	0.3933		0.7479
Adjusted (Rbar)		0.0159	
T-Value for H0: Rho = 0	0.6114	0.6114	4.3532
Prob Level for H0: Rho = 0	0.5445	0.5445	0.0001
Prob Level (Randomization Test N =1000)	0.5390		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14125.34	14125.34			
Slope	1	175.7511	175.7511	0.3738	0.5445	0.0916
Error	39	18338.73	470.2239			
Lack of Fit	37	16595.41	448.5245	0.5146	0.8424	
Pure Error	2	1743.324	871.6622			
Adj. Total	40	18514.48	462.8621			
Total	41	32639.82				

s = Square Root(470.2239) = 21.68465

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	761.0117	0.03503547	-0.001157796
1	376.97	11407.3	8178.432	-0.001157796	0.0001259242
2 (Y'Y)			32639.82		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	16.47452	-0.5444234
1	-0.5444234	0.05921256

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7572	0.000001	No
Anderson Darling	3.1758	0.000000	No
D'Agostino Skewness	4.1762	0.000030	No
D'Agostino Kurtosis	3.2455	0.001172	No
D'Agostino Omnibus	27.9744	0.000001	No
Constant Residual Variance?			
Modified Levene Test	0.0518	0.821223	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.5146	0.842441	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

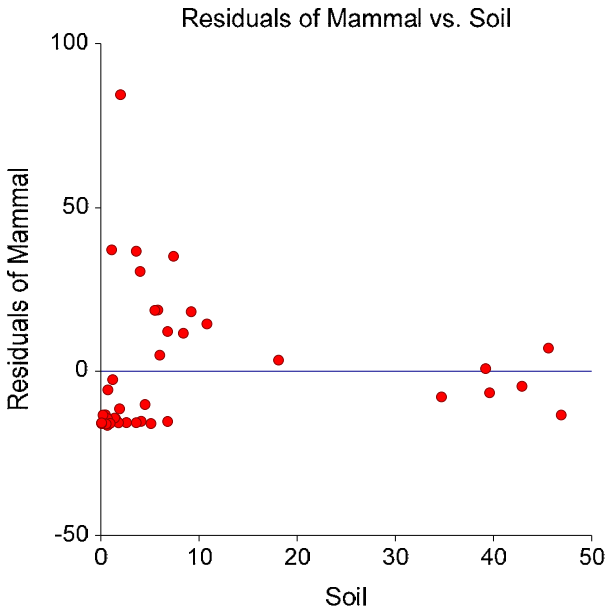
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

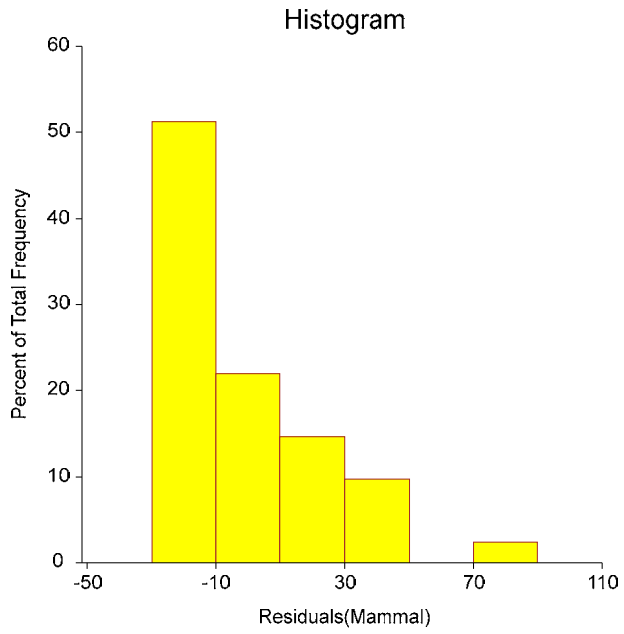
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

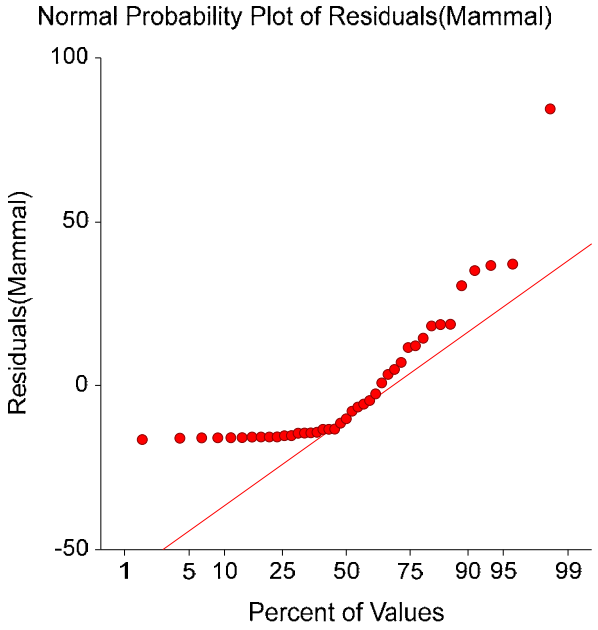
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Original Data Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
11	6.0000	23.0667	18.0860	4.9806
12	46.9000	10.9000	24.1706	-13.2706
13	1.2000	14.8900	17.3720	-2.4820
14	39.6000	16.6000	23.0846	-6.4846
15	4.1000	2.6000	17.8034	-15.2034
16	0.7100	11.6950	17.2991	-5.6041
17	5.1000	2.0767	17.9522	-15.8755
18	0.3500	2.7800	17.2455	-14.4655
19	3.6000	2.1100	17.7290	-15.6190
20	2.6000	1.9900	17.5802	-15.5902
21	0.6600	0.8900	17.2916	-16.4016
22	45.6000	31.1000	23.9772	7.1228
23	4.5000	7.8000	17.8629	-10.0629
24	5.8000	36.8000	18.0563	18.7437
25	6.8000	30.4000	18.2051	12.1949
26	9.2000	36.8000	18.5621	18.2379
27	7.4000	53.4233	18.2943	35.1290
28	10.8000	33.3000	18.8001	14.4999
29	3.6000	54.4000	17.7290	36.6710
30	18.1000	23.3500	19.8861	3.4639
31	42.9000	19.0700	23.5755	-4.5055
32	1.9000	6.0800	17.4761	-11.3961
33	4.0000	48.3000	17.7885	30.5115
34	0.4600	4.0533	17.2619	-13.2085
35	1.5000	2.9867	17.4166	-14.4299
36	1.8000	1.8400	17.4612	-15.6212
37	6.8000	2.9700	18.2051	-15.2351
38	1.4000	3.2100	17.4017	-14.1917
39	0.6700	2.9400	17.2931	-14.3531
40	0.9400	1.5200	17.3333	-15.8133
41	0.1800	1.3900	17.2202	-15.8302
42	0.2100	3.9267	17.2247	-13.2980
43	0.5400	1.2767	17.2738	-15.9971
44	0.0730	1.3100	17.2043	-15.8943
45	0.0770	1.5500	17.2049	-15.6549
46	8.4000	30.1000	18.4431	11.6569
47	2.0000	101.9000	17.4910	84.4090
48	1.1000	54.4500	17.3571	37.0929
49	39.2000	23.9000	23.0251	0.8749
50	34.7000	14.6000	22.3556	-7.7556
51	5.5000	36.6667	18.0117	18.6550

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	23.0667	18.0860	3.4746	11.0579	25.1142
12	46.9000	10.9000	24.1706	9.7802	4.3883	43.9529
13	1.2000	14.8900	17.3720	3.9055	9.4723	25.2716
14	39.6000	16.6000	23.0846	8.1370	6.6259	39.5432
15	4.1000	2.6000	17.8034	3.6063	10.5089	25.0979
16	0.7100	11.6950	17.2991	3.9663	9.2765	25.3216
17	5.1000	2.0767	17.9522	3.5301	10.8119	25.0924
18	0.3500	2.7800	17.2455	4.0126	9.1293	25.3617
19	3.6000	2.1100	17.7290	3.6499	10.3463	25.1117
20	2.6000	1.9900	17.5802	3.7475	10.0002	25.1603
21	0.6600	0.8900	17.2916	3.9726	9.2563	25.3270
22	45.6000	31.1000	23.9772	9.4841	4.7939	43.1605
23	4.5000	7.8000	17.8629	3.5740	10.6337	25.0921
24	5.8000	36.8000	18.0563	3.4858	11.0055	25.1071
25	6.8000	30.4000	18.2051	3.4363	11.2544	25.1557
26	9.2000	36.8000	18.5621	3.3866	11.7121	25.4121
27	7.4000	53.4233	18.2943	3.4146	11.3876	25.2010
28	10.8000	33.3000	18.8001	3.4090	11.9047	25.6955
29	3.6000	54.4000	17.7290	3.6499	10.3463	25.1117
30	18.1000	23.3500	19.8861	4.0206	11.7537	28.0185
31	42.9000	19.0700	23.5755	8.8735	5.6272	41.5238
32	1.9000	6.0800	17.4761	3.8235	9.7423	25.2099
33	4.0000	48.3000	17.7885	3.6148	10.4770	25.1001
34	0.4600	4.0533	17.2619	3.9983	9.1746	25.3491
35	1.5000	2.9867	17.4166	3.8697	9.5894	25.2438
36	1.8000	1.8400	17.4612	3.8349	9.7044	25.2180
37	6.8000	2.9700	18.2051	3.4363	11.2544	25.1557
38	1.4000	3.2100	17.4017	3.8815	9.5506	25.2528
39	0.6700	2.9400	17.2931	3.9713	9.2603	25.3259
40	0.9400	1.5200	17.3333	3.9374	9.3691	25.2975
41	0.1800	1.3900	17.2202	4.0349	9.0589	25.3816
42	0.2100	3.9267	17.2247	4.0309	9.0713	25.3780
43	0.5400	1.2767	17.2738	3.9880	9.2074	25.3402
44	0.0730	1.3100	17.2043	4.0491	9.0142	25.3944
45	0.0770	1.5500	17.2049	4.0486	9.0159	25.3939
46	8.4000	30.1000	18.4431	3.3921	11.5819	25.3042
47	2.0000	101.9000	17.4910	3.8123	9.7799	25.2021
48	1.1000	54.4500	17.3571	3.9177	9.4328	25.2814
49	39.2000	23.9000	23.0251	8.0486	6.7452	39.3049
50	34.7000	14.6000	22.3556	7.0703	8.0546	36.6566
51	5.5000	36.6667	18.0117	3.5039	10.9244	25.0989

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	23.0667	18.0860	21.9613	-26.3348	62.5069
12	46.9000	10.9000	24.1706	23.7881	-23.9455	72.2866
13	1.2000	14.8900	17.3720	22.0335	-27.1951	61.9390
14	39.6000	16.6000	23.0846	23.1611	-23.7631	69.9323
15	4.1000	2.6000	17.8034	21.9825	-26.6604	62.2672
16	0.7100	11.6950	17.2991	22.0444	-27.2899	61.8881
17	5.1000	2.0767	17.9522	21.9701	-26.4866	62.3909
18	0.3500	2.7800	17.2455	22.0528	-27.3604	61.8514
19	3.6000	2.1100	17.7290	21.9897	-26.7493	62.2073
20	2.6000	1.9900	17.5802	22.0061	-26.9313	62.0917
21	0.6600	0.8900	17.2916	22.0455	-27.2997	61.8829
22	45.6000	31.1000	23.9772	23.6679	-23.8957	71.8501
23	4.5000	7.8000	17.8629	21.9772	-26.5902	62.3160
24	5.8000	36.8000	18.0563	21.9630	-26.3681	62.4807
25	6.8000	30.4000	18.2051	21.9552	-26.2036	62.6137
26	9.2000	36.8000	18.5621	21.9475	-25.8309	62.9551
27	7.4000	53.4233	18.2943	21.9518	-26.1075	62.6961
28	10.8000	33.3000	18.8001	21.9510	-25.5999	63.2002
29	3.6000	54.4000	17.7290	21.9897	-26.7493	62.2073
30	18.1000	23.3500	19.8861	22.0542	-24.7228	64.4950
31	42.9000	19.0700	23.5755	23.4299	-23.8160	70.9670
32	1.9000	6.0800	17.4761	22.0192	-27.0618	62.0141
33	4.0000	48.3000	17.7885	21.9839	-26.6781	62.2551
34	0.4600	4.0533	17.2619	22.0502	-27.3388	61.8626
35	1.5000	2.9867	17.4166	22.0272	-27.1377	61.9709
36	1.8000	1.8400	17.4612	22.0211	-27.0807	62.0032
37	6.8000	2.9700	18.2051	21.9552	-26.2036	62.6137
38	1.4000	3.2100	17.4017	22.0293	-27.1567	61.9602
39	0.6700	2.9400	17.2931	22.0453	-27.2977	61.8840
40	0.9400	1.5200	17.3333	22.0392	-27.2452	61.9118
41	0.1800	1.3900	17.2202	22.0568	-27.3940	61.8344
42	0.2100	3.9267	17.2247	22.0561	-27.3880	61.8374
43	0.5400	1.2767	17.2738	22.0483	-27.3231	61.8707
44	0.0730	1.3100	17.2043	22.0594	-27.4151	61.8238
45	0.0770	1.5500	17.2049	22.0593	-27.4143	61.8241
46	8.4000	30.1000	18.4431	21.9484	-25.9516	62.8378
47	2.0000	101.9000	17.4910	22.0172	-27.0430	62.0250
48	1.1000	54.4500	17.3571	22.0357	-27.2143	61.9285
49	39.2000	23.9000	23.0251	23.1302	-23.7601	69.8102
50	34.7000	14.6000	22.3556	22.8082	-23.7783	68.4895
51	5.5000	36.6667	18.0117	21.9659	-26.4186	62.4419

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	23.0667	18.0860	3.4746	8.1838	27.9883
12	46.9000	10.9000	24.1706	9.7802	-3.7017	52.0429
13	1.2000	14.8900	17.3720	3.9055	6.2417	28.5022
14	39.6000	16.6000	23.0846	8.1370	-0.1048	46.2740
15	4.1000	2.6000	17.8034	3.6063	7.5258	28.0810
16	0.7100	11.6950	17.2991	3.9663	5.9957	28.6024
17	5.1000	2.0767	17.9522	3.5301	7.8919	28.0124
18	0.3500	2.7800	17.2455	4.0126	5.8102	28.6808
19	3.6000	2.1100	17.7290	3.6499	7.3271	28.1309
20	2.6000	1.9900	17.5802	3.7475	6.9003	28.2601
21	0.6600	0.8900	17.2916	3.9726	5.9702	28.6131
22	45.6000	31.1000	23.9772	9.4841	-3.0512	51.0055
23	4.5000	7.8000	17.8629	3.5740	7.6773	28.0484
24	5.8000	36.8000	18.0563	3.4858	8.1221	27.9905
25	6.8000	30.4000	18.2051	3.4363	8.4120	27.9981
26	9.2000	36.8000	18.5621	3.3866	8.9108	28.2134
27	7.4000	53.4233	18.2943	3.4146	8.5631	28.0255
28	10.8000	33.3000	18.8001	3.4090	9.0848	28.5154
29	3.6000	54.4000	17.7290	3.6499	7.3271	28.1309
30	18.1000	23.3500	19.8861	4.0206	8.4280	31.3442
31	42.9000	19.0700	23.5755	8.8735	-1.7127	48.8637
32	1.9000	6.0800	17.4761	3.8235	6.5795	28.3727
33	4.0000	48.3000	17.7885	3.6148	7.4869	28.0901
34	0.4600	4.0533	17.2619	3.9983	5.8673	28.6564
35	1.5000	2.9867	17.4166	3.8697	6.3885	28.4447
36	1.8000	1.8400	17.4612	3.8349	6.5323	28.3902
37	6.8000	2.9700	18.2051	3.4363	8.4120	27.9981
38	1.4000	3.2100	17.4017	3.8815	6.3399	28.4635
39	0.6700	2.9400	17.2931	3.9713	5.9753	28.6109
40	0.9400	1.5200	17.3333	3.9374	6.1121	28.5544
41	0.1800	1.3900	17.2202	4.0349	5.7213	28.7192
42	0.2100	3.9267	17.2247	4.0309	5.7370	28.7123
43	0.5400	1.2767	17.2738	3.9880	5.9086	28.6389
44	0.0730	1.3100	17.2043	4.0491	5.6648	28.7438
45	0.0770	1.5500	17.2049	4.0486	5.6670	28.7428
46	8.4000	30.1000	18.4431	3.3921	8.7761	28.1101
47	2.0000	101.9000	17.4910	3.8123	6.6264	28.3556
48	1.1000	54.4500	17.3571	3.9177	6.1921	28.5221
49	39.2000	23.9000	23.0251	8.0486	0.0876	45.9626
50	34.7000	14.6000	22.3556	7.0703	2.2063	42.5050
51	5.5000	36.6667	18.0117	3.5039	8.0261	27.9972

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	23.0667	18.0860	4.9806	0.2327	21.5923
12	46.9000	10.9000	24.1706	-13.2706	-0.6857	121.7484
13	1.2000	14.8900	17.3720	-2.4820	-0.1164	16.6687
14	39.6000	16.6000	23.0846	-6.4846	-0.3226	39.0637
15	4.1000	2.6000	17.8034	-15.2034	-0.7110	584.7457
16	0.7100	11.6950	17.2991	-5.6041	-0.2629	47.9185
17	5.1000	2.0767	17.9522	-15.8755	-0.7420	764.4697
18	0.3500	2.7800	17.2455	-14.4655	-0.6788	520.3423
19	3.6000	2.1100	17.7290	-15.6190	-0.7307	740.2372
20	2.6000	1.9900	17.5802	-15.5902	-0.7299	783.4291
21	0.6600	0.8900	17.2916	-16.4016	-0.7694	1842.8801
22	45.6000	31.1000	23.9772	7.1228	0.3653	22.9030
23	4.5000	7.8000	17.8629	-10.0629	-0.4705	129.0115
24	5.8000	36.8000	18.0563	18.7437	0.8758	50.9340
25	6.8000	30.4000	18.2051	12.1949	0.5696	40.1149
26	9.2000	36.8000	18.5621	18.2379	0.8515	49.5595
27	7.4000	53.4233	18.2943	35.1290	1.6405	65.7559
28	10.8000	33.3000	18.8001	14.4999	0.6771	43.5432
29	3.6000	54.4000	17.7290	36.6710	1.7156	67.4099
30	18.1000	23.3500	19.8861	3.4639	0.1626	14.8346
31	42.9000	19.0700	23.5755	-4.5055	-0.2277	23.6262
32	1.9000	6.0800	17.4761	-11.3961	-0.5339	187.4359
33	4.0000	48.3000	17.7885	30.5115	1.4270	63.1708
34	0.4600	4.0533	17.2619	-13.2085	-0.6197	325.8688
35	1.5000	2.9867	17.4166	-14.4299	-0.6763	483.1450
36	1.8000	1.8400	17.4612	-15.6212	-0.7319	848.9797
37	6.8000	2.9700	18.2051	-15.2351	-0.7116	512.9649
38	1.4000	3.2100	17.4017	-14.1917	-0.6652	442.1097
39	0.6700	2.9400	17.2931	-14.3531	-0.6733	488.2014
40	0.9400	1.5200	17.3333	-15.8133	-0.7416	1040.3479
41	0.1800	1.3900	17.2202	-15.8302	-0.7430	1138.8651
42	0.2100	3.9267	17.2247	-13.2980	-0.6241	338.6593
43	0.5400	1.2767	17.2738	-15.9971	-0.7505	1253.0377
44	0.0730	1.3100	17.2043	-15.8943	-0.7461	1213.3059
45	0.0770	1.5500	17.2049	-15.6549	-0.7349	1009.9937
46	8.4000	30.1000	18.4431	11.6569	0.5443	38.7273
47	2.0000	101.9000	17.4910	84.4090	3.9542	82.8352
48	1.1000	54.4500	17.3571	37.0929	1.7392	68.1229
49	39.2000	23.9000	23.0251	0.8749	0.0435	3.6608
50	34.7000	14.6000	22.3556	-7.7556	-0.3783	53.1207
51	5.5000	36.6667	18.0117	18.6550	0.8717	50.8773

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	4.9806	0.2298	0.0257	0.0007	481.9282
12	46.9000	-13.2706	*-0.6810	0.2034	0.0600	476.7803
13	1.2000	-2.4820	-0.1149	0.0324	0.0002	482.4307
14	39.6000	-6.4846	*-0.3189	0.1408	0.0085	481.3103
15	4.1000	-15.2034	-0.7064	0.0277	0.0072	476.3425
16	0.7100	-5.6041	-0.2597	0.0335	0.0012	481.7431
17	5.1000	-15.8755	-0.7377	0.0265	0.0075	475.7853
18	0.3500	-14.4655	-0.6740	0.0342	0.0082	476.8964
19	3.6000	-15.6190	-0.7263	0.0283	0.0078	475.9912
20	2.6000	-15.5902	-0.7255	0.0299	0.0082	476.0051
21	0.6600	-16.4016	-0.7653	0.0336	0.0103	475.2731
22	45.6000	7.1228	*0.3612	0.1913	0.0158	480.9473
23	4.5000	-10.0629	-0.4657	0.0272	0.0031	479.8590
24	5.8000	18.7437	0.8731	0.0258	0.0102	473.1075
25	6.8000	12.1949	0.5646	0.0251	0.0042	478.5838
26	9.2000	18.2379	0.8484	0.0244	0.0091	473.6262
27	7.4000	35.1290	1.6782	0.0248	0.0342	449.2975
28	10.8000	14.4999	0.6723	0.0247	0.0058	476.9252
29	3.6000	36.6710	1.7612	0.0283	0.0429	446.1779
30	18.1000	3.4639	0.1605	0.0344	0.0005	482.2712
31	42.9000	-4.5055	*-0.2249	0.1674	0.0052	481.9566
32	1.9000	-11.3961	-0.5290	0.0311	0.0046	479.0709
33	4.0000	30.5115	1.4469	0.0278	0.0291	457.3993
34	0.4600	-13.2085	-0.6148	0.0340	0.0068	477.8454
35	1.5000	-14.4299	-0.6715	0.0318	0.0075	476.9384
36	1.8000	-15.6212	-0.7275	0.0313	0.0086	475.9692
37	6.8000	-15.2351	-0.7070	0.0251	0.0065	476.3328
38	1.4000	-14.1917	-0.6604	0.0320	0.0073	477.1226
39	0.6700	-14.3531	-0.6685	0.0335	0.0079	476.9887
40	0.9400	-15.8133	-0.7372	0.0330	0.0094	475.7933
41	0.1800	-15.8302	-0.7387	0.0346	0.0099	475.7671
42	0.2100	-13.2980	-0.6192	0.0346	0.0070	477.7780
43	0.5400	-15.9971	-0.7462	0.0338	0.0099	475.6280
44	0.0730	-15.8943	-0.7418	0.0349	0.0101	475.7099
45	0.0770	-15.6549	-0.7304	0.0349	0.0098	475.9159
46	8.4000	11.6569	0.5393	0.0245	0.0037	478.9326
47	2.0000	84.4090	*5.0427	0.0309	0.2493	289.1213
48	1.1000	37.0929	1.7875	0.0326	0.0510	445.1690
49	39.2000	0.8749	*0.0429	0.1378	0.0002	482.5748
50	34.7000	-7.7556	*-0.3741	0.1063	0.0085	480.8270
51	5.5000	18.6550	0.8690	0.0261	0.0102	473.1945

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.2298	0.0373	0.0007	1.0781	0.0349	-0.0083
12	-0.6810	-0.3441	0.0600	* 1.2906	0.0785	-0.3228
13	-0.1149	-0.0210	0.0002	1.0879	-0.0210	0.0105
14	-0.3189	-0.1291	0.0085	* 1.2194	0.0199	-0.1174
15	-0.7064	-0.1191	0.0072	1.0554	-0.1159	0.0410
16	-0.2597	-0.0483	0.0012	1.0859	-0.0483	0.0252
17	-0.7377	-0.1217	0.0075	1.0517	-0.1164	0.0344
18	-0.6740	-0.1269	0.0082	1.0650	-0.1269	0.0681
19	-0.7263	-0.1240	0.0078	1.0546	-0.1215	0.0463
20	-0.7255	-0.1273	0.0082	1.0563	-0.1260	0.0545
21	-0.7653	-0.1426	0.0103	1.0571	-0.1425	0.0746
22	0.3612	0.1757	0.0158	* 1.2936	-0.0381	0.1641
23	-0.4657	-0.0778	0.0031	1.0705	-0.0752	0.0249
24	0.8731	0.1422	0.0102	1.0392	0.1338	-0.0337
25	0.5646	0.0906	0.0042	1.0626	0.0830	-0.0154
26	0.8484	0.1341	0.0091	1.0399	0.1119	0.0001
27	1.6782	0.2676	0.0342	0.9362	0.2403	-0.0342
28	0.6723	0.1070	0.0058	1.0548	0.0819	0.0123
29	1.7612	0.3007	0.0429	0.9266	0.2946	-0.1122
30	0.1605	0.0303	0.0005	1.0893	0.0123	0.0163
31	-0.2249	-0.1009	0.0052	* 1.2618	0.0193	-0.0932
32	-0.5290	-0.0948	0.0046	1.0713	-0.0943	0.0440
33	1.4469	0.2446	0.0291	0.9732	0.2384	-0.0855
34	-0.6148	-0.1153	0.0068	1.0690	-0.1153	0.0613
35	-0.6715	-0.1218	0.0075	1.0626	-0.1214	0.0589
36	-0.7275	-0.1307	0.0086	1.0577	-0.1301	0.0613
37	-0.7070	-0.1135	0.0065	1.0526	-0.1039	0.0192
38	-0.6604	-0.1201	0.0073	1.0636	-0.1198	0.0587
39	-0.6685	-0.1245	0.0079	1.0647	-0.1245	0.0650
40	-0.7372	-0.1361	0.0094	1.0587	-0.1360	0.0694
41	-0.7387	-0.1399	0.0099	1.0604	-0.1399	0.0760
42	-0.6192	-0.1171	0.0070	1.0693	-0.1171	0.0635
43	-0.7462	-0.1396	0.0099	1.0589	-0.1396	0.0737
44	-0.7418	-0.1410	0.0101	1.0604	-0.1410	0.0773
45	-0.7304	-0.1388	0.0098	1.0614	-0.1388	0.0761
46	0.5393	0.0854	0.0037	1.0634	0.0738	-0.0049
47	* 5.0427	0.9006	0.2493	0.3901	0.8955	-0.4136
48	1.7875	0.3283	0.0510	0.9265	0.3278	-0.1651
49	0.0429	0.0171	0.0002	* 1.2215	-0.0026	0.0156
50	-0.3741	-0.1290	0.0085	* 1.1700	0.0109	-0.1133
51	0.8690	0.1423	0.0102	1.0398	0.1349	-0.0365

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	4.9806	|.....	0.2327	|.....	0.2298	|.....
12	46.9000	-13.2706	||.....	-0.6857	||.....	-0.6810	|.....
13	1.2000	-2.4820	|.....	-0.1164	|.....	-0.1149	|.....
14	39.6000	-6.4846	|.....	-0.3226	|.....	-0.3189	|.....
15	4.1000	-15.2034	||.....	-0.7110	||.....	-0.7064	|.....
16	0.7100	-5.6041	|.....	-0.2629	|.....	-0.2597	|.....
17	5.1000	-15.8755	||.....	-0.7420	||.....	-0.7377	||.....
18	0.3500	-14.4655	||.....	-0.6788	||.....	-0.6740	|.....
19	3.6000	-15.6190	||.....	-0.7307	||.....	-0.7263	||.....
20	2.6000	-15.5902	||.....	-0.7299	||.....	-0.7255	||.....
21	0.6600	-16.4016	||.....	-0.7694	||.....	-0.7653	||.....
22	45.6000	7.1228	|.....	0.3653	|.....	0.3612	|.....
23	4.5000	-10.0629	|.....	-0.4705	|.....	-0.4657	|.....
24	5.8000	18.7437	|||.....	0.8758	|||.....	0.8731	||.....
25	6.8000	12.1949	||.....	0.5696	||.....	0.5646	|.....
26	9.2000	18.2379	|||.....	0.8515	|||.....	0.8484	||.....
27	7.4000	35.1290	||||||.....	1.6405	||||||.....	1.6782	||||.....
28	10.8000	14.4999	||.....	0.6771	||.....	0.6723	|.....
29	3.6000	36.6710	||||||.....	1.7156	||||||.....	1.7612	|||||.....
30	18.1000	3.4639	|.....	0.1626	|.....	0.1605	|.....
31	42.9000	-4.5055	|.....	-0.2277	|.....	-0.2249	|.....
32	1.9000	-11.3961	|.....	-0.5339	|.....	-0.5290	|.....
33	4.0000	30.5115	|||||.....	1.4270	|||||.....	1.4469	||||.....
34	0.4600	-13.2085	||.....	-0.6197	||.....	-0.6148	|.....
35	1.5000	-14.4299	||.....	-0.6763	||.....	-0.6715	|.....
36	1.8000	-15.6212	||.....	-0.7319	||.....	-0.7275	||.....
37	6.8000	-15.2351	||.....	-0.7116	||.....	-0.7070	|.....
38	1.4000	-14.1917	||.....	-0.6652	||.....	-0.6604	|.....
39	0.6700	-14.3531	||.....	-0.6733	||.....	-0.6685	|.....
40	0.9400	-15.8133	||.....	-0.7416	||.....	-0.7372	||.....
41	0.1800	-15.8302	||.....	-0.7430	||.....	-0.7387	||.....
42	0.2100	-13.2980	||.....	-0.6241	||.....	-0.6192	|.....
43	0.5400	-15.9971	||.....	-0.7505	||.....	-0.7462	||.....
44	0.0730	-15.8943	||.....	-0.7461	||.....	-0.7418	||.....
45	0.0770	-15.6549	||.....	-0.7349	||.....	-0.7304	||.....
46	8.4000	11.6569	|.....	0.5443	|.....	0.5393	|.....
47	2.0000	84.4090	||||||||||||||	3.9542	||||||||||||||	* 5.0427	||||||||||||||
48	1.1000	37.0929	||||||.....	1.7392	||||||.....	1.7875	|||||.....
49	39.2000	0.8749	|.....	0.0435	|.....	0.0429	|.....
50	34.7000	-7.7556	|.....	-0.3783	|.....	-0.3741	|.....
51	5.5000	18.6550	|||.....	0.8717	|||.....	0.8690	||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.0373	|.....	0.0007	|.....	-0.0083	|.....
12	46.9000	-0.3441	|||||.....	0.0600	|||.....	-0.3228	|||||||||||....
13	1.2000	-0.0210	|.....	0.0002	|.....	0.0105	|.....
14	39.6000	-0.1291	|.....	0.0085	|.....	-0.1174	||||.....
15	4.1000	-0.1191	|.....	0.0072	|.....	0.0410	|.....
16	0.7100	-0.0483	|.....	0.0012	|.....	0.0252	|.....
17	5.1000	-0.1217	|.....	0.0075	|.....	0.0344	|.....
18	0.3500	-0.1269	|.....	0.0082	|.....	0.0681	||.....
19	3.6000	-0.1240	|.....	0.0078	|.....	0.0463	|.....
20	2.6000	-0.1273	|.....	0.0082	|.....	0.0545	|.....
21	0.6600	-0.1426	||.....	0.0103	|.....	0.0746	||.....
22	45.6000	0.1757	||.....	0.0158	|.....	0.1641	|||||.....
23	4.5000	-0.0778	|.....	0.0031	|.....	0.0249	|.....
24	5.8000	0.1422	||.....	0.0102	|.....	-0.0337	|.....
25	6.8000	0.0906	|.....	0.0042	|.....	-0.0154	|.....
26	9.2000	0.1341	|.....	0.0091	|.....	0.0001	|.....
27	7.4000	0.2676	||||.....	0.0342	||.....	-0.0342	|.....
28	10.8000	0.1070	|.....	0.0058	|.....	0.0123	|.....
29	3.6000	0.3007	||||.....	0.0429	||.....	-0.1122	||||.....
30	18.1000	0.0303	|.....	0.0005	|.....	0.0163	|.....
31	42.9000	-0.1009	|.....	0.0052	|.....	-0.0932	|||.....
32	1.9000	-0.0948	|.....	0.0046	|.....	0.0440	|.....
33	4.0000	0.2446	|||.....	0.0291	|.....	-0.0855	|||.....
34	0.4600	-0.1153	|.....	0.0068	|.....	0.0613	||.....
35	1.5000	-0.1218	|.....	0.0075	|.....	0.0589	||.....
36	1.8000	-0.1307	|.....	0.0086	|.....	0.0613	||.....
37	6.8000	-0.1135	|.....	0.0065	|.....	0.0192	|.....
38	1.4000	-0.1201	|.....	0.0073	|.....	0.0587	||.....
39	0.6700	-0.1245	|.....	0.0079	|.....	0.0650	||.....
40	0.9400	-0.1361	||.....	0.0094	|.....	0.0694	||.....
41	0.1800	-0.1399	||.....	0.0099	|.....	0.0760	||.....
42	0.2100	-0.1171	|.....	0.0070	|.....	0.0635	||.....
43	0.5400	-0.1396	||.....	0.0099	|.....	0.0737	||.....
44	0.0730	-0.1410	||.....	0.0101	|.....	0.0773	||.....
45	0.0770	-0.1388	||.....	0.0098	|.....	0.0761	||.....
46	8.4000	0.0854	|.....	0.0037	|.....	-0.0049	|.....
47	2.0000	0.9006	|||||||||||||||	0.2493	||||||||||||||	-0.4136	||||||||||||||
48	1.1000	0.3283	|||||.....	0.0510	|||.....	-0.1651	|||||.....
49	39.2000	0.0171	|.....	0.0002	|.....	0.0156	|.....
50	34.7000	-0.1290	|.....	0.0085	|.....	-0.1133	||||.....
51	5.5000	0.1423	||.....	0.0102	|.....	-0.0365	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	0.2298	|.....	0.0007	|.....	0.0257	|.....
12	46.9000	-0.6810	|.....	0.0600	|||.....	0.2034	||||||||||||||
13	1.2000	-0.1149	|.....	0.0002	|.....	0.0324	|.....
14	39.6000	-0.3189	|.....	0.0085	|.....	0.1408	||||||||.....
15	4.1000	-0.7064	|.....	0.0072	|.....	0.0277	|.....
16	0.7100	-0.2597	|.....	0.0012	|.....	0.0335	|.....
17	5.1000	-0.7377	||.....	0.0075	|.....	0.0265	|.....
18	0.3500	-0.6740	|.....	0.0082	|.....	0.0342	|.....
19	3.6000	-0.7263	||.....	0.0078	|.....	0.0283	|.....
20	2.6000	-0.7255	||.....	0.0082	|.....	0.0299	|.....
21	0.6600	-0.7653	||.....	0.0103	|.....	0.0336	|.....
22	45.6000	0.3612	|.....	0.0158	|.....	0.1913	||||||||||||..
23	4.5000	-0.4657	|.....	0.0031	|.....	0.0272	|.....
24	5.8000	0.8731	||.....	0.0102	|.....	0.0258	|.....
25	6.8000	0.5646	|.....	0.0042	|.....	0.0251	|.....
26	9.2000	0.8484	||.....	0.0091	|.....	0.0244	|.....
27	7.4000	1.6782	||||.....	0.0342	||.....	0.0248	|.....
28	10.8000	0.6723	|.....	0.0058	|.....	0.0247	|.....
29	3.6000	1.7612	|||||.....	0.0429	||.....	0.0283	|.....
30	18.1000	0.1605	|.....	0.0005	|.....	0.0344	|.....
31	42.9000	-0.2249	|.....	0.0052	|.....	0.1674	||||||||||....
32	1.9000	-0.5290	|.....	0.0046	|.....	0.0311	|.....
33	4.0000	1.4469	||||.....	0.0291	|.....	0.0278	|.....
34	0.4600	-0.6148	|.....	0.0068	|.....	0.0340	|.....
35	1.5000	-0.6715	|.....	0.0075	|.....	0.0318	|.....
36	1.8000	-0.7275	||.....	0.0086	|.....	0.0313	|.....
37	6.8000	-0.7070	|.....	0.0065	|.....	0.0251	|.....
38	1.4000	-0.6604	|.....	0.0073	|.....	0.0320	|.....
39	0.6700	-0.6685	|.....	0.0079	|.....	0.0335	|.....
40	0.9400	-0.7372	||.....	0.0094	|.....	0.0330	|.....
41	0.1800	-0.7387	||.....	0.0099	|.....	0.0346	|.....
42	0.2100	-0.6192	|.....	0.0070	|.....	0.0346	|.....
43	0.5400	-0.7462	||.....	0.0099	|.....	0.0338	|.....
44	0.0730	-0.7418	||.....	0.0101	|.....	0.0349	|.....
45	0.0770	-0.7304	||.....	0.0098	|.....	0.0349	|.....
46	8.4000	0.5393	|.....	0.0037	|.....	0.0245	|.....
47	2.0000	* 5.0427	|||||||||||||||	0.2493	||||||||||||||	0.0309	|.....
48	1.1000	1.7875	|||||.....	0.0510	|||.....	0.0326	|.....
49	39.2000	0.0429	|.....	0.0002	|.....	0.1378	||||||||.....
50	34.7000	-0.3741	|.....	0.0085	|.....	0.1063	|||||.....
51	5.5000	0.8690	||.....	0.0102	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Means

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	23.0667	6.0000	39.4796	-33.4796	-4.4182	16.7173
12	10.9000	46.9000	-42.3043	89.2043	5.4116	23.3326
13	14.8900	1.2000	-15.4837	16.6837	-0.3983	23.7494
14	16.6000	39.6000	-3.9891	43.5891	-3.4061	24.4458
15	2.6000	4.1000	-98.0967	102.1967	-12.5847	52.5476
16	11.6950	0.7100	-36.9604	37.6704	9.0864	18.5832
17	2.0767	5.1000	-101.6145	106.7145	-13.5093	54.1796
18	2.7800	0.3500	-96.8867	97.2367	-12.2648	51.9844
19	2.1100	3.6000	-101.3904	104.9904	-13.4507	54.0759
20	1.9900	2.6000	-102.1971	104.7971	-13.6617	54.4491
21	0.8900	0.6600	-109.5912	110.2512	-15.5792	57.8535
22	31.1000	45.6000	93.4794	-47.8794	-23.2146	24.6553
23	7.8000	4.5000	-63.1424	67.6424	-2.6592	35.5935
24	36.8000	5.8000	131.7946	-125.9946	-41.2104	34.9467
25	30.4000	6.8000	88.7740	-81.9740	-20.8875	23.2743
26	36.8000	9.2000	131.7946	-122.5946	-41.2104	34.9467
27	53.4233	7.4000	243.5361	-236.1361	-90.9381	62.2053
28	33.3000	10.8000	108.2677	-97.4677	-30.3115	28.7786
29	54.4000	3.6000	250.1012	-246.5012	-93.8202	63.7673
30	23.3500	18.1000	41.3841	-23.2841	-3.9673	15.8833
31	19.0700	42.9000	12.6141	30.2859	-5.7052	23.4063
32	6.0800	1.9000	-74.7042	76.6042	-6.1547	41.4138
33	48.3000	4.0000	209.0972	-205.0972	-75.7767	53.9689
34	4.0533	0.4600	-88.3274	88.7874	-9.9690	47.9675
35	2.9867	1.5000	-95.4975	96.9975	-11.8961	51.3364
36	1.8400	1.8000	-103.2054	105.0054	-13.9249	54.9151
37	2.9700	6.8000	-95.6095	102.4095	-11.9259	51.3887
38	3.2100	1.4000	-93.9963	95.3963	-11.4962	50.6346
39	2.9400	0.6700	-95.8112	96.4812	-11.9795	51.4829
40	1.5200	0.9400	-105.3564	106.2964	-14.4846	55.9073
41	1.3900	0.1800	-106.2303	106.4103	-14.7112	56.3097
42	3.9267	0.2100	-89.1789	89.3889	-10.2002	48.3700
43	1.2767	0.5400	-106.9921	107.5321	-14.9085	56.6601
44	1.3100	0.0730	-106.7680	106.8410	-14.8505	56.5571
45	1.5500	0.0770	-105.1547	105.2317	-14.4322	55.8144
46	30.1000	8.4000	86.7574	-78.3574	-19.8759	22.6683
47	101.9000	2.0000	569.3946	-567.3946	-232.8999	138.6433
48	54.4500	1.1000	250.4373	-249.3373	-93.9677	63.8472
49	23.9000	39.2000	45.0812	-5.8812	-2.8198	13.9924
50	14.6000	34.7000	-17.4331	52.1331	0.2650	23.4780
51	36.6667	5.5000	130.8983	-125.3983	-40.8008	34.7173

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Individuals

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	23.0667	6.0000	39.4796	-33.4796	-87.9323	100.2313
12	10.9000	46.9000	-42.3043	89.2043	-78.6839	107.4281
13	14.8900	1.2000	-15.4837	16.6837	-82.5873	105.9384
14	16.6000	39.6000	-3.9891	43.5891	-83.9981	105.0378
15	2.6000	4.1000	-98.0967	102.1967	-67.6493	107.6122
16	11.6950	0.7100	-36.9604	37.6704	-79.5309	107.2005
17	2.0767	5.1000	-101.6145	106.7145	-66.8099	107.4802
18	2.7800	0.3500	-96.8867	97.2367	-67.9338	107.6534
19	2.1100	3.6000	-101.3904	104.9904	-66.8639	107.4891
20	1.9900	2.6000	-102.1971	104.7971	-66.6691	107.4565
21	0.8900	0.6600	-109.5912	110.2512	-64.8374	107.1116
22	31.1000	45.6000	93.4794	-47.8794	-89.6501	91.0908
23	7.8000	4.5000	-63.1424	67.6424	-75.0418	107.9761
24	36.8000	5.8000	131.7946	-125.9946	-88.5118	82.2480
25	30.4000	6.8000	88.7740	-81.9740	-89.6479	92.0347
26	36.8000	9.2000	131.7946	-122.5946	-88.5118	82.2480
27	53.4233	7.4000	243.5361	-236.1361	-67.9992	39.2664
28	33.3000	10.8000	108.2677	-97.4677	-89.4614	87.9285
29	54.4000	3.6000	250.1012	-246.5012	-65.3380	35.2851
30	23.3500	18.1000	41.3841	-23.2841	-88.0538	99.9698
31	19.0700	42.9000	12.6141	30.2859	-85.7622	103.4633
32	6.0800	1.9000	-74.7042	76.6042	-72.7807	108.0398
33	48.3000	4.0000	209.0972	-205.0972	-78.2183	56.4104
34	4.0533	0.4600	-88.3274	88.7874	-69.8857	107.8843
35	2.9867	1.5000	-95.4975	96.9975	-68.2578	107.6981
36	1.8400	1.8000	-103.2054	105.0054	-66.4242	107.4144
37	2.9700	6.8000	-95.6095	102.4095	-68.2318	107.6946
38	3.2100	1.4000	-93.9963	95.3963	-68.6047	107.7432
39	2.9400	0.6700	-95.8112	96.4812	-68.1849	107.6882
40	1.5200	0.9400	-105.3564	106.2964	-65.8967	107.3194
41	1.3900	0.1800	-106.2303	106.4103	-65.6803	107.2788
42	3.9267	0.2100	-89.1789	89.3889	-69.6963	107.8660
43	1.2767	0.5400	-106.9921	107.5321	-65.4908	107.2424
44	1.3100	0.0730	-106.7680	106.8410	-65.5466	107.2532
45	1.5500	0.0770	-105.1547	105.2317	-65.9464	107.3286
46	30.1000	8.4000	86.7574	-78.3574	-89.6379	92.4303
47	101.9000	2.0000	569.3946	-567.3946	-207.6630	113.4063
48	54.4500	1.1000	250.4373	-249.3373	-65.1933	35.0728
49	23.9000	39.2000	45.0812	-5.8812	-88.2772	99.4499
50	14.6000	34.7000	-17.4331	52.1331	-82.3326	106.0756
51	36.6667	5.5000	130.8983	-125.3983	-88.5634	82.4799

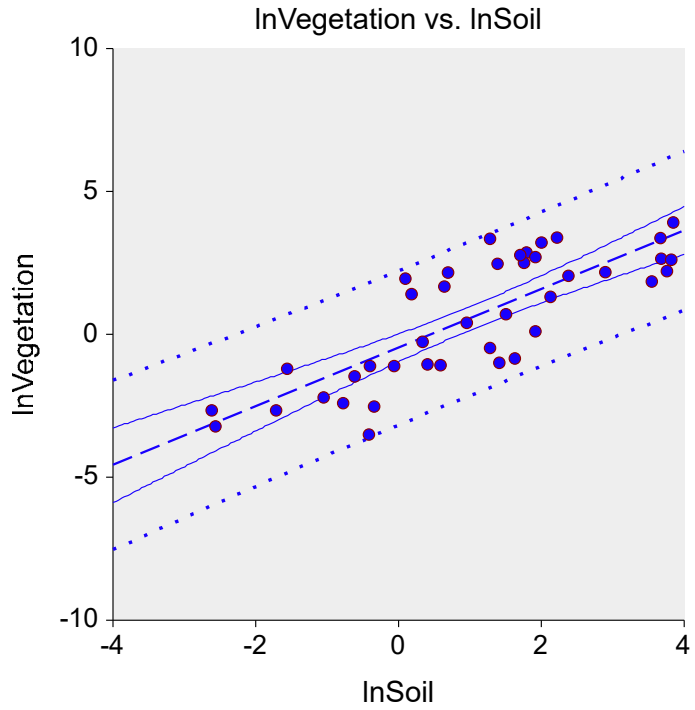
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
ln Transformation – APL 10 Excluded

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnVegetation	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-0.4733	Rows Prediction Only	0
Slope	1.0254	Sum of Frequencies	41
R-Squared	0.6468	Sum of Weights	41.0000
Correlation	0.8043	Coefficient of Variation	2.1555
Mean Square Error	1.727502	Square Root of MSE	1.314345

Linear Regression Report

Y = lnVegetation X = lnSoil

Summary Statement

The equation of the straight line relating lnVegetation and lnSoil is estimated as: lnVegetation = (-0.4733) + (1.0254) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnVegetation when lnSoil is zero, is -0.4733 with a standard error of 0.2420. The slope, the estimated change in lnVegetation per unit change in lnSoil, is 1.0254 with a standard error of 0.1213. The value of R-Squared, the proportion of the variation in lnVegetation that can be accounted for by variation in lnSoil, is 0.6468. The correlation between lnVegetation and lnSoil is 0.8043.

A significance test that the slope is zero resulted in a t-value of 8.4514. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 1.0254. The lower limit of the 95% confidence interval for the slope is 0.7800 and the upper limit is 1.2708. The estimated intercept is -0.4733. The lower limit of the 95% confidence interval for the intercept is -0.9627 and the upper limit is 0.0162.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnVegetation	lnSoil
Count	41	41
Mean	0.6098	1.0562
Standard Deviation	2.1838	1.7128
Minimum	-3.5066	-2.6173
Maximum	3.9140	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	-0.4733	1.0254
Lower 95% Confidence Limit	-0.9627	0.7800
Upper 95% Confidence Limit	0.0162	1.2708
Standard Error	0.2420	0.1213
Standardized Coefficient	0.0000	0.8043
T Value	-1.9558	8.4514
Prob Level (T Test)	0.0577	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.4792	1.0000
Regression of Y on X	-0.4733	1.0254
Inverse Regression from X on Y	-1.0646	1.5853
Orthogonal Regression of Y and X	-0.8167	1.3505

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(-0.473278702218619) + (1.02542063324731) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	-0.4733	0.9000	-0.8585	-0.1121
Bootstrap Mean	-0.4712	0.9500	-0.9386	-0.0403
Bias (BM - OV)	0.0021	0.9900	-1.0754	0.1058
Bias Corrected	-0.4754			
Standard Error	0.2286			
Slope				
Original Value	1.0254	0.9000	0.8685	1.1571
Bootstrap Mean	1.0323	0.9500	0.8323	1.1915
Bias (BM - OV)	0.0069	0.9900	0.7552	1.2547
Bias Corrected	1.0186			
Standard Error	0.0897			
Correlation				
Original Value	0.8043	0.9000	0.7400	0.8864
Bootstrap Mean	0.8021	0.9500	0.7289	0.9107
Bias (BM - OV)	-0.0021	0.9900	0.7085	0.9564
Bias Corrected	0.8064			
Standard Error	0.0459			
R-Squared				
Original Value	0.6468	0.9000	0.5393	0.7723
Bootstrap Mean	0.6455	0.9500	0.5199	0.8066
Bias (BM - OV)	-0.0013	0.9900	0.4836	0.8684
Bias Corrected	0.6481			
Standard Error	0.0723			
Standard Error of Estimate				
Original Value	1.3143	0.9000	1.1671	1.5273
Bootstrap Mean	1.2869	0.9500	1.1345	1.5652
Bias (BM - OV)	-0.0274	0.9900	1.0814	1.6500
Bias Corrected	1.3417			
Standard Error	0.1087			
Orthogonal Intercept				
Original Value	-0.8167	0.9000	-1.2068	-0.3463
Bootstrap Mean	-0.8354	0.9500	-1.2728	-0.2538
Bias (BM - OV)	-0.0187	0.9900	-1.4214	-0.0244
Bias Corrected	-0.7980			
Standard Error	0.2607			
Orthogonal Slope				
Original Value	1.3505	0.9000	1.0313	1.5466
Bootstrap Mean	1.3752	0.9500	0.9515	1.5793
Bias (BM - OV)	0.0247	0.9900	0.7699	1.6416
Bias Corrected	1.3259			
Standard Error	0.1589			

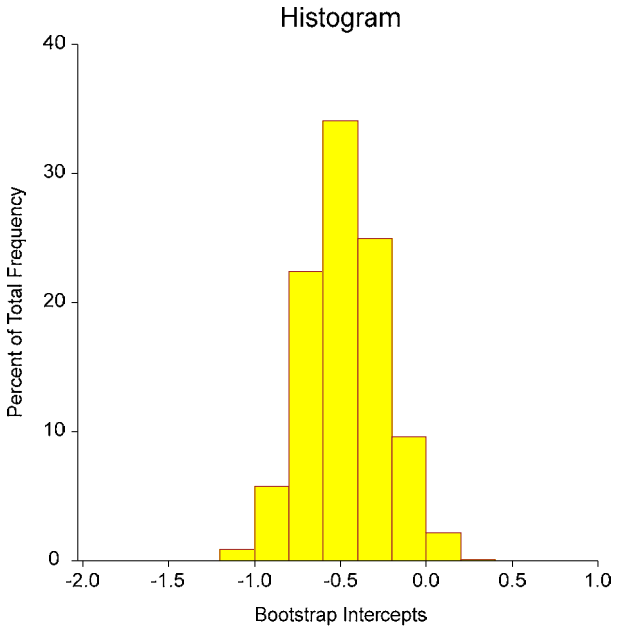
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

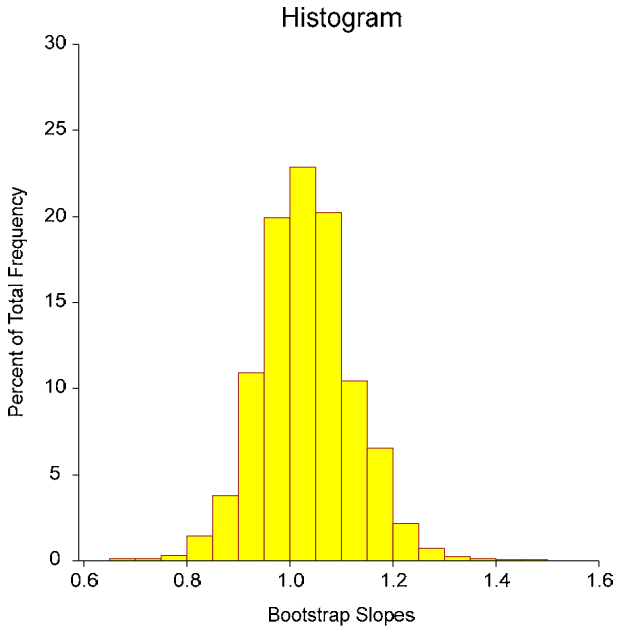
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

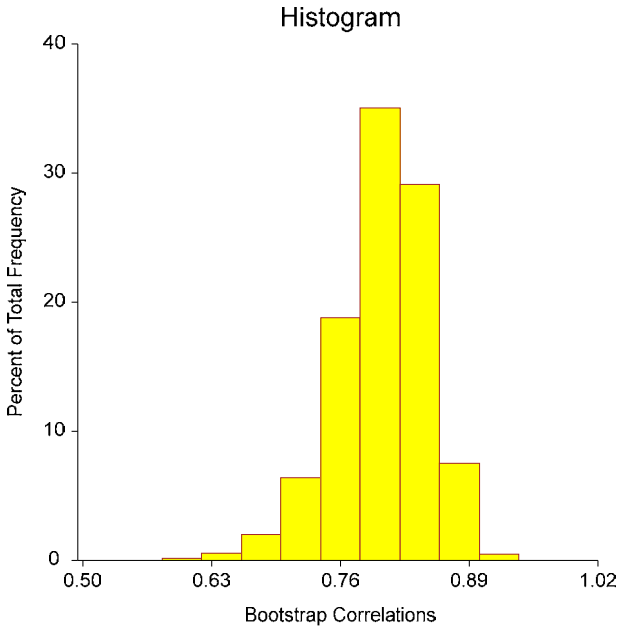
Linear Regression Report

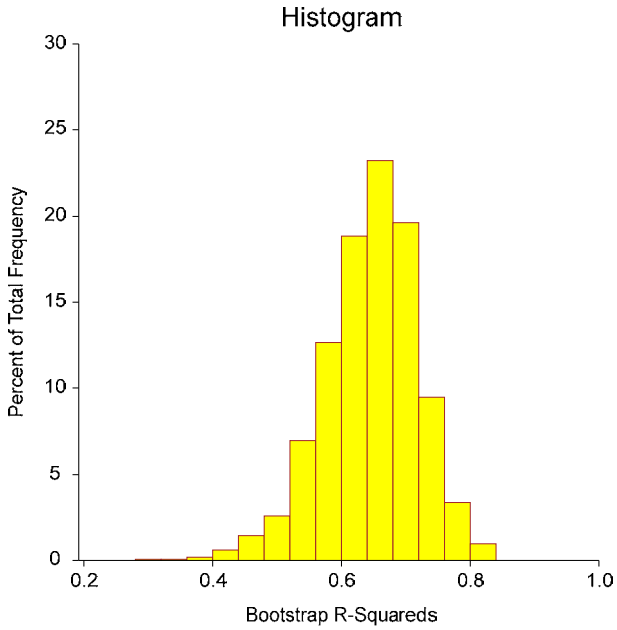
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Histograms Section



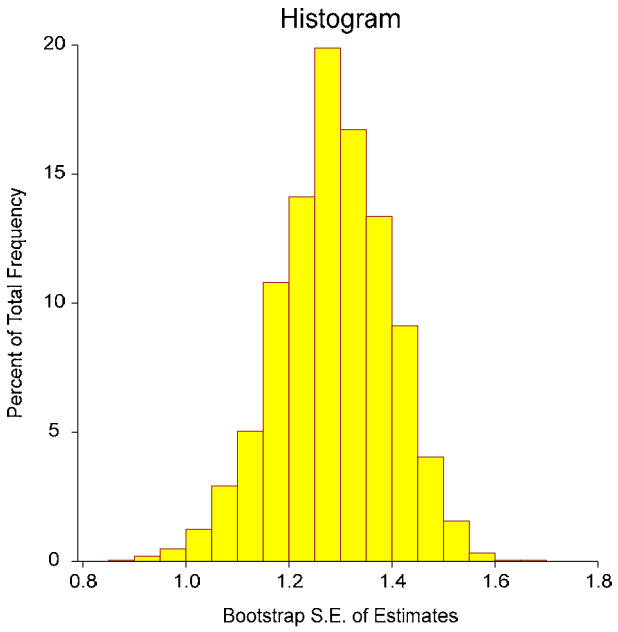


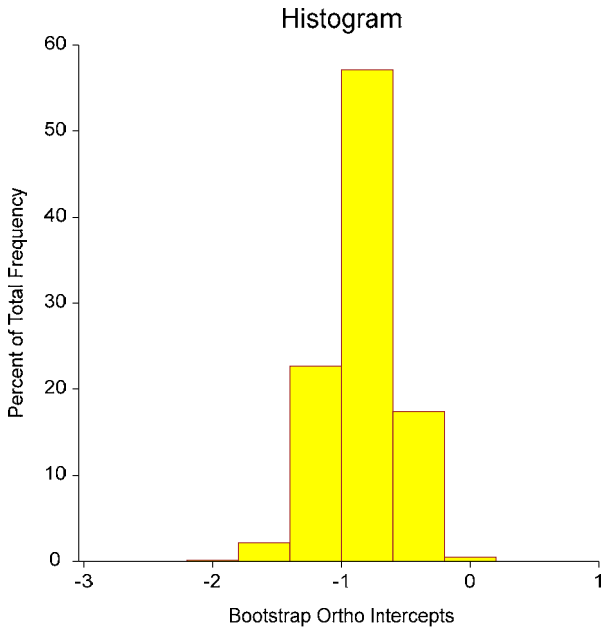


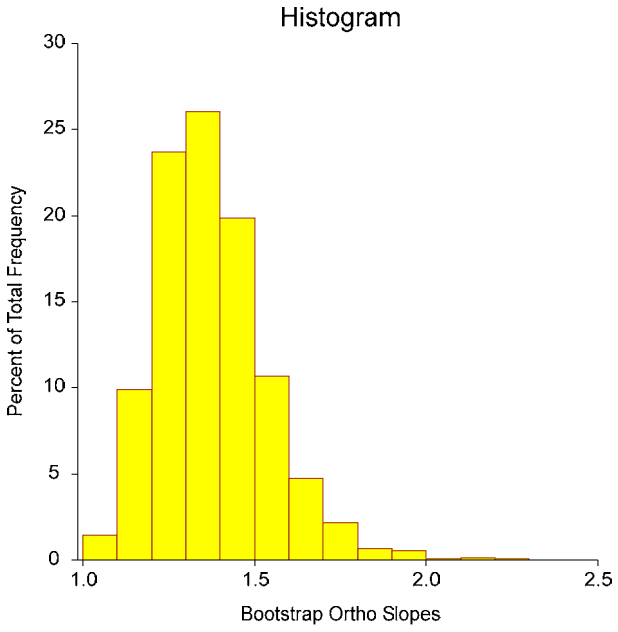


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8043	0.6468	0.8200
Lower 95% Conf. Limit (r dist'n)	0.6552		
Upper 95% Conf. Limit (r dist'n)	0.8887		
Lower 95% Conf. Limit (Fisher's z)	0.6599		0.6852
Upper 95% Conf. Limit (Fisher's z)	0.8914		0.9005
Adjusted (Rbar)		0.6378	
T-Value for H0: Rho = 0	8.4514	8.4514	8.9470
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	15.24484	15.24484			
Slope	1	123.3896	123.3896	71.4266	0.0000	1.0000
Error	39	67.37257	1.727502			
Lack of Fit	37	56.70074	1.532452	0.2872	0.9588	
Pure Error	2	10.67184	5.335918			
Adj. Total	40	190.7622	4.769054			
Total	41	206.007				

s = Square Root(1.727502) = 1.314345

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	25.00077	0.03389676	-0.009000641
1	43.30437	163.0859	146.7366	-0.009000641	0.008521686
2 (Y'Y)			206.007		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.05855672	-0.01554863
1	-0.01554863	0.01472123

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9642	0.219796	Yes
Anderson Darling	0.6197	0.106752	No
D'Agostino Skewness	0.4406	0.659494	Yes
D'Agostino Kurtosis	-1.5904	0.111756	No
D'Agostino Omnibus	2.7234	0.256230	Yes
Constant Residual Variance?			
Modified Levene Test	0.0030	0.956345	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2872	0.958842	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

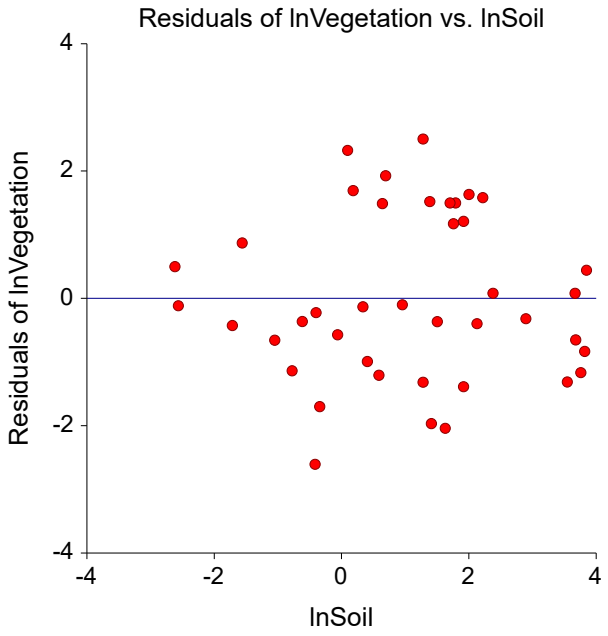
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

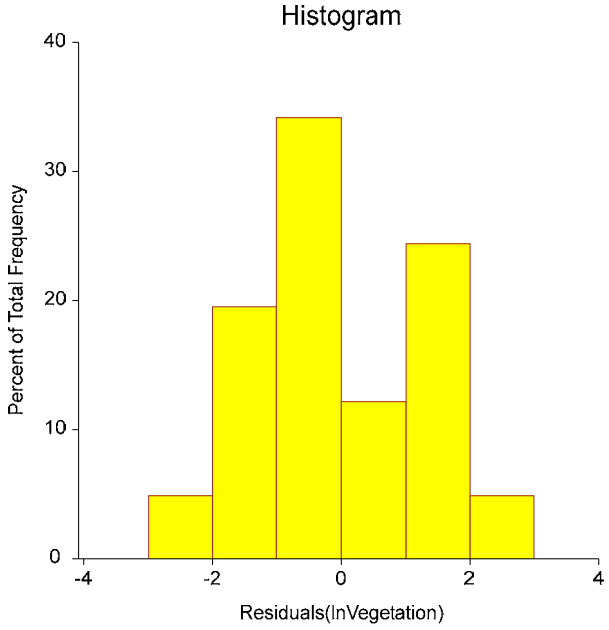
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

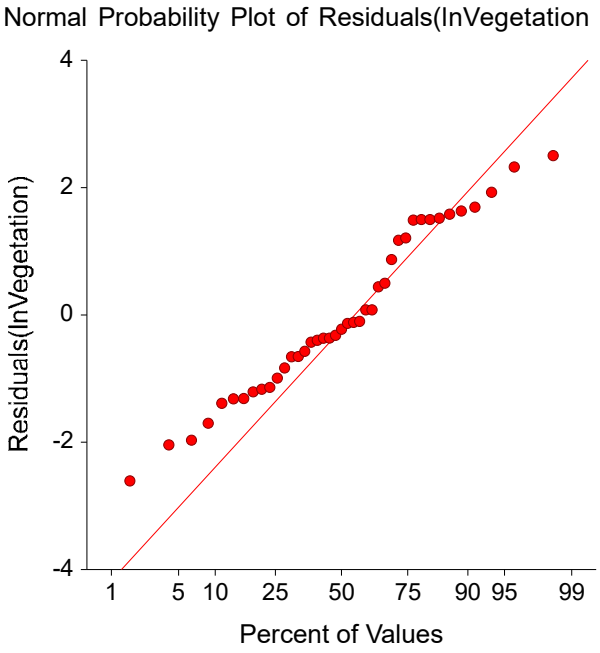
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Original Data Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual
11	1.7918	2.8622	1.3640	1.4982
12	3.8480	3.9140	3.4726	0.4415
13	0.1823	1.4061	-0.2863	1.6924
14	3.6788	2.6462	3.2991	-0.6529
15	1.4110	-0.9943	0.9736	-1.9678
16	-0.3425	-2.5257	-0.8245	-1.7013
17	1.6292	-0.8440	1.1974	-2.0413
18	-1.0498	-2.2073	-1.5498	-0.6575
19	1.2809	-0.4780	0.8402	-1.3183
20	0.9555	0.4055	0.5065	-0.1011
21	-0.4155	-3.5066	-0.8994	-2.6072
22	3.8199	2.6101	3.4437	-0.8337
23	1.5041	0.7031	1.0690	-0.3659
24	1.7579	2.5014	1.3293	1.1722
25	1.9169	2.7014	1.4924	1.2090
26	2.2192	3.3844	1.8023	1.5821
27	2.0015	3.2108	1.5791	1.6318
28	2.3795	2.0464	1.9668	0.0796
29	1.2809	3.3429	0.8402	2.5026
30	2.8959	2.1759	2.4962	-0.3204
31	3.7589	2.2138	3.3811	-1.1674
32	0.6419	1.6734	0.1849	1.4885
33	1.3863	2.4681	0.9483	1.5198
34	-0.7765	-2.4079	-1.2695	-1.1384
35	0.4055	-1.0498	-0.0575	-0.9923
36	0.5878	-1.0788	0.1294	-1.2083
37	1.9169	0.1044	1.4924	-1.3880
38	0.3365	-0.2614	-0.1283	-0.1331
39	-0.4005	-1.1087	-0.8839	-0.2247
40	-0.0619	-1.1087	-0.5367	-0.5719
41	-1.7148	-2.6593	-2.2317	-0.4276
42	-1.5606	-1.2040	-2.0736	0.8696
43	-0.6162	-1.4697	-1.1051	-0.3645
44	-2.6173	-2.6593	-3.1571	0.4978
45	-2.5639	-3.2189	-3.1024	-0.1165
46	2.1282	1.3110	1.7091	-0.3980
47	0.6931	2.1633	0.2375	1.9258
48	0.0953	1.9488	-0.3755	2.3243
49	3.6687	3.3673	3.2887	0.0786
50	3.5467	1.8500	3.1636	-1.3136
51	1.7047	2.7726	1.2748	1.4978

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	2.8622	1.3640	0.2238	0.9113	1.8168
12	3.8480	3.9140	3.4726	0.3961	2.6714	4.2737
13	0.1823	1.4061	-0.2863	0.2310	-0.7536	0.1810
14	3.6788	2.6462	3.2991	0.3787	2.5331	4.0650
15	1.4110	-0.9943	0.9736	0.2097	0.5494	1.3978
16	-0.3425	-2.5257	-0.8245	0.2663	-1.3632	-0.2858
17	1.6292	-0.8440	1.1974	0.2167	0.7590	1.6357
18	-1.0498	-2.2073	-1.5498	0.3278	-2.2127	-0.8868
19	1.2809	-0.4780	0.8402	0.2071	0.4214	1.2591
20	0.9555	0.4055	0.5065	0.2056	0.0906	0.9224
21	-0.4155	-3.5066	-0.8994	0.2721	-1.4497	-0.3491
22	3.8199	2.6101	3.4437	0.3932	2.6485	4.2390
23	1.5041	0.7031	1.0690	0.2123	0.6395	1.4985
24	1.7579	2.5014	1.3293	0.2222	0.8798	1.7787
25	1.9169	2.7014	1.4924	0.2303	1.0265	1.9582
26	2.2192	3.3844	1.8023	0.2491	1.2985	2.3062
27	2.0015	3.2108	1.5791	0.2351	1.1035	2.0547
28	2.3795	2.0464	1.9668	0.2606	1.4396	2.4939
29	1.2809	3.3429	0.8402	0.2071	0.4214	1.2591
30	2.8959	2.1759	2.4962	0.3032	1.8829	3.1096
31	3.7589	2.2138	3.3811	0.3869	2.5986	4.1637
32	0.6419	1.6734	0.1849	0.2113	-0.2426	0.6124
33	1.3863	2.4681	0.9483	0.2091	0.5252	1.3713
34	-0.7765	-2.4079	-1.2695	0.3026	-1.8817	-0.6574
35	0.4055	-1.0498	-0.0575	0.2199	-0.5024	0.3873
36	0.5878	-1.0788	0.1294	0.2130	-0.3014	0.5603
37	1.9169	0.1044	1.4924	0.2303	1.0265	1.9582
38	0.3365	-0.2614	-0.1283	0.2231	-0.5795	0.3229
39	-0.4005	-1.1087	-0.8839	0.2709	-1.4318	-0.3360
40	-0.0619	-1.1087	-0.5367	0.2460	-1.0344	-0.0391
41	-1.7148	-2.6593	-2.2317	0.3939	-3.0284	-1.4349
42	-1.5606	-1.2040	-2.0736	0.3781	-2.8383	-1.3089
43	-0.6162	-1.4697	-1.1051	0.2886	-1.6889	-0.5213
44	-2.6173	-2.6593	-3.1571	0.4907	-4.1497	-2.1646
45	-2.5639	-3.2189	-3.1024	0.4848	-4.0831	-2.1217
46	2.1282	1.3110	1.7091	0.2430	1.2175	2.2006
47	0.6931	2.1633	0.2375	0.2099	-0.1872	0.6621
48	0.0953	1.9488	-0.3755	0.2361	-0.8530	0.1019
49	3.6687	3.3673	3.2887	0.3776	2.5248	4.0525
50	3.5467	1.8500	3.1636	0.3653	2.4247	3.9025
51	1.7047	2.7726	1.2748	0.2198	0.8302	1.7195

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	2.8622	1.3640	1.3333	-1.3328	4.0608
12	3.8480	3.9140	3.4726	1.3727	0.6960	6.2492
13	0.1823	1.4061	-0.2863	1.3345	-2.9856	2.4129
14	3.6788	2.6462	3.2991	1.3678	0.5324	6.0657
15	1.4110	-0.9943	0.9736	1.3310	-1.7186	3.6657
16	-0.3425	-2.5257	-0.8245	1.3411	-3.5370	1.8881
17	1.6292	-0.8440	1.1974	1.3321	-1.4970	3.8918
18	-1.0498	-2.2073	-1.5498	1.3546	-4.2897	1.1901
19	1.2809	-0.4780	0.8402	1.3306	-1.8511	3.5315
20	0.9555	0.4055	0.5065	1.3303	-2.1843	3.1974
21	-0.4155	-3.5066	-0.8994	1.3422	-3.6142	1.8155
22	3.8199	2.6101	3.4437	1.3719	0.6688	6.2186
23	1.5041	0.7031	1.0690	1.3314	-1.6239	3.7620
24	1.7579	2.5014	1.3293	1.3330	-1.3670	4.0255
25	1.9169	2.7014	1.4924	1.3344	-1.2066	4.1914
26	2.2192	3.3844	1.8023	1.3377	-0.9035	4.5082
27	2.0015	3.2108	1.5791	1.3352	-1.1216	4.2798
28	2.3795	2.0464	1.9668	1.3399	-0.7435	4.6770
29	1.2809	3.3429	0.8402	1.3306	-1.8511	3.5315
30	2.8959	2.1759	2.4962	1.3489	-0.2321	5.2246
31	3.7589	2.2138	3.3811	1.3701	0.6099	6.1524
32	0.6419	1.6734	0.1849	1.3312	-2.5078	2.8776
33	1.3863	2.4681	0.9483	1.3309	-1.7437	3.6402
34	-0.7765	-2.4079	-1.2695	1.3487	-3.9976	1.4585
35	0.4055	-1.0498	-0.0575	1.3326	-2.7530	2.6380
36	0.5878	-1.0788	0.1294	1.3315	-2.5637	2.8226
37	1.9169	0.1044	1.4924	1.3344	-1.2066	4.1914
38	0.3365	-0.2614	-0.1283	1.3331	-2.8248	2.5683
39	-0.4005	-1.1087	-0.8839	1.3420	-3.5983	1.8304
40	-0.0619	-1.1087	-0.5367	1.3372	-3.2414	2.1680
41	-1.7148	-2.6593	-2.2317	1.3721	-5.0070	0.5437
42	-1.5606	-1.2040	-2.0736	1.3676	-4.8399	0.6927
43	-0.6162	-1.4697	-1.1051	1.3457	-3.8270	1.6167
44	-2.6173	-2.6593	-3.1571	1.4030	-5.9949	-0.3194
45	-2.5639	-3.2189	-3.1024	1.4009	-5.9360	-0.2688
46	2.1282	1.3110	1.7091	1.3366	-0.9945	4.4126
47	0.6931	2.1633	0.2375	1.3310	-2.4547	2.9297
48	0.0953	1.9488	-0.3755	1.3354	-3.0766	2.3255
49	3.6687	3.3673	3.2887	1.3675	0.5226	6.0547
50	3.5467	1.8500	3.1636	1.3642	0.4043	5.9229
51	1.7047	2.7726	1.2748	1.3326	-1.4206	3.9702

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	2.8622	1.3640	0.2238	0.7261	2.0019
12	3.8480	3.9140	3.4726	0.3961	2.3438	4.6013
13	0.1823	1.4061	-0.2863	0.2310	-0.9447	0.3721
14	3.6788	2.6462	3.2991	0.3787	2.2199	4.3782
15	1.4110	-0.9943	0.9736	0.2097	0.3759	1.5713
16	-0.3425	-2.5257	-0.8245	0.2663	-1.5835	-0.0655
17	1.6292	-0.8440	1.1974	0.2167	0.5797	1.8150
18	-1.0498	-2.2073	-1.5498	0.3278	-2.4839	-0.6157
19	1.2809	-0.4780	0.8402	0.2071	0.2501	1.4303
20	0.9555	0.4055	0.5065	0.2056	-0.0795	1.0925
21	-0.4155	-3.5066	-0.8994	0.2721	-1.6747	-0.1240
22	3.8199	2.6101	3.4437	0.3932	2.3233	4.5642
23	1.5041	0.7031	1.0690	0.2123	0.4639	1.6742
24	1.7579	2.5014	1.3293	0.2222	0.6960	1.9626
25	1.9169	2.7014	1.4924	0.2303	0.8360	2.1487
26	2.2192	3.3844	1.8023	0.2491	1.0925	2.5122
27	2.0015	3.2108	1.5791	0.2351	0.9090	2.2492
28	2.3795	2.0464	1.9668	0.2606	1.2241	2.7094
29	1.2809	3.3429	0.8402	0.2071	0.2501	1.4303
30	2.8959	2.1759	2.4962	0.3032	1.6320	3.3605
31	3.7589	2.2138	3.3811	0.3869	2.2786	4.4837
32	0.6419	1.6734	0.1849	0.2113	-0.4174	0.7872
33	1.3863	2.4681	0.9483	0.2091	0.3522	1.5443
34	-0.7765	-2.4079	-1.2695	0.3026	-2.1320	-0.4071
35	0.4055	-1.0498	-0.0575	0.2199	-0.6843	0.5693
36	0.5878	-1.0788	0.1294	0.2130	-0.4775	0.7364
37	1.9169	0.1044	1.4924	0.2303	0.8360	2.1487
38	0.3365	-0.2614	-0.1283	0.2231	-0.7640	0.5075
39	-0.4005	-1.1087	-0.8839	0.2709	-1.6559	-0.1120
40	-0.0619	-1.1087	-0.5367	0.2460	-1.2379	0.1645
41	-1.7148	-2.6593	-2.2317	0.3939	-3.3543	-1.1091
42	-1.5606	-1.2040	-2.0736	0.3781	-3.1511	-0.9961
43	-0.6162	-1.4697	-1.1051	0.2886	-1.9277	-0.2826
44	-2.6173	-2.6593	-3.1571	0.4907	-4.5556	-1.7587
45	-2.5639	-3.2189	-3.1024	0.4848	-4.4841	-1.7207
46	2.1282	1.3110	1.7091	0.2430	1.0165	2.4016
47	0.6931	2.1633	0.2375	0.2099	-0.3608	0.8358
48	0.0953	1.9488	-0.3755	0.2361	-1.0483	0.2972
49	3.6687	3.3673	3.2887	0.3776	2.2125	4.3649
50	3.5467	1.8500	3.1636	0.3653	2.1226	4.2047
51	1.7047	2.7726	1.2748	0.2198	0.6483	1.9013

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	2.8622	1.3640	1.4982	1.1568	52.3434
12	3.8480	3.9140	3.4726	0.4415	0.3523	11.2790
13	0.1823	1.4061	-0.2863	1.6924	1.3080	120.3629
14	3.6788	2.6462	3.2991	-0.6529	-0.5187	24.6731
15	1.4110	-0.9943	0.9736	-1.9678	-1.5166	197.9205
16	-0.3425	-2.5257	-0.8245	-1.7013	-1.3218	67.3569
17	1.6292	-0.8440	1.1974	-2.0413	-1.5747	241.8745
18	-1.0498	-2.2073	-1.5498	-0.6575	-0.5166	29.7873
19	1.2809	-0.4780	0.8402	-1.3183	-1.0157	275.7645
20	0.9555	0.4055	0.5065	-0.1011	-0.0778	24.9238
21	-0.4155	-3.5066	-0.8994	-2.6072	-2.0276	74.3521
22	3.8199	2.6101	3.4437	-0.8337	-0.6647	31.9403
23	1.5041	0.7031	1.0690	-0.3659	-0.2821	52.0462
24	1.7579	2.5014	1.3293	1.1722	0.9049	46.8599
25	1.9169	2.7014	1.4924	1.2090	0.9343	44.7548
26	2.2192	3.3844	1.8023	1.5821	1.2259	46.7456
27	2.0015	3.2108	1.5791	1.6318	1.2619	50.8204
28	2.3795	2.0464	1.9668	0.0796	0.0618	3.8919
29	1.2809	3.3429	0.8402	2.5026	1.9282	74.8653
30	2.8959	2.1759	2.4962	-0.3204	-0.2505	14.7233
31	3.7589	2.2138	3.3811	-1.1674	-0.9294	52.7336
32	0.6419	1.6734	0.1849	1.4885	1.1474	88.9508
33	1.3863	2.4681	0.9483	1.5198	1.1713	61.5795
34	-0.7765	-2.4079	-1.2695	-1.1384	-0.8900	47.2767
35	0.4055	-1.0498	-0.0575	-0.9923	-0.7658	94.5223
36	0.5878	-1.0788	0.1294	-1.2083	-0.9316	111.9993
37	1.9169	0.1044	1.4924	-1.3880	-1.0726	1330.0240
38	0.3365	-0.2614	-0.1283	-0.1331	-0.1028	50.9294
39	-0.4005	-1.1087	-0.8839	-0.2247	-0.1747	20.2700
40	-0.0619	-1.1087	-0.5367	-0.5719	-0.4430	51.5879
41	-1.7148	-2.6593	-2.2317	-0.4276	-0.3410	16.0793
42	-1.5606	-1.2040	-2.0736	0.8696	0.6908	72.2297
43	-0.6162	-1.4697	-1.1051	-0.3645	-0.2843	24.8046
44	-2.6173	-2.6593	-3.1571	0.4978	0.4083	18.7213
45	-2.5639	-3.2189	-3.1024	-0.1165	-0.0953	3.6183
46	2.1282	1.3110	1.7091	-0.3980	-0.3081	30.3595
47	0.6931	2.1633	0.2375	1.9258	1.4843	89.0220
48	0.0953	1.9488	-0.3755	2.3243	1.7976	119.2710
49	3.6687	3.3673	3.2887	0.0786	0.0625	2.3353
50	3.5467	1.8500	3.1636	-1.3136	-1.0404	71.0039
51	1.7047	2.7726	1.2748	1.4978	1.1558	54.0211

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	1.4982	1.1619	0.0290	0.0200	1.7121
12	3.8480	0.4415	0.3483	0.0908	0.0062	1.7673
13	0.1823	1.6924	1.3204	0.0309	0.0273	1.6952
14	3.6788	-0.6529	-0.5138	0.0830	0.0122	1.7607
15	1.4110	-1.9678	-1.5433	0.0255	0.0300	1.6684
16	-0.3425	-1.7013	-1.3350	0.0411	0.0374	1.6935
17	1.6292	-2.0413	-1.6063	0.0272	0.0347	1.6602
18	-1.0498	-0.6575	-0.5116	0.0622	0.0088	1.7608
19	1.2809	-1.3183	-1.0161	0.0248	0.0131	1.7261
20	0.9555	-0.1011	-0.0768	0.0245	0.0001	1.7727
21	-0.4155	-2.6072	*-2.1160	0.0428	0.0920	1.5861
22	3.8199	-0.8337	-0.6599	0.0895	0.0217	1.7529
23	1.5041	-0.3659	-0.2788	0.0261	0.0011	1.7693
24	1.7579	1.1722	0.9027	0.0286	0.0120	1.7357
25	1.9169	1.2090	0.9327	0.0307	0.0138	1.7333
26	2.2192	1.5821	1.2341	0.0359	0.0280	1.7046
27	2.0015	1.6318	1.2718	0.0320	0.0263	1.7006
28	2.3795	0.0796	0.0610	0.0393	0.0001	1.7728
29	1.2809	2.5026	*2.0011	0.0248	0.0473	1.6039
30	2.8959	-0.3204	-0.2475	0.0532	0.0018	1.7701
31	3.7589	-1.1674	-0.9277	0.0866	0.0410	1.7337
32	0.6419	1.4885	1.1522	0.0259	0.0175	1.7131
33	1.3863	1.5198	1.1770	0.0253	0.0178	1.7106
34	-0.7765	-1.1384	-0.8876	0.0530	0.0222	1.7369
35	0.4055	-0.9923	-0.7617	0.0280	0.0084	1.7463
36	0.5878	-1.2083	-0.9300	0.0263	0.0117	1.7335
37	1.9169	-1.3880	-1.0748	0.0307	0.0182	1.7207
38	0.3365	-0.1331	-0.1015	0.0288	0.0002	1.7725
39	-0.4005	-0.2247	-0.1725	0.0425	0.0007	1.7716
40	-0.0619	-0.5719	-0.4384	0.0350	0.0036	1.7640
41	-1.7148	-0.4276	-0.3371	0.0898	0.0057	1.7677
42	-1.5606	0.8696	0.6861	0.0827	0.0215	1.7513
43	-0.6162	-0.3645	-0.2809	0.0482	0.0020	1.7693
44	-2.6173	0.4978	*0.4039	0.1394	0.0135	1.7654
45	-2.5639	-0.1165	*-0.0941	0.1361	0.0007	1.7725
46	2.1282	-0.3980	-0.3045	0.0342	0.0017	1.7686
47	0.6931	1.9258	1.5084	0.0255	0.0288	1.6728
48	0.0953	2.3243	1.8529	0.0323	0.0539	1.6261
49	3.6687	0.0786	0.0617	0.0826	0.0002	1.7728
50	3.5467	-1.3136	-1.0416	0.0772	0.0453	1.7238
51	1.7047	1.4978	1.1610	0.0280	0.0192	1.7122

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	1.1619	0.2008	0.0200	1.0116	0.1138	0.0801
12	0.3483	0.1101	0.0062	* 1.1512	-0.0015	0.0941
13	1.3204	0.2358	0.0273	0.9936	0.2350	-0.1082
14	-0.5138	-0.1546	0.0122	1.1329	-0.0023	-0.1299
15	-1.5433	-0.2495	0.0300	0.9571	-0.1800	-0.0512
16	-1.3350	-0.2762	0.0374	1.0022	-0.2738	0.1760
17	-1.6063	-0.2685	0.0347	0.9495	-0.1701	-0.0861
18	-0.5116	-0.1318	0.0088	1.1079	-0.1244	0.1027
19	-1.0161	-0.1621	0.0131	1.0237	-0.1250	-0.0213
20	-0.0768	-0.0122	0.0001	1.0794	-0.0107	0.0007
21	* -2.1160	-0.4477	0.0920	0.8807	-0.4421	0.2938
22	-0.6599	-0.2069	0.0217	1.1308	0.0018	-0.1764
23	-0.2788	-0.0456	0.0011	1.0771	-0.0312	-0.0117
24	0.9027	0.1549	0.0120	1.0393	0.0899	0.0593
25	0.9327	0.1660	0.0138	1.0386	0.0856	0.0753
26	1.2341	0.2382	0.0280	1.0100	0.0950	0.1349
27	1.2718	0.2313	0.0263	1.0011	0.1115	0.1128
28	0.0610	0.0123	0.0001	1.0962	0.0042	0.0076
29	* 2.0011	0.3192	0.0473	0.8840	0.2462	0.0420
30	-0.2475	-0.0587	0.0018	1.1090	-0.0108	-0.0432
31	-0.9277	-0.2857	0.0410	1.1027	-0.0003	-0.2422
32	1.1522	0.1877	0.0175	1.0095	0.1783	-0.0447
33	1.1770	0.1897	0.0178	1.0060	0.1387	0.0363
34	-0.8876	-0.2100	0.0222	1.0676	-0.2026	0.1543
35	-0.7617	-0.1293	0.0084	1.0513	-0.1269	0.0464
36	-0.9300	-0.1527	0.0117	1.0341	-0.1464	0.0408
37	-1.0748	-0.1913	0.0182	1.0235	-0.0987	-0.0867
38	-0.1015	-0.0175	0.0002	1.0840	-0.0173	0.0068
39	-0.1725	-0.0363	0.0007	1.0983	-0.0359	0.0237
40	-0.4384	-0.0835	0.0036	1.0806	-0.0835	0.0461
41	-0.3371	-0.1059	0.0057	* 1.1504	-0.0947	0.0904
42	0.6861	0.2061	0.0215	1.1204	0.1866	-0.1731
43	-0.2809	-0.0632	0.0020	1.1021	-0.0617	0.0445
44	0.4039	0.1625	0.0135	* 1.2135	0.1359	-0.1476
45	-0.0941	-0.0374	0.0007	* 1.2187	-0.0313	0.0338
46	-0.3045	-0.0573	0.0017	1.0853	-0.0248	-0.0307
47	1.5084	0.2441	0.0288	0.9622	0.2295	-0.0512
48	1.8529	0.3383	0.0539	0.9155	0.3380	-0.1671
49	0.0617	0.0185	0.0002	* 1.1479	0.0003	0.0155
50	-1.0416	-0.3014	0.0453	1.0790	-0.0116	-0.2493
51	1.1610	0.1970	0.0192	1.0107	0.1187	0.0705

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	1.4982	||||||||.....	1.1568	||||||||.....	1.1619	||||||||.....
12	3.8480	0.4415	||.....	0.3523	||.....	0.3483	||.....
13	0.1823	1.6924	||||||||.....	1.3080	||||||||.....	1.3204	||||||||.....
14	3.6788	-0.6529	|||.....	-0.5187	|||.....	-0.5138	|||.....
15	1.4110	-1.9678	||||||||||....	-1.5166	||||||||||....	-1.5433	|||||||||.....
16	-0.3425	-1.7013	||||||||.....	-1.3218	||||||||.....	-1.3350	||||||||.....
17	1.6292	-2.0413	||||||||||....	-1.5747	||||||||||....	-1.6063	||||||||||....
18	-1.0498	-0.6575	|||.....	-0.5166	|||.....	-0.5116	|||.....
19	1.2809	-1.3183	|||||||.....	-1.0157	|||||||.....	-1.0161	||||||.....
20	0.9555	-0.1011	|.....	-0.0778	|.....	-0.0768	|.....
21	-0.4155	-2.6072	||||||||||||||	-2.0276	||||||||||||||	* -2.1160	||||||||||||||
22	3.8199	-0.8337	||||.....	-0.6647	||||.....	-0.6599	||||.....
23	1.5041	-0.3659	|.....	-0.2821	|.....	-0.2788	|.....
24	1.7579	1.1722	||||||.....	0.9049	||||||.....	0.9027	||||||.....
25	1.9169	1.2090	||||||.....	0.9343	||||||.....	0.9327	||||||.....
26	2.2192	1.5821	|||||||.....	1.2259	|||||||.....	1.2341	|||||||.....
27	2.0015	1.6318	||||||||.....	1.2619	||||||||.....	1.2718	|||||||.....
28	2.3795	0.0796	|.....	0.0618	|.....	0.0610	|.....
29	1.2809	2.5026	|||||||||||||.	1.9282	|||||||||||||.	* 2.0011	|||||||||||||.
30	2.8959	-0.3204	|.....	-0.2505	|.....	-0.2475	|.....
31	3.7589	-1.1674	||||||.....	-0.9294	||||||.....	-0.9277	||||||.....
32	0.6419	1.4885	|||||||.....	1.1474	|||||||.....	1.1522	|||||||.....
33	1.3863	1.5198	|||||||.....	1.1713	|||||||.....	1.1770	|||||||.....
34	-0.7765	-1.1384	||||||.....	-0.8900	||||||.....	-0.8876	||||||.....
35	0.4055	-0.9923	|||||.....	-0.7658	|||||.....	-0.7617	|||||.....
36	0.5878	-1.2083	||||||.....	-0.9316	||||||.....	-0.9300	||||||.....
37	1.9169	-1.3880	|||||||.....	-1.0726	|||||||.....	-1.0748	|||||||.....
38	0.3365	-0.1331	|.....	-0.1028	|.....	-0.1015	|.....
39	-0.4005	-0.2247	|.....	-0.1747	|.....	-0.1725	|.....
40	-0.0619	-0.5719	||.....	-0.4430	||.....	-0.4384	||.....
41	-1.7148	-0.4276	||.....	-0.3410	||.....	-0.3371	||.....
42	-1.5606	0.8696	||||.....	0.6908	||||.....	0.6861	||||.....
43	-0.6162	-0.3645	|.....	-0.2843	|.....	-0.2809	|.....
44	-2.6173	0.4978	||.....	0.4083	||.....	0.4039	||.....
45	-2.5639	-0.1165	|.....	-0.0953	|.....	-0.0941	|.....
46	2.1282	-0.3980	|.....	-0.3081	|.....	-0.3045	|.....
47	0.6931	1.9258	|||||||||.....	1.4843	|||||||||.....	1.5084	|||||||||.....
48	0.0953	2.3243	||||||||||||..	1.7976	||||||||||||..	1.8529	||||||||||||..
49	3.6687	0.0786	|.....	0.0625	|.....	0.0617	|.....
50	3.5467	-1.3136	|||||||.....	-1.0404	|||||||.....	-1.0416	|||||||.....
51	1.7047	1.4978	|||||||.....	1.1558	|||||||.....	1.1610	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.2008	||||||.....	0.0200	|||.....	0.0801	||||.....
12	3.8480	0.1101	|||.....	0.0062	|.....	0.0941	||||.....
13	0.1823	0.2358	|||||||.....	0.0273	||||.....	-0.1082	|||||.....
14	3.6788	-0.1546	||||.....	0.0122	|.....	-0.1299	||||||.....
15	1.4110	-0.2495	|||||||.....	0.0300	||||.....	-0.0512	||.....
16	-0.3425	-0.2762	|||||||||.....	0.0374	||||||.....	0.1760	|||||||.....
17	1.6292	-0.2685	|||||||.....	0.0347	|||||.....	-0.0861	||||.....
18	-1.0498	-0.1318	||||.....	0.0088	|.....	0.1027	|||||.....
19	1.2809	-0.1621	|||||.....	0.0131	||.....	-0.0213	|.....
20	0.9555	-0.0122	|.....	0.0001	|.....	0.0007	|.....
21	-0.4155	-0.4477	|||||||||||||||	0.0920	|||||||||||||||	0.2938	|||||||||||||||
22	3.8199	-0.2069	||||||.....	0.0217	|||.....	-0.1764	|||||||.....
23	1.5041	-0.0456	|.....	0.0011	|.....	-0.0117	|.....
24	1.7579	0.1549	||||.....	0.0120	|.....	0.0593	||.....
25	1.9169	0.1660	|||||.....	0.0138	||.....	0.0753	|||.....
26	2.2192	0.2382	|||||||.....	0.0280	||||.....	0.1349	||||||.....
27	2.0015	0.2313	|||||||.....	0.0263	||||.....	0.1128	|||||.....
28	2.3795	0.0123	|.....	0.0001	|.....	0.0076	|.....
29	1.2809	0.3192	||||||||.....	0.0473	||||||.....	0.0420	||.....
30	2.8959	-0.0587	|.....	0.0018	|.....	-0.0432	||.....
31	3.7589	-0.2857	|||||||||.....	0.0410	||||||.....	-0.2422	||||||||||...
32	0.6419	0.1877	||||||.....	0.0175	||.....	-0.0447	||.....
33	1.3863	0.1897	||||||.....	0.0178	||.....	0.0363	|.....
34	-0.7765	-0.2100	||||||.....	0.0222	|||.....	0.1543	|||||||.....
35	0.4055	-0.1293	||||.....	0.0084	|.....	0.0464	||.....
36	0.5878	-0.1527	||||.....	0.0117	|.....	0.0408	||.....
37	1.9169	-0.1913	||||||.....	0.0182	||.....	-0.0867	||||.....
38	0.3365	-0.0175	|.....	0.0002	|.....	0.0068	|.....
39	-0.4005	-0.0363	|.....	0.0007	|.....	0.0237	|.....
40	-0.0619	-0.0835	||.....	0.0036	|.....	0.0461	||.....
41	-1.7148	-0.1059	|||.....	0.0057	|.....	0.0904	||||.....
42	-1.5606	0.2061	||||||.....	0.0215	|||.....	-0.1731	|||||||.....
43	-0.6162	-0.0632	|.....	0.0020	|.....	0.0445	||.....
44	-2.6173	0.1625	|||||.....	0.0135	||.....	-0.1476	|||||||.....
45	-2.5639	-0.0374	|.....	0.0007	|.....	0.0338	|.....
46	2.1282	-0.0573	|.....	0.0017	|.....	-0.0307	|.....
47	0.6931	0.2441	|||||||.....	0.0288	||||.....	-0.0512	||.....
48	0.0953	0.3383	||||||||||....	0.0539	||||||||.....	-0.1671	|||||||.....
49	3.6687	0.0185	|.....	0.0002	|.....	0.0155	|.....
50	3.5467	-0.3014	|||||||||.....	0.0453	||||||.....	-0.2493	||||||||||...
51	1.7047	0.1970	||||||.....	0.0192	|||.....	0.0705	|||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	1.1619	||||||||.....	0.0200	|||.....	0.0290	|.....
12	3.8480	0.3483	||.....	0.0062	|.....	0.0908	||||||||.....
13	0.1823	1.3204	||||||||.....	0.0273	||||.....	0.0309	|.....
14	3.6788	-0.5138	|||.....	0.0122	|.....	0.0830	|||||||.....
15	1.4110	-1.5433	|||||||||.....	0.0300	||||.....	0.0255	|.....
16	-0.3425	-1.3350	||||||||.....	0.0374	||||||.....	0.0411	||.....
17	1.6292	-1.6063	||||||||||....	0.0347	|||||.....	0.0272	|.....
18	-1.0498	-0.5116	|||.....	0.0088	|.....	0.0622	||||.....
19	1.2809	-1.0161	||||||.....	0.0131	||.....	0.0248	|.....
20	0.9555	-0.0768	|.....	0.0001	|.....	0.0245	|.....
21	-0.4155	* -2.1160	||||||||||||||	0.0920	||||||||||||||	0.0428	||.....
22	3.8199	-0.6599	||||.....	0.0217	|||.....	0.0895	||||||||.....
23	1.5041	-0.2788	|.....	0.0011	|.....	0.0261	|.....
24	1.7579	0.9027	||||||.....	0.0120	|.....	0.0286	|.....
25	1.9169	0.9327	||||||.....	0.0138	||.....	0.0307	|.....
26	2.2192	1.2341	||||||||.....	0.0280	||||.....	0.0359	|.....
27	2.0015	1.2718	||||||||.....	0.0263	||||.....	0.0320	|.....
28	2.3795	0.0610	|.....	0.0001	|.....	0.0393	|.....
29	1.2809	* 2.0011	|||||||||||||.	0.0473	||||||.....	0.0248	|.....
30	2.8959	-0.2475	|.....	0.0018	|.....	0.0532	|||.....
31	3.7589	-0.9277	||||||.....	0.0410	||||||.....	0.0866	||||||||.....
32	0.6419	1.1522	|||||||.....	0.0175	||.....	0.0259	|.....
33	1.3863	1.1770	||||||||.....	0.0178	||.....	0.0253	|.....
34	-0.7765	-0.8876	||||||.....	0.0222	|||.....	0.0530	|||.....
35	0.4055	-0.7617	|||||.....	0.0084	|.....	0.0280	|.....
36	0.5878	-0.9300	||||||.....	0.0117	|.....	0.0263	|.....
37	1.9169	-1.0748	|||||||.....	0.0182	||.....	0.0307	|.....
38	0.3365	-0.1015	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.1725	|.....	0.0007	|.....	0.0425	||.....
40	-0.0619	-0.4384	||.....	0.0036	|.....	0.0350	|.....
41	-1.7148	-0.3371	||.....	0.0057	|.....	0.0898	||||||||.....
42	-1.5606	0.6861	||||.....	0.0215	|||.....	0.0827	|||||||.....
43	-0.6162	-0.2809	|.....	0.0020	|.....	0.0482	|||.....
44	-2.6173	0.4039	||.....	0.0135	||.....	0.1394	||||||||||||||
45	-2.5639	-0.0941	|.....	0.0007	|.....	0.1361	|||||||||||||.
46	2.1282	-0.3045	|.....	0.0017	|.....	0.0342	|.....
47	0.6931	1.5084	|||||||||.....	0.0288	||||.....	0.0255	|.....
48	0.0953	1.8529	||||||||||||..	0.0539	||||||||.....	0.0323	|.....
49	3.6687	0.0617	|.....	0.0002	|.....	0.0826	|||||||.....
50	3.5467	-1.0416	|||||||.....	0.0453	|||||||.....	0.0772	||||||.....
51	1.7047	1.1610	||||||||.....	0.0192	|||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Means

Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	2.8622	1.7918	3.2528	-1.4610	2.6899	4.0826
12	3.9140	3.8480	4.2785	-0.4305	3.5561	5.3925
13	1.4061	0.1823	1.8328	-1.6505	1.4187	2.3412
14	2.6462	3.6788	3.0421	0.6367	2.5085	3.8171
15	-0.9943	1.4110	-0.5081	1.9190	-1.1790	-0.0272
16	-2.5257	-0.3425	-2.0016	1.6591	-3.0686	-1.3062
17	-0.8440	1.6292	-0.3615	1.9907	-0.9985	0.1032
18	-2.2073	-1.0498	-1.6910	0.6412	-2.6705	-1.0453
19	-0.4780	1.2809	-0.0046	1.2856	-0.5655	0.4273
20	0.4055	0.9555	0.8570	0.0986	0.4248	1.2649
21	-3.5066	-0.4155	-2.9581	2.5426	-4.3031	-2.1009
22	2.6101	3.8199	3.0069	0.8130	2.4780	3.7729
23	0.7031	1.5041	1.1472	0.3569	0.7351	1.5704
24	2.5014	1.7579	2.9010	-1.1431	2.3860	3.6401
25	2.7014	1.9169	3.0959	-1.1790	2.5550	3.8847
26	3.3844	2.2192	3.7620	-1.5428	3.1228	4.7300
27	3.2108	2.0015	3.5928	-1.5913	2.9797	4.5141
28	2.0464	2.3795	2.4572	-0.0777	1.9942	3.0904
29	3.3429	1.2809	3.7215	-2.4406	3.0886	4.6783
30	2.1759	2.8959	2.5835	0.3124	2.1069	3.2457
31	2.2138	3.7589	2.6204	1.1385	2.1396	3.2913
32	1.6734	0.6419	2.0934	-1.4516	1.6632	2.6496
33	2.4681	1.3863	2.8685	-1.4822	2.3576	3.5995
34	-2.4079	-0.7765	-1.8867	1.1102	-2.9211	-1.2099
35	-1.0498	0.4055	-0.5623	0.9677	-1.2460	-0.0752
36	-1.0788	0.5878	-0.5905	1.1783	-1.2811	-0.1001
37	0.1044	1.9169	0.5633	1.3536	0.0980	0.9688
38	-0.2614	0.3365	0.2067	0.1298	-0.3144	0.6245
39	-1.1087	-0.4005	-0.6196	0.2192	-1.3172	-0.1257
40	-1.1087	-0.0619	-0.6196	0.5578	-1.3172	-0.1257
41	-2.6593	-1.7148	-2.1318	0.4170	-3.2360	-1.4150
42	-1.2040	-1.5606	-0.7126	-0.8481	-1.4329	-0.2072
43	-1.4697	-0.6162	-0.9717	0.3555	-1.7574	-0.4324
44	-2.6593	-2.6173	-2.1318	-0.4855	-3.2360	-1.4150
45	-3.2189	-2.5639	-2.6775	0.1136	-3.9400	-1.8688
46	1.3110	2.1282	1.7401	0.3882	1.3299	2.2333
47	2.1633	0.6931	2.5712	-1.8781	2.0960	3.2306
48	1.9488	0.0953	2.3620	-2.2667	1.9086	2.9741
49	3.3673	3.6687	3.7454	-0.0767	3.1088	4.7088
50	1.8500	3.5467	2.2657	1.2810	1.8213	2.8571
51	2.7726	1.7047	3.1654	-1.4607	2.6149	3.9723

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Individuals

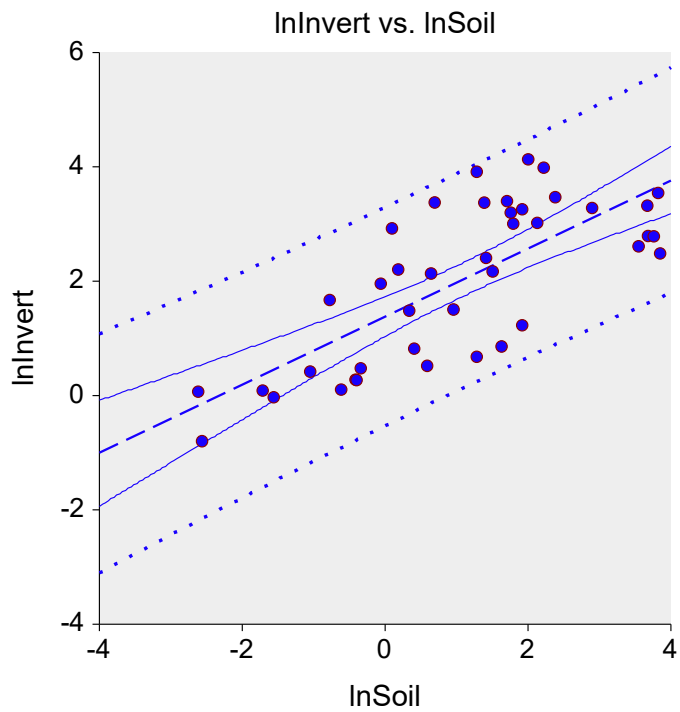
Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	2.8622	1.7918	3.2528	-1.4610	0.6267	6.1458
12	3.9140	3.8480	4.2785	-0.4305	1.6506	7.2980
13	1.4061	0.1823	1.8328	-1.6505	-0.8298	4.5897
14	2.6462	3.6788	3.0421	0.6367	0.4136	5.9120
15	-0.9943	1.4110	-0.5081	1.9190	-3.3347	2.1285
16	-2.5257	-0.3425	-2.0016	1.6591	-4.9992	0.6245
17	-0.8440	1.6292	-0.3615	1.9907	-3.1741	2.2788
18	-2.2073	-1.0498	-1.6910	0.6412	-4.6490	0.9332
19	-0.4780	1.2809	-0.0046	1.2856	-2.7851	2.6469
20	0.4055	0.9555	0.8570	0.0986	-1.8582	3.5479
21	-3.5066	-0.4155	-2.9581	2.5426	-6.0903	-0.3136
22	2.6101	3.8199	3.0069	0.8130	0.3779	5.8730
23	0.7031	1.5041	1.1472	0.3569	-1.5499	3.8554
24	2.5014	1.7579	2.9010	-1.1431	0.2702	5.7559
25	2.7014	1.9169	3.0959	-1.1790	0.4681	5.9716
26	3.3844	2.2192	3.7620	-1.5428	1.1379	6.7150
27	3.2108	2.0015	3.5928	-1.5913	0.9687	6.5252
28	2.0464	2.3795	2.4572	-0.0777	-0.1835	5.2682
29	3.3429	1.2809	3.7215	-2.4406	1.0975	6.6695
30	2.1759	2.8959	2.5835	0.3124	-0.0540	5.4065
31	2.2138	3.7589	2.6204	1.1385	-0.0161	5.4471
32	1.6734	0.6419	2.0934	-1.4516	-0.5589	4.8718
33	2.4681	1.3863	2.8685	-1.4822	0.2371	5.7200
34	-2.4079	-0.7765	-1.8867	1.1102	-4.8695	0.7384
35	-1.0498	0.4055	-0.5623	0.9677	-3.3942	2.0730
36	-1.0788	0.5878	-0.5905	1.1783	-3.4253	2.0441
37	0.1044	1.9169	0.5633	1.3536	-2.1721	3.2388
38	-0.2614	0.3365	0.2067	0.1298	-2.5561	2.8662
39	-1.1087	-0.4005	-0.6196	0.2192	-3.4573	2.0144
40	-1.1087	-0.0619	-0.6196	0.5578	-3.4573	2.0144
41	-2.6593	-1.7148	-2.1318	0.4170	-5.1467	0.4957
42	-1.2040	-1.5606	-0.7126	-0.8481	-3.5597	1.9196
43	-1.4697	-0.6162	-0.9717	0.3555	-3.8461	1.6563
44	-2.6593	-2.6173	-2.1318	-0.4855	-5.1467	0.4957
45	-3.2189	-2.5639	-2.6775	0.1136	-5.7684	-0.0404
46	1.3110	2.1282	1.7401	0.3882	-0.9265	4.4898
47	2.1633	0.6931	2.5712	-1.8781	-0.0665	5.3931
48	1.9488	0.0953	2.3620	-2.2667	-0.2815	5.1642
49	3.3673	3.6687	3.7454	-0.0767	1.1213	6.6962
50	1.8500	3.5467	2.2657	1.2810	-0.3808	5.0592
51	2.7726	1.7047	3.1654	-1.4607	0.5384	6.0487

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnInvert	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.3793	Rows Prediction Only	0
Slope	0.5966	Sum of Frequencies	41
R-Squared	0.5538	Sum of Weights	41.0000
Correlation	0.7442	Coefficient of Variation	0.4623
Mean Square Error	0.8630409	Square Root of MSE	0.929

Linear Regression Report

Y = lnInvert X = lnSoil

Summary Statement

The equation of the straight line relating lnInvert and lnSoil is estimated as: lnInvert = (1.3793) + (0.5966) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnInvert when lnSoil is zero, is 1.3793 with a standard error of 0.1710. The slope, the estimated change in lnInvert per unit change in lnSoil, is 0.5966 with a standard error of 0.0858. The value of R-Squared, the proportion of the variation in lnInvert that can be accounted for by variation in lnSoil, is 0.5538. The correlation between lnInvert and lnSoil is 0.7442.

A significance test that the slope is zero resulted in a t-value of 6.9572. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5966. The lower limit of the 95% confidence interval for the slope is 0.4232 and the upper limit is 0.7701. The estimated intercept is 1.3793. The lower limit of the 95% confidence interval for the intercept is 1.0333 and the upper limit is 1.7252.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnInvert	lnSoil
Count	41	41
Mean	2.0094	1.0562
Standard Deviation	1.3732	1.7128
Minimum	-0.7985	-2.6173
Maximum	4.1320	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.3793	0.5966
Lower 95% Confidence Limit	1.0333	0.4232
Upper 95% Confidence Limit	1.7252	0.7701
Standard Error	0.1710	0.0858
Standardized Coefficient	0.0000	0.7442
T Value	8.0641	6.9572
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	1.0000
Regression of Y on X	1.3793	0.5966
Inverse Regression from X on Y	0.8715	1.0774
Orthogonal Regression of Y and X	1.2231	0.7445

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.37927513474856) + (0.596638015350715) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.3793	0.9000	1.1235	1.6146
Bootstrap Mean	1.3824	0.9500	1.0655	1.6665
Bias (BM - OV)	0.0032	0.9900	0.9301	1.7459
Bias Corrected	1.3761			
Standard Error	0.1513			
Slope				
Original Value	0.5966	0.9000	0.4752	0.7030
Bootstrap Mean	0.6007	0.9500	0.4526	0.7260
Bias (BM - OV)	0.0040	0.9900	0.3918	0.7718
Bias Corrected	0.5926			
Standard Error	0.0696			
Correlation				
Original Value	0.7442	0.9000	0.6555	0.8563
Bootstrap Mean	0.7424	0.9500	0.6449	0.8777
Bias (BM - OV)	-0.0017	0.9900	0.6240	0.9457
Bias Corrected	0.7459			
Standard Error	0.0604			
R-Squared				
Original Value	0.5538	0.9000	0.4139	0.7082
Bootstrap Mean	0.5549	0.9500	0.3961	0.7347
Bias (BM - OV)	0.0011	0.9900	0.3604	0.8131
Bias Corrected	0.5527			
Standard Error	0.0875			
Standard Error of Estimate				
Original Value	0.9290	0.9000	0.8333	1.0713
Bootstrap Mean	0.9071	0.9500	0.8095	1.0961
Bias (BM - OV)	-0.0219	0.9900	0.7630	1.1489
Bias Corrected	0.9509			
Standard Error	0.0733			
Orthogonal Intercept				
Original Value	1.2231	0.9000	0.9807	1.4798
Bootstrap Mean	1.2167	0.9500	0.9290	1.5308
Bias (BM - OV)	-0.0064	0.9900	0.8424	1.6492
Bias Corrected	1.2295			
Standard Error	0.1528			
Orthogonal Slope				
Original Value	0.7445	0.9000	0.5632	0.8705
Bootstrap Mean	0.7560	0.9500	0.5146	0.8949
Bias (BM - OV)	0.0115	0.9900	0.4138	0.9475
Bias Corrected	0.7330			
Standard Error	0.0964			

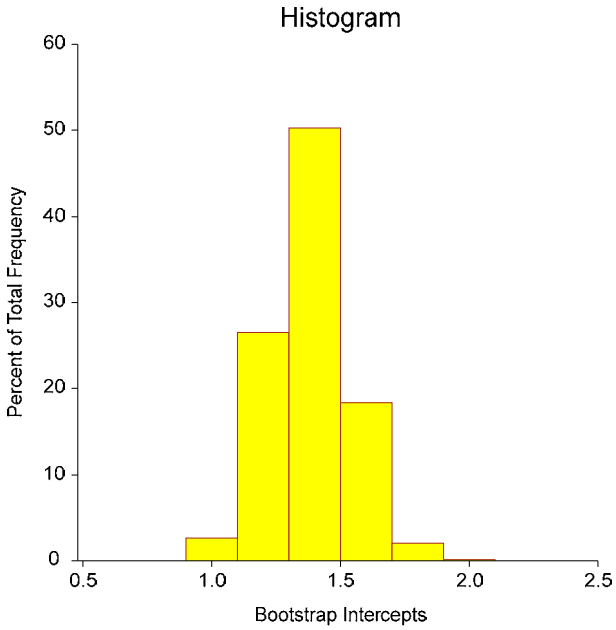
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

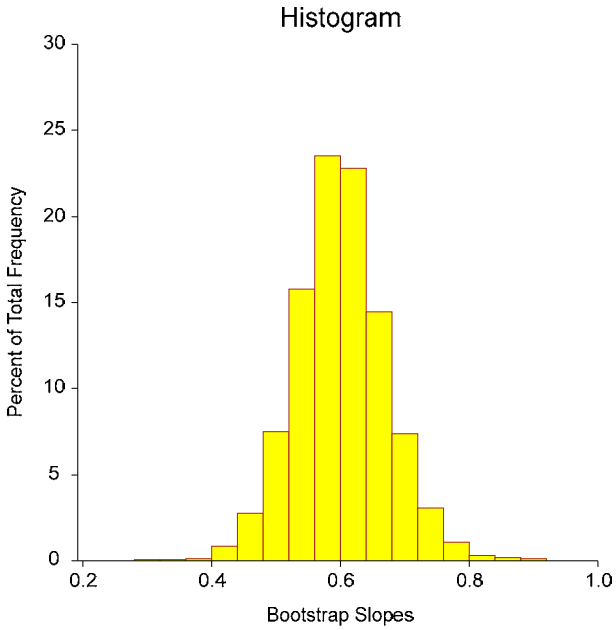
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

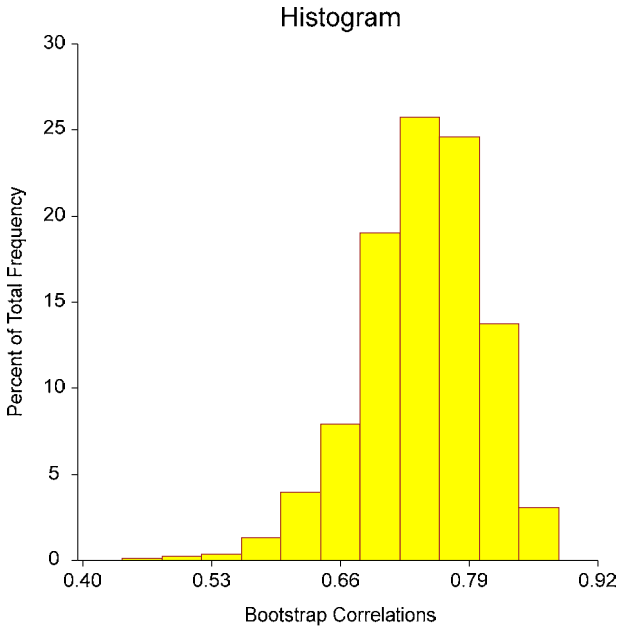
Linear Regression Report

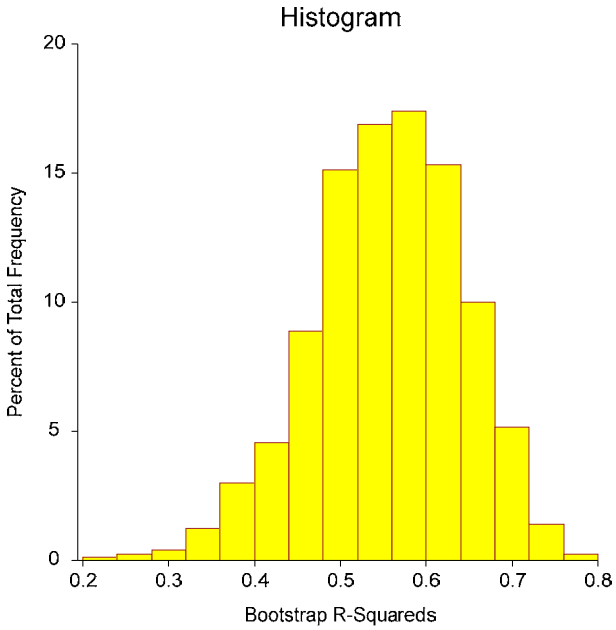
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Histograms Section



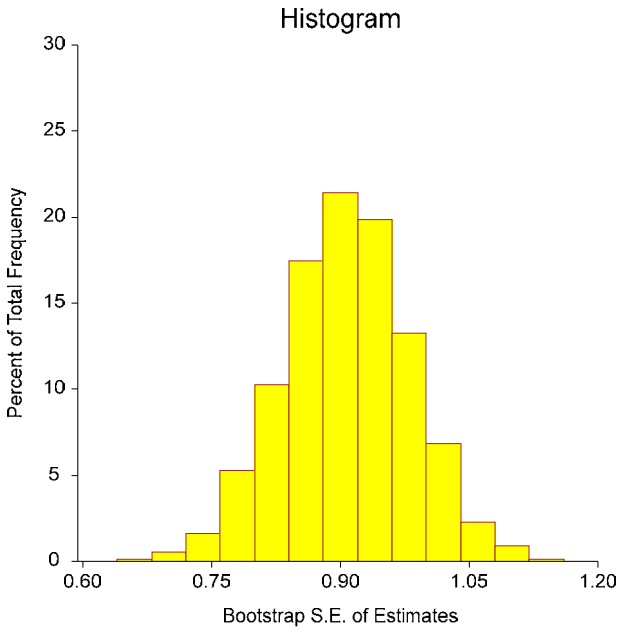


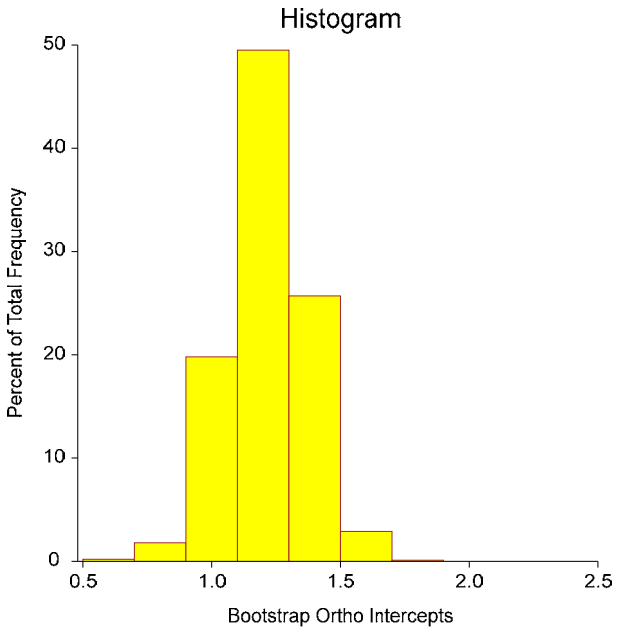


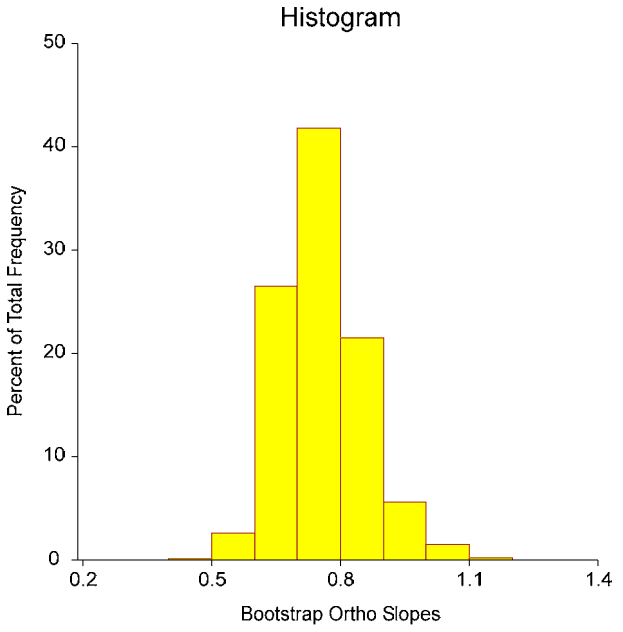


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.7442	0.5538	0.7444
Lower 95% Conf. Limit (r dist'n)	0.5612		
Upper 95% Conf. Limit (r dist'n)	0.8526		
Lower 95% Conf. Limit (Fisher's z)	0.5661		0.5665
Upper 95% Conf. Limit (Fisher's z)	0.8559		0.8560
Adjusted (Rbar)		0.5423	
T-Value for H0: Rho = 0	6.9572	6.9572	6.9621
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	165.5529	165.5529			
Slope	1	41.77306	41.77306	48.4022	0.0000	1.0000
Error	39	33.6586	0.8630409			
Lack of Fit	37	26.36547	0.7125803	0.1954	0.9891	
Pure Error	2	7.293124	3.646562			
Adj. Total	40	75.43166	1.885791			
Total	41	240.9846				

s = Square Root(0.8630409) = 0.929

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	82.38731	0.03389676	-0.009000641
1	43.30437	163.0859	157.0319	-0.009000641	0.008521686
2 (Y'Y)			240.9846		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.02925429	-0.007767921
1	-0.007767921	0.007354564

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9602	0.160175	No
Anderson Darling	0.4811	0.232211	Yes
D'Agostino Skewness	0.6295	0.529007	Yes
D'Agostino Kurtosis	-2.0347	0.041877	No
D'Agostino Omnibus	4.5365	0.103495	No
Constant Residual Variance?			
Modified Levene Test	0.0053	0.942532	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.1954	0.989089	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

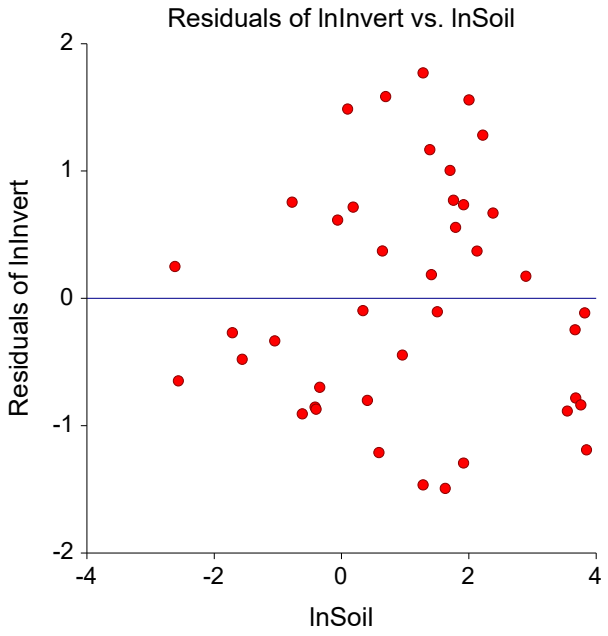
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

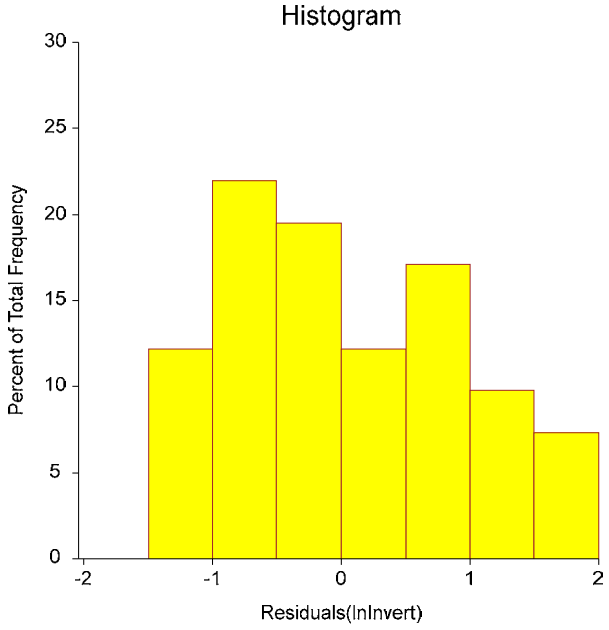
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

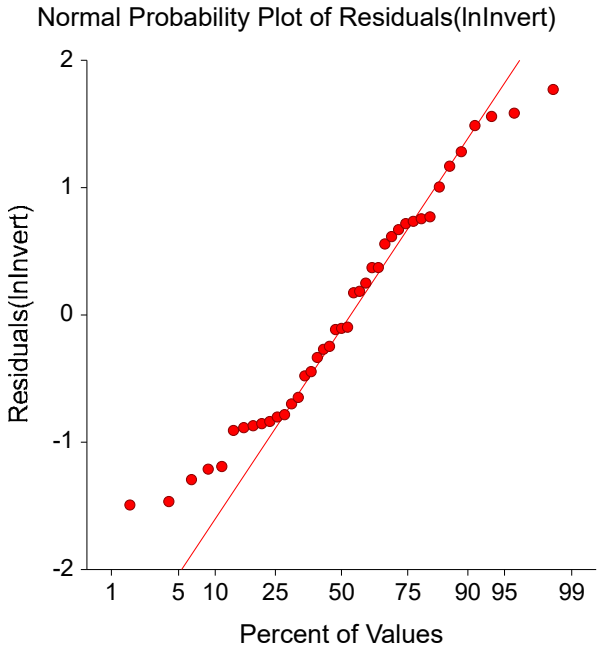
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Original Data Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual
11	1.7918	3.0057	2.4483	0.5574
12	3.8480	2.4849	3.6751	-1.1902
13	0.1823	2.2050	1.4881	0.7169
14	3.6788	2.7912	3.5742	-0.7830
15	1.4110	2.4069	2.2211	0.1858
16	-0.3425	0.4762	1.1749	-0.6987
17	1.6292	0.8587	2.3513	-1.4927
18	-1.0498	0.4187	0.7529	-0.3342
19	1.2809	0.6780	2.1435	-1.4655
20	0.9555	1.5041	1.9494	-0.4453
21	-0.4155	0.2776	1.1314	-0.8537
22	3.8199	3.5439	3.6584	-0.1145
23	1.5041	2.1713	2.2767	-0.1053
24	1.7579	3.1987	2.4281	0.7706
25	1.9169	3.2581	2.5230	0.7351
26	2.2192	3.9853	2.7033	1.2819
27	2.0015	4.1320	2.5734	1.5585
28	2.3795	3.4689	2.7990	0.6699
29	1.2809	3.9140	2.1435	1.7705
30	2.8959	3.2809	3.1071	0.1738
31	3.7589	2.7850	3.6220	-0.8369
32	0.6419	2.1342	1.7622	0.3719
33	1.3863	3.3742	2.2064	1.1678
34	-0.7765	1.6715	0.9160	0.7555
35	0.4055	0.8198	1.6212	-0.8014
36	0.5878	0.5188	1.7300	-1.2112
37	1.9169	1.2296	2.5230	-1.2933
38	0.3365	1.4839	1.5800	-0.0962
39	-0.4005	0.2700	1.1403	-0.8703
40	-0.0619	1.9573	1.3424	0.6149
41	-1.7148	0.0862	0.3562	-0.2700
42	-1.5606	-0.0305	0.4481	-0.4786
43	-0.6162	0.1044	1.0116	-0.9073
44	-2.6173	0.0677	-0.1823	0.2500
45	-2.5639	-0.7985	-0.1505	-0.6480
46	2.1282	3.0204	2.6491	0.3714
47	0.6931	3.3776	1.7928	1.5848
48	0.0953	2.9232	1.4361	1.4870
49	3.6687	3.3214	3.5681	-0.2467
50	3.5467	2.6101	3.4954	-0.8853
51	1.7047	3.4012	2.3964	1.0048

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	3.0057	2.4483	0.1582	2.1283	2.7683
12	3.8480	2.4849	3.6751	0.2800	3.1089	4.2414
13	0.1823	2.2050	1.4881	0.1633	1.1578	1.8184
14	3.6788	2.7912	3.5742	0.2676	3.0328	4.1156
15	1.4110	2.4069	2.2211	0.1482	1.9213	2.5210
16	-0.3425	0.4762	1.1749	0.1882	0.7942	1.5557
17	1.6292	0.8587	2.3513	0.1532	2.0415	2.6612
18	-1.0498	0.4187	0.7529	0.2317	0.2843	1.2215
19	1.2809	0.6780	2.1435	0.1464	1.8475	2.4396
20	0.9555	1.5041	1.9494	0.1453	1.6554	2.2434
21	-0.4155	0.2776	1.1314	0.1923	0.7424	1.5203
22	3.8199	3.5439	3.6584	0.2779	3.0963	4.2205
23	1.5041	2.1713	2.2767	0.1501	1.9731	2.5802
24	1.7579	3.1987	2.4281	0.1571	2.1104	2.7458
25	1.9169	3.2581	2.5230	0.1628	2.1937	2.8522
26	2.2192	3.9853	2.7033	0.1761	2.3472	3.0595
27	2.0015	4.1320	2.5734	0.1662	2.2373	2.9096
28	2.3795	3.4689	2.7990	0.1842	2.4264	3.1716
29	1.2809	3.9140	2.1435	0.1464	1.8475	2.4396
30	2.8959	3.2809	3.1071	0.2143	2.6735	3.5406
31	3.7589	2.7850	3.6220	0.2734	3.0689	4.1750
32	0.6419	2.1342	1.7622	0.1494	1.4601	2.0644
33	1.3863	3.3742	2.2064	0.1478	1.9074	2.5054
34	-0.7765	1.6715	0.9160	0.2139	0.4833	1.3486
35	0.4055	0.8198	1.6212	0.1554	1.3068	1.9356
36	0.5878	0.5188	1.7300	0.1505	1.4255	2.0345
37	1.9169	1.2296	2.5230	0.1628	2.1937	2.8522
38	0.3365	1.4839	1.5800	0.1577	1.2611	1.8989
39	-0.4005	0.2700	1.1403	0.1915	0.7531	1.5276
40	-0.0619	1.9573	1.3424	0.1739	0.9906	1.6941
41	-1.7148	0.0862	0.3562	0.2784	-0.2070	0.9193
42	-1.5606	-0.0305	0.4481	0.2672	-0.0924	0.9887
43	-0.6162	0.1044	1.0116	0.2040	0.5990	1.4243
44	-2.6173	0.0677	-0.1823	0.3468	-0.8838	0.5192
45	-2.5639	-0.7985	-0.1505	0.3427	-0.8436	0.5427
46	2.1282	3.0204	2.6491	0.1718	2.3016	2.9965
47	0.6931	3.3776	1.7928	0.1484	1.4927	2.0930
48	0.0953	2.9232	1.4361	0.1669	1.0986	1.7736
49	3.6687	3.3214	3.5681	0.2669	3.0283	4.1080
50	3.5467	2.6101	3.4954	0.2582	2.9731	4.0177
51	1.7047	3.4012	2.3964	0.1554	2.0821	2.7107

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	3.0057	2.4483	0.9424	0.5422	4.3544
12	3.8480	2.4849	3.6751	0.9703	1.7126	5.6377
13	0.1823	2.2050	1.4881	0.9432	-0.4198	3.3959
14	3.6788	2.7912	3.5742	0.9668	1.6187	5.5297
15	1.4110	2.4069	2.2211	0.9408	0.3183	4.1240
16	-0.3425	0.4762	1.1749	0.9479	-0.7423	3.0922
17	1.6292	0.8587	2.3513	0.9415	0.4469	4.2558
18	-1.0498	0.4187	0.7529	0.9575	-1.1837	2.6895
19	1.2809	0.6780	2.1435	0.9405	0.2413	4.0458
20	0.9555	1.5041	1.9494	0.9403	0.0474	3.8513
21	-0.4155	0.2776	1.1314	0.9487	-0.7876	3.0503
22	3.8199	3.5439	3.6584	0.9697	1.6970	5.6197
23	1.5041	2.1713	2.2767	0.9410	0.3732	4.1801
24	1.7579	3.1987	2.4281	0.9422	0.5223	4.3338
25	1.9169	3.2581	2.5230	0.9432	0.6153	4.4307
26	2.2192	3.9853	2.7033	0.9455	0.7908	4.6159
27	2.0015	4.1320	2.5734	0.9437	0.6645	4.4823
28	2.3795	3.4689	2.7990	0.9471	0.8833	4.7147
29	1.2809	3.9140	2.1435	0.9405	0.2413	4.0458
30	2.8959	3.2809	3.1071	0.9534	1.1786	5.0355
31	3.7589	2.7850	3.6220	0.9684	1.6632	5.5807
32	0.6419	2.1342	1.7622	0.9409	-0.1410	3.6654
33	1.3863	3.3742	2.2064	0.9407	0.3037	4.1091
34	-0.7765	1.6715	0.9160	0.9533	-1.0123	2.8442
35	0.4055	0.8198	1.6212	0.9419	-0.2840	3.5264
36	0.5878	0.5188	1.7300	0.9411	-0.1736	3.6336
37	1.9169	1.2296	2.5230	0.9432	0.6153	4.4307
38	0.3365	1.4839	1.5800	0.9423	-0.3259	3.4860
39	-0.4005	0.2700	1.1403	0.9485	-0.7782	3.0589
40	-0.0619	1.9573	1.3424	0.9451	-0.5694	3.2541
41	-1.7148	0.0862	0.3562	0.9698	-1.6055	2.3178
42	-1.5606	-0.0305	0.4481	0.9667	-1.5071	2.4034
43	-0.6162	0.1044	1.0116	0.9511	-0.9122	2.9355
44	-2.6173	0.0677	-0.1823	0.9916	-2.1881	1.8235
45	-2.5639	-0.7985	-0.1505	0.9902	-2.1533	1.8524
46	2.1282	3.0204	2.6491	0.9447	0.7381	4.5600
47	0.6931	3.3776	1.7928	0.9408	-0.1101	3.6957
48	0.0953	2.9232	1.4361	0.9439	-0.4730	3.3453
49	3.6687	3.3214	3.5681	0.9666	1.6130	5.5232
50	3.5467	2.6101	3.4954	0.9642	1.5451	5.4457
51	1.7047	3.4012	2.3964	0.9419	0.4912	4.3016

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	3.0057	2.4483	0.1582	1.9974	2.8992
12	3.8480	2.4849	3.6751	0.2800	2.8773	4.4730
13	0.1823	2.2050	1.4881	0.1633	1.0227	1.9534
14	3.6788	2.7912	3.5742	0.2676	2.8114	4.3370
15	1.4110	2.4069	2.2211	0.1482	1.7987	2.6436
16	-0.3425	0.4762	1.1749	0.1882	0.6384	1.7114
17	1.6292	0.8587	2.3513	0.1532	1.9148	2.7879
18	-1.0498	0.4187	0.7529	0.2317	0.0927	1.4131
19	1.2809	0.6780	2.1435	0.1464	1.7264	2.5606
20	0.9555	1.5041	1.9494	0.1453	1.5352	2.3636
21	-0.4155	0.2776	1.1314	0.1923	0.5833	1.6794
22	3.8199	3.5439	3.6584	0.2779	2.8664	4.4503
23	1.5041	2.1713	2.2767	0.1501	1.8489	2.7044
24	1.7579	3.1987	2.4281	0.1571	1.9805	2.8757
25	1.9169	3.2581	2.5230	0.1628	2.0591	2.9869
26	2.2192	3.9853	2.7033	0.1761	2.2016	3.2051
27	2.0015	4.1320	2.5734	0.1662	2.0998	3.0471
28	2.3795	3.4689	2.7990	0.1842	2.2741	3.3239
29	1.2809	3.9140	2.1435	0.1464	1.7264	2.5606
30	2.8959	3.2809	3.1071	0.2143	2.4962	3.7179
31	3.7589	2.7850	3.6220	0.2734	2.8427	4.4012
32	0.6419	2.1342	1.7622	0.1494	1.3365	2.1879
33	1.3863	3.3742	2.2064	0.1478	1.7851	2.6277
34	-0.7765	1.6715	0.9160	0.2139	0.3064	1.5256
35	0.4055	0.8198	1.6212	0.1554	1.1782	2.0642
36	0.5878	0.5188	1.7300	0.1505	1.3009	2.1590
37	1.9169	1.2296	2.5230	0.1628	2.0591	2.9869
38	0.3365	1.4839	1.5800	0.1577	1.1307	2.0294
39	-0.4005	0.2700	1.1403	0.1915	0.5947	1.6860
40	-0.0619	1.9573	1.3424	0.1739	0.8467	1.8380
41	-1.7148	0.0862	0.3562	0.2784	-0.4373	1.1496
42	-1.5606	-0.0305	0.4481	0.2672	-0.3134	1.2097
43	-0.6162	0.1044	1.0116	0.2040	0.4302	1.5930
44	-2.6173	0.0677	-0.1823	0.3468	-1.1707	0.8061
45	-2.5639	-0.7985	-0.1505	0.3427	-1.1271	0.8261
46	2.1282	3.0204	2.6491	0.1718	2.1596	3.1386
47	0.6931	3.3776	1.7928	0.1484	1.3699	2.2157
48	0.0953	2.9232	1.4361	0.1669	0.9606	1.9117
49	3.6687	3.3214	3.5681	0.2669	2.8075	4.3288
50	3.5467	2.6101	3.4954	0.2582	2.7596	4.2312
51	1.7047	3.4012	2.3964	0.1554	1.9536	2.8392

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	3.0057	2.4483	0.5574	0.6089	18.5441
12	3.8480	2.4849	3.6751	-1.1902	-1.3437	47.8989
13	0.1823	2.2050	1.4881	0.7169	0.7839	32.5137
14	3.6788	2.7912	3.5742	-0.7830	-0.8802	28.0542
15	1.4110	2.4069	2.2211	0.1858	0.2026	7.7202
16	-0.3425	0.4762	1.1749	-0.6987	-0.7680	146.7132
17	1.6292	0.8587	2.3513	-1.4927	-1.6291	173.8380
18	-1.0498	0.4187	0.7529	-0.3342	-0.3715	79.8168
19	1.2809	0.6780	2.1435	-1.4655	-1.5974	216.1391
20	0.9555	1.5041	1.9494	-0.4453	-0.4853	29.6057
21	-0.4155	0.2776	1.1314	-0.8537	-0.9393	307.5049
22	3.8199	3.5439	3.6584	-0.1145	-0.1292	3.2316
23	1.5041	2.1713	2.2767	-0.1053	-0.1149	4.8508
24	1.7579	3.1987	2.4281	0.7706	0.8416	24.0910
25	1.9169	3.2581	2.5230	0.7351	0.8037	22.5626
26	2.2192	3.9853	2.7033	1.2819	1.4054	32.1669
27	2.0015	4.1320	2.5734	1.5585	1.7051	37.7188
28	2.3795	3.4689	2.7990	0.6699	0.7357	19.3105
29	1.2809	3.9140	2.1435	1.7705	1.9299	45.2346
30	2.8959	3.2809	3.1071	0.1738	0.1923	5.2981
31	3.7589	2.7850	3.6220	-0.8369	-0.9427	30.0519
32	0.6419	2.1342	1.7622	0.3719	0.4056	17.4277
33	1.3863	3.3742	2.2064	1.1678	1.2732	34.6093
34	-0.7765	1.6715	0.9160	0.7555	0.8357	45.1999
35	0.4055	0.8198	1.6212	-0.8014	-0.8750	97.7593
36	0.5878	0.5188	1.7300	-1.2112	-1.3212	233.4602
37	1.9169	1.2296	2.5230	-1.2933	-1.4141	105.1806
38	0.3365	1.4839	1.5800	-0.0962	-0.1050	6.4798
39	-0.4005	0.2700	1.1403	-0.8703	-0.9574	322.3038
40	-0.0619	1.9573	1.3424	0.6149	0.6738	31.4170
41	-1.7148	0.0862	0.3562	-0.2700	-0.3046	313.2870
42	-1.5606	-0.0305	0.4481	-0.4786	-0.5379	1571.2575
43	-0.6162	0.1044	1.0116	-0.9073	-1.0011	869.3704
44	-2.6173	0.0677	-0.1823	0.2500	0.2900	369.4453
45	-2.5639	-0.7985	-0.1505	-0.6480	-0.7505	81.1555
46	2.1282	3.0204	2.6491	0.3714	0.4068	12.2952
47	0.6931	3.3776	1.7928	1.5848	1.7281	46.9197
48	0.0953	2.9232	1.4361	1.4870	1.6271	50.8703
49	3.6687	3.3214	3.5681	-0.2467	-0.2773	7.4280
50	3.5467	2.6101	3.4954	-0.8853	-0.9921	33.9196
51	1.7047	3.4012	2.3964	1.0048	1.0971	29.5427

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	0.5574	0.6039	0.0290	0.0055	0.8773
12	3.8480	-1.1902	-1.3581	0.0908	0.0902	0.8447
13	0.1823	0.7169	0.7800	0.0309	0.0098	0.8718
14	3.6788	-0.7830	-0.8776	0.0830	0.0351	0.8682
15	1.4110	0.1858	0.2001	0.0255	0.0005	0.8848
16	-0.3425	-0.6987	-0.7639	0.0411	0.0126	0.8724
17	1.6292	-1.4927	-1.6657	0.0272	0.0371	0.8255
18	-1.0498	-0.3342	-0.3673	0.0622	0.0046	0.8826
19	1.2809	-1.4655	-1.6311	0.0248	0.0325	0.8278
20	0.9555	-0.4453	-0.4805	0.0245	0.0030	0.8804
21	-0.4155	-0.8537	-0.9379	0.0428	0.0197	0.8657
22	3.8199	-0.1145	-0.1276	0.0895	0.0008	0.8854
23	1.5041	-0.1053	-0.1134	0.0261	0.0002	0.8855
24	1.7579	0.7706	0.8384	0.0286	0.0104	0.8697
25	1.9169	0.7351	0.8000	0.0307	0.0102	0.8711
26	2.2192	1.2819	1.4238	0.0359	0.0368	0.8409
27	2.0015	1.5585	1.7496	0.0320	0.0481	0.8197
28	2.3795	0.6699	0.7313	0.0393	0.0111	0.8735
29	1.2809	1.7705	*2.0030	0.0248	0.0474	0.8012
30	2.8959	0.1738	0.1899	0.0532	0.0010	0.8849
31	3.7589	-0.8369	-0.9413	0.0866	0.0421	0.8656
32	0.6419	0.3719	0.4013	0.0259	0.0022	0.8820
33	1.3863	1.1678	1.2838	0.0253	0.0211	0.8489
34	-0.7765	0.7555	0.8324	0.0530	0.0195	0.8699
35	0.4055	-0.8014	-0.8723	0.0280	0.0110	0.8684
36	0.5878	-1.2112	-1.3344	0.0263	0.0235	0.8461
37	1.9169	-1.2933	-1.4330	0.0307	0.0317	0.8403
38	0.3365	-0.0962	-0.1037	0.0288	0.0002	0.8855
39	-0.4005	-0.8703	-0.9563	0.0425	0.0203	0.8649
40	-0.0619	0.6149	0.6690	0.0350	0.0082	0.8754
41	-1.7148	-0.2700	-0.3010	0.0898	0.0046	0.8836
42	-1.5606	-0.4786	-0.5329	0.0827	0.0131	0.8792
43	-0.6162	-0.9073	-1.0011	0.0482	0.0254	0.8630
44	-2.6173	0.2500	*0.2866	0.1394	0.0068	0.8838
45	-2.5639	-0.6480	*-0.7462	0.1361	0.0444	0.8730
46	2.1282	0.3714	0.4024	0.0342	0.0029	0.8820
47	0.6931	1.5848	1.7751	0.0255	0.0391	0.8179
48	0.0953	1.4870	1.6636	0.0323	0.0441	0.8256
49	3.6687	-0.2467	-0.2740	0.0826	0.0035	0.8840
50	3.5467	-0.8853	-0.9919	0.0772	0.0412	0.8634
51	1.7047	1.0048	1.1000	0.0280	0.0173	0.8584

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.6039	0.1044	0.0055	1.0643	0.0591	0.0416
12	-1.3581	-0.4292	0.0902	1.0537	0.0057	-0.3671
13	0.7800	0.1393	0.0098	1.0529	0.1388	-0.0639
14	-0.8776	-0.2640	0.0351	1.1035	-0.0039	-0.2219
15	0.2001	0.0323	0.0005	1.0786	0.0233	0.0066
16	-0.7639	-0.1581	0.0126	1.0655	-0.1567	0.1007
17	-1.6657	-0.2785	0.0371	0.9404	-0.1764	-0.0893
18	-0.3673	-0.0946	0.0046	1.1152	-0.0893	0.0737
19	-1.6311	-0.2602	0.0325	0.9434	-0.2007	-0.0343
20	-0.4805	-0.0761	0.0030	1.0668	-0.0668	0.0045
21	-0.9379	-0.1984	0.0197	1.0512	-0.1960	0.1302
22	-0.1276	-0.0400	0.0008	* 1.1558	0.0004	-0.0341
23	-0.1134	-0.0186	0.0002	1.0808	-0.0127	-0.0048
24	0.8384	0.1438	0.0104	1.0453	0.0835	0.0551
25	0.8000	0.1424	0.0102	1.0510	0.0735	0.0646
26	1.4238	0.2748	0.0368	0.9847	0.1097	0.1557
27	1.7496	0.3181	0.0481	0.9320	0.1534	0.1552
28	0.7313	0.1479	0.0111	1.0662	0.0506	0.0911
29	* 2.0030	0.3196	0.0474	0.8837	0.2464	0.0421
30	0.1899	0.0450	0.0010	1.1104	0.0083	0.0331
31	-0.9413	-0.2899	0.0421	1.1013	-0.0003	-0.2457
32	0.4013	0.0654	0.0022	1.0722	0.0621	-0.0156
33	1.2838	0.2069	0.0211	0.9927	0.1513	0.0396
34	0.8324	0.1969	0.0195	1.0728	0.1900	-0.1447
35	-0.8723	-0.1480	0.0110	1.0415	-0.1454	0.0532
36	-1.3344	-0.2191	0.0235	0.9871	-0.2101	0.0585
37	-1.4330	-0.2550	0.0317	0.9781	-0.1316	-0.1157
38	-0.1037	-0.0179	0.0002	1.0840	-0.0176	0.0070
39	-0.9563	-0.2014	0.0203	1.0489	-0.1991	0.1314
40	0.6690	0.1275	0.0082	1.0663	0.1275	-0.0703
41	-0.3010	-0.0946	0.0046	* 1.1518	-0.0846	0.0807
42	-0.5329	-0.1601	0.0131	1.1314	-0.1449	0.1344
43	-1.0011	-0.2253	0.0254	1.0506	-0.2198	0.1584
44	0.2866	0.1153	0.0068	* 1.2186	0.0964	-0.1048
45	-0.7462	-0.2961	0.0444	* 1.1843	-0.2484	0.2683
46	0.4024	0.0757	0.0029	1.0814	0.0328	0.0405
47	1.7751	0.2872	0.0391	0.9217	0.2701	-0.0603
48	1.6636	0.3037	0.0441	0.9457	0.3035	-0.1500
49	-0.2740	-0.0822	0.0035	1.1436	-0.0014	-0.0690
50	-0.9919	-0.2870	0.0412	1.0846	-0.0111	-0.2374
51	1.1000	0.1866	0.0173	1.0178	0.1124	0.0668

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	0.5574	||||.....	0.6089	||||.....	0.6039	|||.....
12	3.8480	-1.1902	|||||||||.....	-1.3437	|||||||||.....	-1.3581	|||||||||.....
13	0.1823	0.7169	|||||.....	0.7839	|||||.....	0.7800	|||||.....
14	3.6788	-0.7830	||||||.....	-0.8802	||||||.....	-0.8776	||||||.....
15	1.4110	0.1858	|.....	0.2026	|.....	0.2001	|.....
16	-0.3425	-0.6987	|||||.....	-0.7680	|||||.....	-0.7639	|||||.....
17	1.6292	-1.4927	||||||||||...	-1.6291	||||||||||...	-1.6657	||||||||||...
18	-1.0498	-0.3342	||.....	-0.3715	||.....	-0.3673	||.....
19	1.2809	-1.4655	||||||||||...	-1.5974	||||||||||...	-1.6311	||||||||||...
20	0.9555	-0.4453	|||.....	-0.4853	|||.....	-0.4805	||.....
21	-0.4155	-0.8537	||||||.....	-0.9393	||||||.....	-0.9379	||||||.....
22	3.8199	-0.1145	|.....	-0.1292	|.....	-0.1276	|.....
23	1.5041	-0.1053	|.....	-0.1149	|.....	-0.1134	|.....
24	1.7579	0.7706	||||||.....	0.8416	||||||.....	0.8384	|||||.....
25	1.9169	0.7351	|||||.....	0.8037	|||||.....	0.8000	|||||.....
26	2.2192	1.2819	|||||||||.....	1.4054	|||||||||.....	1.4238	|||||||||.....
27	2.0015	1.5585	||||||||||||..	1.7051	||||||||||||..	1.7496	||||||||||...
28	2.3795	0.6699	|||||.....	0.7357	|||||.....	0.7313	||||.....
29	1.2809	1.7705	|||||||||||||||	1.9299	|||||||||||||||	* 2.0030	|||||||||||||||
30	2.8959	0.1738	|.....	0.1923	|.....	0.1899	|.....
31	3.7589	-0.8369	||||||.....	-0.9427	||||||.....	-0.9413	||||||.....
32	0.6419	0.3719	||.....	0.4056	||.....	0.4013	||.....
33	1.3863	1.1678	|||||||||.....	1.2732	|||||||||.....	1.2838	|||||||||.....
34	-0.7765	0.7555	|||||.....	0.8357	|||||.....	0.8324	|||||.....
35	0.4055	-0.8014	||||||.....	-0.8750	||||||.....	-0.8723	||||||.....
36	0.5878	-1.2112	|||||||||.....	-1.3212	|||||||||.....	-1.3344	|||||||||.....
37	1.9169	-1.2933	|||||||||.....	-1.4141	|||||||||.....	-1.4330	|||||||||.....
38	0.3365	-0.0962	|.....	-0.1050	|.....	-0.1037	|.....
39	-0.4005	-0.8703	||||||.....	-0.9574	||||||.....	-0.9563	||||||.....
40	-0.0619	0.6149	||||.....	0.6738	||||.....	0.6690	||||.....
41	-1.7148	-0.2700	|.....	-0.3046	|.....	-0.3010	|.....
42	-1.5606	-0.4786	|||.....	-0.5379	|||.....	-0.5329	|||.....
43	-0.6162	-0.9073	|||||||.....	-1.0011	|||||||.....	-1.0011	|||||||.....
44	-2.6173	0.2500	|.....	0.2900	|.....	0.2866	|.....
45	-2.5639	-0.6480	||||.....	-0.7505	|||||.....	-0.7462	|||||.....
46	2.1282	0.3714	||.....	0.4068	||.....	0.4024	||.....
47	0.6931	1.5848	||||||||||||..	1.7281	||||||||||||..	1.7751	||||||||||||..
48	0.0953	1.4870	||||||||||||...	1.6271	||||||||||||...	1.6636	||||||||||||...
49	3.6687	-0.2467	|.....	-0.2773	|.....	-0.2740	|.....
50	3.5467	-0.8853	|||||||.....	-0.9921	|||||||.....	-0.9919	|||||||.....
51	1.7047	1.0048	|||||||.....	1.0971	|||||||.....	1.1000	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.1044	|||.....	0.0055	|.....	0.0416	|.....
12	3.8480	-0.4292	||||||||||||||	0.0902	||||||||||||||	-0.3671	||||||||||||||
13	0.1823	0.1393	||||.....	0.0098	|.....	-0.0639	||.....
14	3.6788	-0.2640	|||||||.....	0.0351	|||||.....	-0.2219	|||||||.....
15	1.4110	0.0323	|.....	0.0005	|.....	0.0066	|.....
16	-0.3425	-0.1581	|||||.....	0.0126	||.....	0.1007	|||.....
17	1.6292	-0.2785	||||||||.....	0.0371	||||||.....	-0.0893	|||.....
18	-1.0498	-0.0946	||.....	0.0046	|.....	0.0737	||.....
19	1.2809	-0.2602	|||||||.....	0.0325	|||||.....	-0.0343	|.....
20	0.9555	-0.0761	||.....	0.0030	|.....	0.0045	|.....
21	-0.4155	-0.1984	||||||.....	0.0197	|||.....	0.1302	|||||.....
22	3.8199	-0.0400	|.....	0.0008	|.....	-0.0341	|.....
23	1.5041	-0.0186	|.....	0.0002	|.....	-0.0048	|.....
24	1.7579	0.1438	||||.....	0.0104	|.....	0.0551	||.....
25	1.9169	0.1424	||||.....	0.0102	|.....	0.0646	||.....
26	2.2192	0.2748	||||||||.....	0.0368	||||||.....	0.1557	||||||.....
27	2.0015	0.3181	|||||||||.....	0.0481	|||||||.....	0.1552	||||||.....
28	2.3795	0.1479	||||.....	0.0111	|.....	0.0911	|||.....
29	1.2809	0.3196	||||||||||....	0.0474	|||||||.....	0.0421	|.....
30	2.8959	0.0450	|.....	0.0010	|.....	0.0331	|.....
31	3.7589	-0.2899	||||||||.....	0.0421	||||||.....	-0.2457	||||||||.....
32	0.6419	0.0654	|.....	0.0022	|.....	-0.0156	|.....
33	1.3863	0.2069	||||||.....	0.0211	|||.....	0.0396	|.....
34	-0.7765	0.1969	||||||.....	0.0195	|||.....	-0.1447	|||||.....
35	0.4055	-0.1480	||||.....	0.0110	|.....	0.0532	||.....
36	0.5878	-0.2191	|||||||.....	0.0235	|||.....	0.0585	||.....
37	1.9169	-0.2550	|||||||.....	0.0317	|||||.....	-0.1157	||||.....
38	0.3365	-0.0179	|.....	0.0002	|.....	0.0070	|.....
39	-0.4005	-0.2014	||||||.....	0.0203	|||.....	0.1314	|||||.....
40	-0.0619	0.1275	|||.....	0.0082	|.....	-0.0703	||.....
41	-1.7148	-0.0946	||.....	0.0046	|.....	0.0807	|||.....
42	-1.5606	-0.1601	|||||.....	0.0131	||.....	0.1344	|||||.....
43	-0.6162	-0.2253	|||||||.....	0.0254	||||.....	0.1584	||||||.....
44	-2.6173	0.1153	|||.....	0.0068	|.....	-0.1048	||||.....
45	-2.5639	-0.2961	||||||||.....	0.0444	|||||||.....	0.2683	||||||||.....
46	2.1282	0.0757	||.....	0.0029	|.....	0.0405	|.....
47	0.6931	0.2872	||||||||.....	0.0391	|||||.....	-0.0603	||.....
48	0.0953	0.3037	||||||||.....	0.0441	|||||||.....	-0.1500	||||||.....
49	3.6687	-0.0822	||.....	0.0035	|.....	-0.0690	||.....
50	3.5467	-0.2870	||||||||.....	0.0412	||||||.....	-0.2374	||||||||.....
51	1.7047	0.1866	||||||.....	0.0173	||.....	0.0668	||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	0.6039	|||.....	0.0055	|.....	0.0290	|.....
12	3.8480	-1.3581	||||||||.....	0.0902	||||||||||||||	0.0908	|||||||.....
13	0.1823	0.7800	|||||.....	0.0098	|.....	0.0309	|.....
14	3.6788	-0.8776	||||||.....	0.0351	|||||.....	0.0830	|||||||.....
15	1.4110	0.2001	|.....	0.0005	|.....	0.0255	|.....
16	-0.3425	-0.7639	|||||.....	0.0126	||.....	0.0411	||.....
17	1.6292	-1.6657	|||||||||||...	0.0371	||||||.....	0.0272	|.....
18	-1.0498	-0.3673	||.....	0.0046	|.....	0.0622	||||.....
19	1.2809	-1.6311	|||||||||||...	0.0325	|||||.....	0.0248	|.....
20	0.9555	-0.4805	||.....	0.0030	|.....	0.0245	|.....
21	-0.4155	-0.9379	||||||.....	0.0197	|||.....	0.0428	||.....
22	3.8199	-0.1276	|.....	0.0008	|.....	0.0895	|||||||.....
23	1.5041	-0.1134	|.....	0.0002	|.....	0.0261	|.....
24	1.7579	0.8384	|||||.....	0.0104	|.....	0.0286	|.....
25	1.9169	0.8000	|||||.....	0.0102	|.....	0.0307	|.....
26	2.2192	1.4238	|||||||||.....	0.0368	||||||.....	0.0359	|.....
27	2.0015	1.7496	|||||||||||...	0.0481	|||||||.....	0.0320	|.....
28	2.3795	0.7313	||||.....	0.0111	|.....	0.0393	|.....
29	1.2809	* 2.0030	||||||||||||||	0.0474	||||||.....	0.0248	|.....
30	2.8959	0.1899	|.....	0.0010	|.....	0.0532	|||.....
31	3.7589	-0.9413	||||||.....	0.0421	||||||.....	0.0866	|||||||.....
32	0.6419	0.4013	||.....	0.0022	|.....	0.0259	|.....
33	1.3863	1.2838	||||||||.....	0.0211	|||.....	0.0253	|.....
34	-0.7765	0.8324	|||||.....	0.0195	|||.....	0.0530	|||.....
35	0.4055	-0.8723	||||||.....	0.0110	|.....	0.0280	|.....
36	0.5878	-1.3344	||||||||.....	0.0235	|||.....	0.0263	|.....
37	1.9169	-1.4330	|||||||||.....	0.0317	|||||.....	0.0307	|.....
38	0.3365	-0.1037	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.9563	||||||.....	0.0203	|||.....	0.0425	||.....
40	-0.0619	0.6690	||||.....	0.0082	|.....	0.0350	|.....
41	-1.7148	-0.3010	|.....	0.0046	|.....	0.0898	|||||||.....
42	-1.5606	-0.5329	|||.....	0.0131	||.....	0.0827	||||||.....
43	-0.6162	-1.0011	|||||||.....	0.0254	||||.....	0.0482	|||.....
44	-2.6173	0.2866	|.....	0.0068	|.....	0.1394	||||||||||||||
45	-2.5639	-0.7462	|||||.....	0.0444	||||||.....	0.1361	|||||||||||||.
46	2.1282	0.4024	||.....	0.0029	|.....	0.0342	|.....
47	0.6931	1.7751	||||||||||||..	0.0391	||||||.....	0.0255	|.....
48	0.0953	1.6636	|||||||||||...	0.0441	|||||||.....	0.0323	|.....
49	3.6687	-0.2740	|.....	0.0035	|.....	0.0826	|||||||.....
50	3.5467	-0.9919	|||||||.....	0.0412	||||||.....	0.0772	||||||.....
51	1.7047	1.1000	|||||||.....	0.0173	||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Means

Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	3.0057	1.7918	2.7260	-0.9342	2.1416	3.6187
12	2.4849	3.8480	1.8531	1.9949	1.3537	2.4997
13	2.2050	0.1823	1.3839	-1.2016	0.8897	1.9387
14	2.7912	3.6788	2.3664	1.3124	1.8260	3.1487
15	2.4069	1.4110	1.7224	-0.3114	1.2280	2.3399
16	0.4762	-0.3425	-1.5135	1.1711	-2.7153	-0.7863
17	0.8587	1.6292	-0.8726	2.5018	-1.8503	-0.2510
18	0.4187	-1.0498	-1.6100	0.5601	-2.8467	-0.8656
19	0.6780	1.2809	-1.1753	2.4563	-2.2569	-0.5059
20	1.5041	0.9555	0.2092	0.7463	-0.4492	0.7112
21	0.2776	-0.4155	-1.8464	1.4309	-3.1699	-1.0590
22	3.5439	3.8199	3.6280	0.1919	2.9004	4.8305
23	2.1713	1.5041	1.3275	0.1765	0.8314	1.8738
24	3.1987	1.7579	3.0494	-1.2916	2.4180	4.0489
25	3.2581	1.9169	3.1490	-1.2321	2.5020	4.1825
26	3.9853	2.2192	4.3678	-2.1486	3.5030	5.8442
27	4.1320	2.0015	4.6137	-2.6122	3.7009	6.1834
28	3.4689	2.3795	3.5023	-1.1227	2.7966	4.6596
29	3.9140	1.2809	4.2484	-2.9674	3.4065	5.6798
30	3.2809	2.8959	3.1873	-0.2913	2.5341	4.2339
31	2.7850	3.7589	2.3561	1.4028	1.8168	3.1354
32	2.1342	0.6419	1.2652	-0.6234	0.7662	1.8029
33	3.3742	1.3863	3.3436	-1.9573	2.6648	4.4447
34	1.6715	-0.7765	0.4897	-1.2663	-0.1072	0.9821
35	0.8198	0.4055	-0.9377	1.3432	-1.9375	-0.3062
36	0.5188	0.5878	-1.4422	2.0300	-2.6183	-0.7275
37	1.2296	1.9169	-0.2508	2.1677	-1.0322	0.2892
38	1.4839	0.3365	0.1753	0.1612	-0.4913	0.6792
39	0.2700	-0.4005	-1.8592	1.4587	-3.1873	-1.0693
40	1.9573	-0.0619	0.9688	-1.0306	0.4459	1.4755
41	0.0862	-1.7148	-2.1673	0.4525	-3.6105	-1.3194
42	-0.0305	-1.5606	-2.3628	0.8021	-3.8798	-1.4771
43	0.1044	-0.6162	-2.1368	1.5206	-3.5685	-1.2947
44	0.0677	-2.6173	-2.1983	-0.4190	-3.6532	-1.3445
45	-0.7985	-2.5639	-3.6501	1.0861	-5.6652	-2.5041
46	3.0204	2.1282	2.7507	-0.6224	2.1629	3.6513
47	3.3776	0.6931	3.3493	-2.6561	2.6696	4.4524
48	2.9232	0.0953	2.5876	-2.4923	2.0214	3.4367
49	3.3214	3.6687	3.2552	0.4135	2.5911	4.3254
50	2.6101	3.5467	2.0629	1.4839	1.5505	2.7612
51	3.4012	1.7047	3.3889	-1.6841	2.7025	4.5059

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Individuals

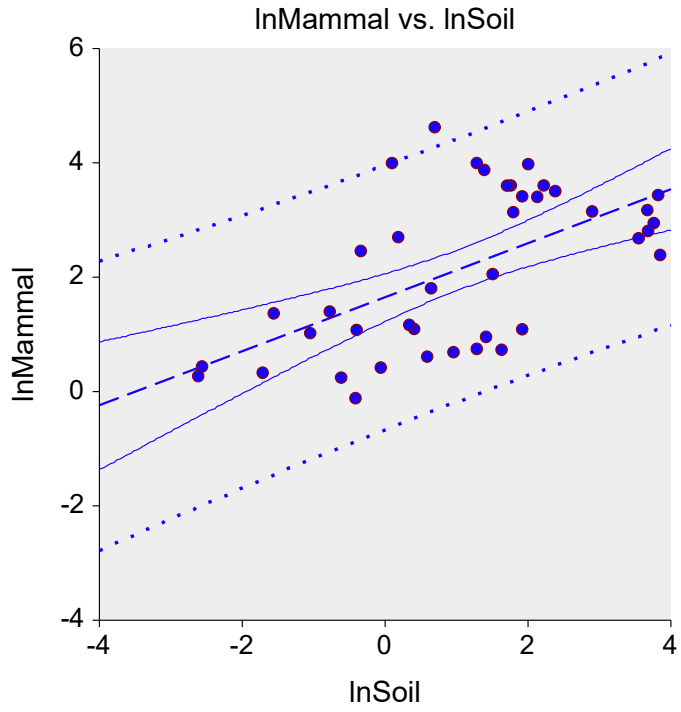
Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	3.0057	1.7918	2.7260	-0.9342	-0.4933	6.2536
12	2.4849	3.8480	1.8531	1.9949	-1.4145	5.2678
13	2.2050	0.1823	1.3839	-1.2016	-1.9190	4.7473
14	2.7912	3.6788	2.3664	1.3124	-0.8700	5.8448
15	2.4069	1.4110	1.7224	-0.3114	-1.5543	5.1222
16	0.4762	-0.3425	-1.5135	1.1711	-5.1809	1.6792
17	0.8587	1.6292	-0.8726	2.5018	-4.4380	2.3367
18	0.4187	-1.0498	-1.6100	0.5601	-5.2936	1.5813
19	0.6780	1.2809	-1.1753	2.4563	-4.7874	2.0247
20	1.5041	0.9555	0.2092	0.7463	-3.2114	3.4733
21	0.2776	-0.4155	-1.8464	1.4309	-5.5711	1.3423
22	3.5439	3.8199	3.6280	0.1919	0.4352	7.2956
23	2.1713	1.5041	1.3275	0.1765	-1.9801	4.6852
24	3.1987	1.7579	3.0494	-1.2916	-0.1577	6.6246
25	3.2581	1.9169	3.1490	-1.2321	-0.0549	6.7394
26	3.9853	2.2192	4.3678	-2.1486	1.1800	8.1672
27	4.1320	2.0015	4.6137	-2.6122	1.4242	8.4600
28	3.4689	2.3795	3.5023	-1.1227	0.3072	7.1490
29	3.9140	1.2809	4.2484	-2.9674	1.0608	8.0255
30	3.2809	2.8959	3.1873	-0.2913	-0.0156	6.7836
31	2.7850	3.7589	2.3561	1.4028	-0.8809	5.8331
32	2.1342	0.6419	1.2652	-0.6234	-2.0477	4.6167
33	3.3742	1.3863	3.3436	-1.9573	0.1449	6.9646
34	1.6715	-0.7765	0.4897	-1.2663	-2.8989	3.7738
35	0.8198	0.4055	-0.9377	1.3432	-4.5130	2.2693
36	0.5188	0.5878	-1.4422	2.0300	-5.0976	1.7518
37	1.2296	1.9169	-0.2508	2.1677	-3.7288	2.9858
38	1.4839	0.3365	0.1753	0.1612	-3.2493	3.4372
39	0.2700	-0.4005	-1.8592	1.4587	-5.5861	1.3294
40	1.9573	-0.0619	0.9688	-1.0306	-2.3710	4.2923
41	0.0862	-1.7148	-2.1673	0.4525	-5.9502	1.0203
42	-0.0305	-1.5606	-2.3628	0.8021	-6.1825	0.8255
43	0.1044	-0.6162	-2.1368	1.5206	-5.9141	1.0508
44	0.0677	-2.6173	-2.1983	-0.4190	-5.9870	0.9893
45	-0.7985	-2.5639	-3.6501	1.0861	-7.7361	-0.4332
46	3.0204	2.1282	2.7507	-0.6224	-0.4676	6.2818
47	3.3776	0.6931	3.3493	-2.6561	0.1508	6.9712
48	2.9232	0.0953	2.5876	-2.4923	-0.6378	6.0959
49	3.3214	3.6687	3.2552	0.4135	0.0543	6.8621
50	2.6101	3.5467	2.0629	1.4839	-1.1910	5.5027
51	3.4012	1.7047	3.3889	-1.6841	0.1913	7.0171

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnMammal	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.6437	Rows Prediction Only	0
Slope	0.4734	Sum of Frequencies	41
R-Squared	0.3482	Sum of Weights	41.0000
Correlation	0.5901	Coefficient of Variation	0.5241
Mean Square Error	1.262028	Square Root of MSE	1.1234

Linear Regression Report

Y = lnMammal X = lnSoil

Summary Statement
The equation of the straight line relating lnMammal and lnSoil is estimated as: lnMammal = (1.6437) + (0.4734) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnMammal when lnSoil is zero, is 1.6437 with a standard error of 0.2068. The slope, the estimated change in lnMammal per unit change in lnSoil, is 0.4734 with a standard error of 0.1037. The value of R-Squared, the proportion of the variation in lnMammal that can be accounted for by variation in lnSoil, is 0.3482. The correlation between lnMammal and lnSoil is 0.5901.

A significance test that the slope is zero resulted in a t-value of 4.5645. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.4734. The lower limit of the 95% confidence interval for the slope is 0.2636 and the upper limit is 0.6831. The estimated intercept is 1.6437. The lower limit of the 95% confidence interval for the intercept is 1.2253 and the upper limit is 2.0620.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnMammal	lnSoil
Count	41	41
Mean	2.1436	1.0562
Standard Deviation	1.3740	1.7128
Minimum	-0.1165	-2.6173
Maximum	4.6240	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.6437	0.4734
Lower 95% Confidence Limit	1.2253	0.2636
Upper 95% Confidence Limit	2.0620	0.6831
Standard Error	0.2068	0.1037
Standardized Coefficient	0.0000	0.5901
T Value	7.9470	4.5645
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	0.9936
Regression of Y on X	1.6437	0.4734
Inverse Regression from X on Y	0.7078	1.3594
Orthogonal Regression of Y and X	1.4128	0.6920

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.64367805589492) + (0.473354536224307) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.6437	0.9000	1.3238	1.9539
Bootstrap Mean	1.6426	0.9500	1.2651	2.0107
Bias (BM - OV)	-0.0010	0.9900	1.1080	2.1046
Bias Corrected	1.6447			
Standard Error	0.1897			
Slope				
Original Value	0.4734	0.9000	0.3621	0.5743
Bootstrap Mean	0.4775	0.9500	0.3347	0.5935
Bias (BM - OV)	0.0041	0.9900	0.2701	0.6324
Bias Corrected	0.4692			
Standard Error	0.0649			
Correlation				
Original Value	0.5901	0.9000	0.4628	0.7293
Bootstrap Mean	0.5932	0.9500	0.4395	0.7609
Bias (BM - OV)	0.0031	0.9900	0.4008	0.8250
Bias Corrected	0.5870			
Standard Error	0.0815			
R-Squared				
Original Value	0.3482	0.9000	0.1818	0.4931
Bootstrap Mean	0.3585	0.9500	0.1478	0.5206
Bias (BM - OV)	0.0103	0.9900	0.0891	0.5702
Bias Corrected	0.3379			
Standard Error	0.0946			
Standard Error of Estimate				
Original Value	1.1234	0.9000	0.9679	1.3267
Bootstrap Mean	1.0975	0.9500	0.9363	1.3612
Bias (BM - OV)	-0.0259	0.9900	0.8764	1.4417
Bias Corrected	1.1493			
Standard Error	0.1084			
Orthogonal Intercept				
Original Value	1.4128	0.9000	1.1029	1.8006
Bootstrap Mean	1.3867	0.9500	1.0394	1.9057
Bias (BM - OV)	-0.0260	0.9900	0.9219	2.2242
Bias Corrected	1.4388			
Standard Error	0.2239			
Orthogonal Slope				
Original Value	0.6920	0.9000	0.3992	0.8492
Bootstrap Mean	0.7186	0.9500	0.3071	0.8715
Bias (BM - OV)	0.0266	0.9900	0.0045	0.9200
Bias Corrected	0.6654			
Standard Error	0.1497			

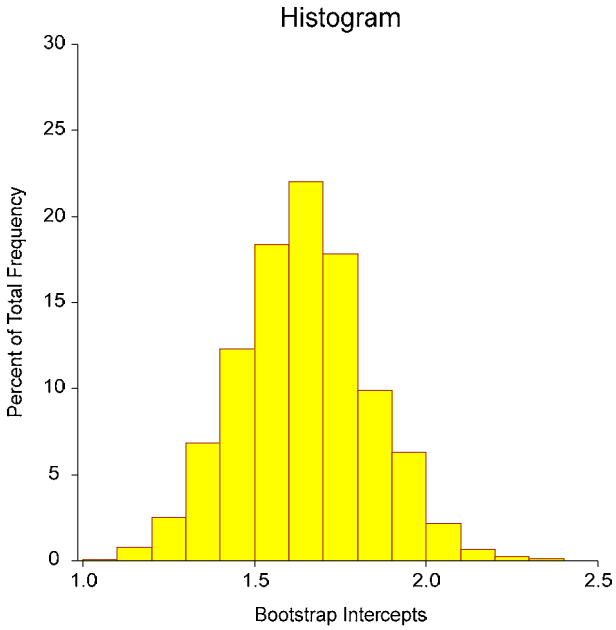
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

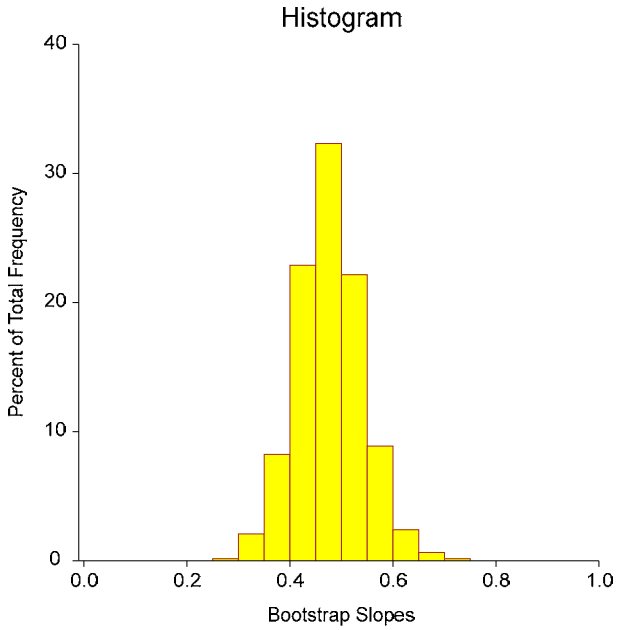
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

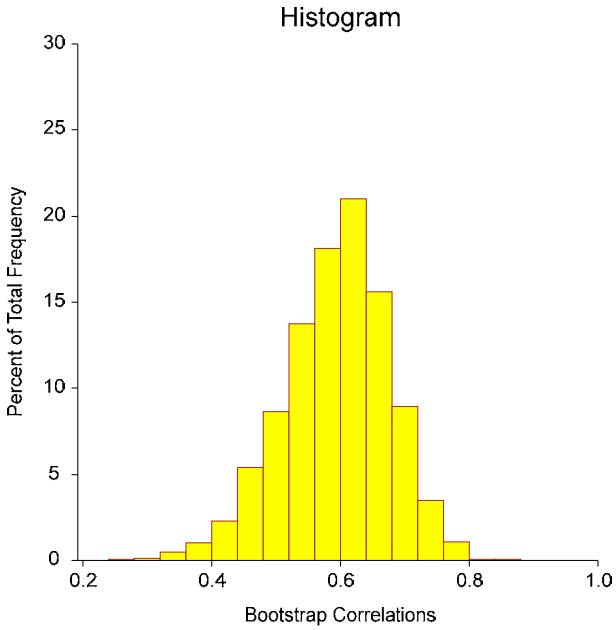
Linear Regression Report

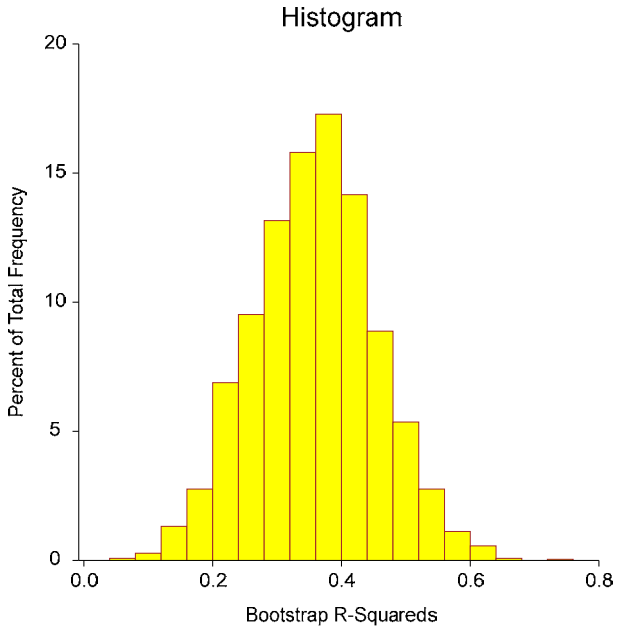
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Histograms Section



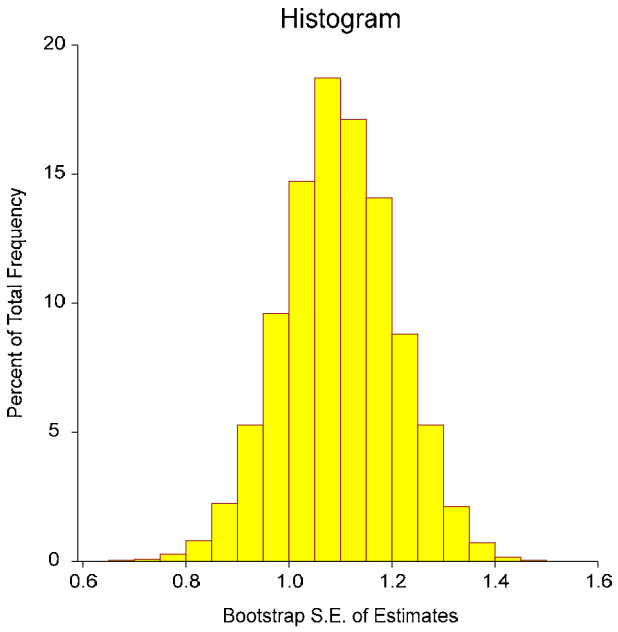


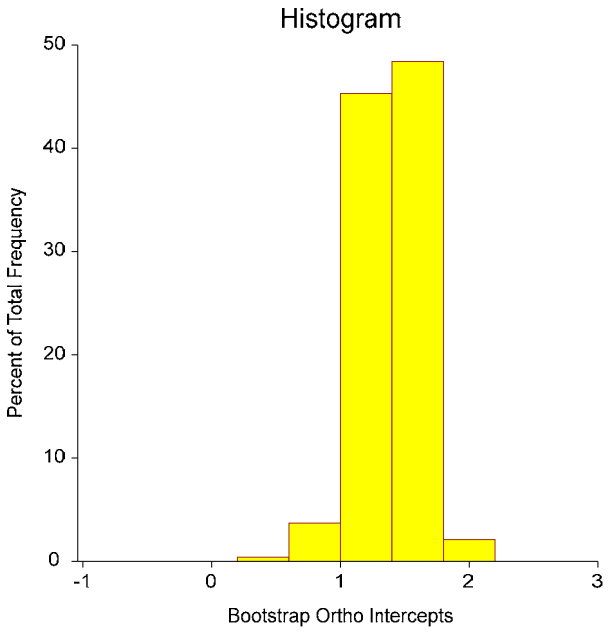


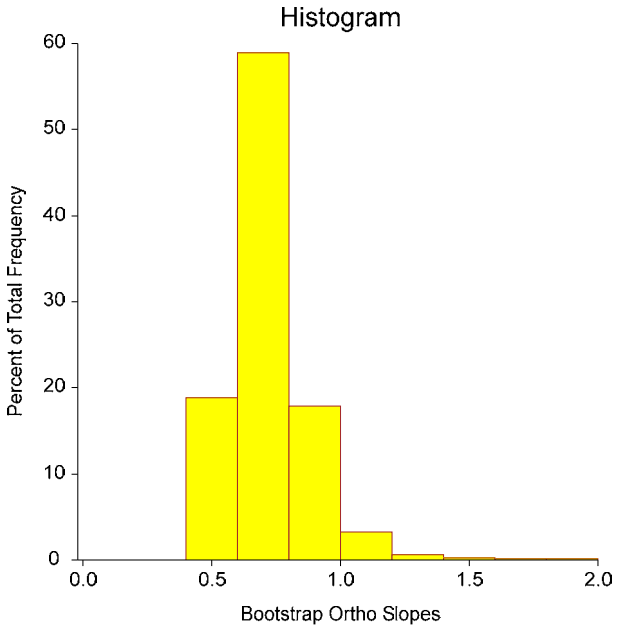


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.5901	0.3482	0.5719
Lower 95% Conf. Limit (r dist'n)	0.3409		
Upper 95% Conf. Limit (r dist'n)	0.7553		
Lower 95% Conf. Limit (Fisher's z)	0.3451		0.3206
Upper 95% Conf. Limit (Fisher's z)	0.7598		0.7479
Adjusted (Rbar)		0.3315	
T-Value for H0: Rho = 0	4.5645	4.5645	4.3532
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0001
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	188.4024	188.4024			
Slope	1	26.29345	26.29345	20.8343	0.0000	0.9936
Error	39	49.21909	1.262028			
Lack of Fit	37	41.23403	1.114433	0.2791	0.9622	
Pure Error	2	7.985058	3.992529			
Adj. Total	40	75.51254	1.887813			
Total	41	263.9149				

s = Square Root(1.262028) = 1.1234

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	87.88912	0.03389676	-0.009000641
1	43.30437	163.0859	148.3759	-0.009000641	0.008521686
2 (Y'Y)			263.9149		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.04277866	-0.01135906
1	-0.01135906	0.01075461

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9631	0.201044	Yes
Anderson Darling	0.4099	0.343615	Yes
D'Agostino Skewness	1.1736	0.240562	Yes
D'Agostino Kurtosis	-0.6192	0.535795	Yes
D'Agostino Omnibus	1.7607	0.414641	Yes
Constant Residual Variance?			
Modified Levene Test	0.1059	0.746581	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2791	0.962177	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

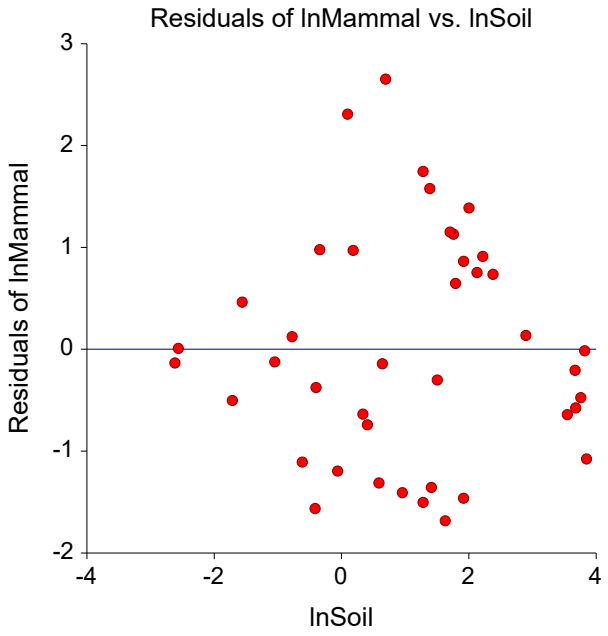
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

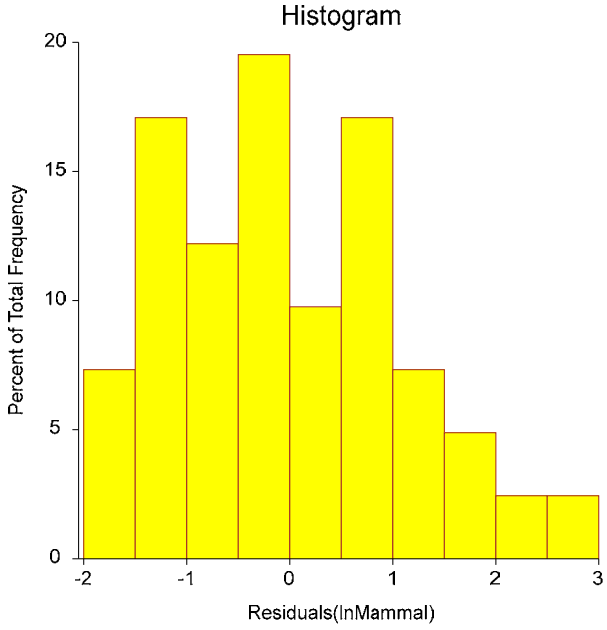
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

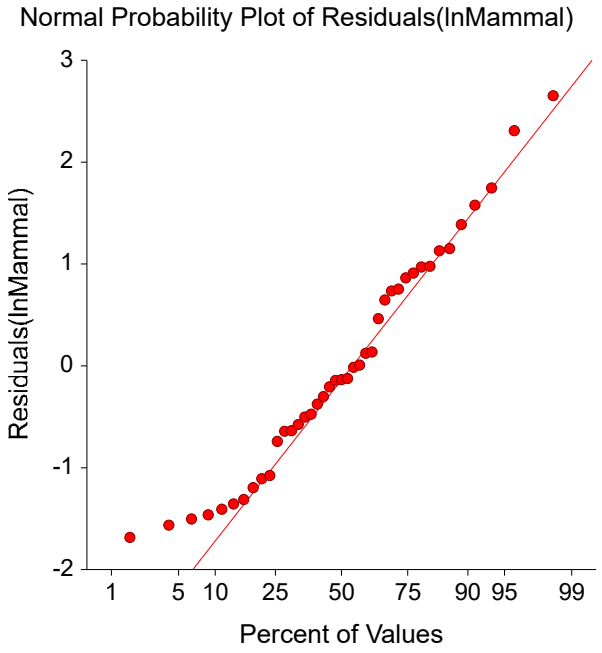
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Original Data Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual
11	1.7918	3.1384	2.4918	0.6466
12	3.8480	2.3888	3.4652	-1.0764
13	0.1823	2.7007	1.7300	0.9707
14	3.6788	2.8094	3.3851	-0.5757
15	1.4110	0.9555	2.3116	-1.3561
16	-0.3425	2.4592	1.4816	0.9776
17	1.6292	0.7308	2.4149	-1.6841
18	-1.0498	1.0225	1.1467	-0.1243
19	1.2809	0.7467	2.2500	-1.5033
20	0.9555	0.6881	2.0960	-1.4078
21	-0.4155	-0.1165	1.4470	-1.5635
22	3.8199	3.4372	3.4518	-0.0146
23	1.5041	2.0541	2.3556	-0.3015
24	1.7579	3.6055	2.4758	1.1297
25	1.9169	3.4144	2.5511	0.8634
26	2.2192	3.6055	2.6941	0.9113
27	2.0015	3.9782	2.5911	1.3872
28	2.3795	3.5056	2.7700	0.7355
29	1.2809	3.9964	2.2500	1.7464
30	2.8959	3.1506	3.0145	0.1361
31	3.7589	2.9481	3.4230	-0.4748
32	0.6419	1.8050	1.9475	-0.1425
33	1.3863	3.8774	2.2999	1.5775
34	-0.7765	1.3995	1.2761	0.1234
35	0.4055	1.0942	1.8356	-0.7414
36	0.5878	0.6098	1.9219	-1.3121
37	1.9169	1.0886	2.5511	-1.4625
38	0.3365	1.1663	1.8029	-0.6367
39	-0.4005	1.0784	1.4541	-0.3757
40	-0.0619	0.4187	1.6144	-1.1957
41	-1.7148	0.3293	0.8320	-0.5027
42	-1.5606	1.3678	0.9049	0.4629
43	-0.6162	0.2443	1.3520	-1.1078
44	-2.6173	0.2700	0.4048	-0.1347
45	-2.5639	0.4383	0.4300	0.0082
46	2.1282	3.4045	2.6511	0.7534
47	0.6931	4.6240	1.9718	2.6522
48	0.0953	3.9973	1.6888	2.3085
49	3.6687	3.1739	3.3803	-0.2064
50	3.5467	2.6810	3.3225	-0.6415
51	1.7047	3.6019	2.4506	1.1512

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	3.1384	2.4918	0.1913	2.1049	2.8788
12	3.8480	2.3888	3.4652	0.3385	2.7804	4.1499
13	0.1823	2.7007	1.7300	0.1975	1.3306	2.1294
14	3.6788	2.8094	3.3851	0.3237	2.7304	4.0397
15	1.4110	0.9555	2.3116	0.1793	1.9490	2.6742
16	-0.3425	2.4592	1.4816	0.2276	1.0211	1.9420
17	1.6292	0.7308	2.4149	0.1852	2.0402	2.7896
18	-1.0498	1.0225	1.1467	0.2801	0.5801	1.7134
19	1.2809	0.7467	2.2500	0.1770	1.8920	2.6080
20	0.9555	0.6881	2.0960	0.1758	1.7405	2.4515
21	-0.4155	-0.1165	1.4470	0.2325	0.9766	1.9174
22	3.8199	3.4372	3.4518	0.3360	2.7721	4.1316
23	1.5041	2.0541	2.3556	0.1815	1.9885	2.7227
24	1.7579	3.6055	2.4758	0.1899	2.0916	2.8600
25	1.9169	3.4144	2.5511	0.1968	2.1529	2.9492
26	2.2192	3.6055	2.6941	0.2129	2.2635	3.1248
27	2.0015	3.9782	2.5911	0.2010	2.1846	2.9976
28	2.3795	3.5056	2.7700	0.2227	2.3195	3.2206
29	1.2809	3.9964	2.2500	0.1770	1.8920	2.6080
30	2.8959	3.1506	3.0145	0.2592	2.4902	3.5387
31	3.7589	2.9481	3.4230	0.3307	2.7541	4.0918
32	0.6419	1.8050	1.9475	0.1806	1.5821	2.3129
33	1.3863	3.8774	2.2999	0.1788	1.9383	2.6615
34	-0.7765	1.3995	1.2761	0.2587	0.7529	1.7993
35	0.4055	1.0942	1.8356	0.1880	1.4554	2.2158
36	0.5878	0.6098	1.9219	0.1820	1.5537	2.2901
37	1.9169	1.0886	2.5511	0.1968	2.1529	2.9492
38	0.3365	1.1663	1.8029	0.1907	1.4173	2.1886
39	-0.4005	1.0784	1.4541	0.2315	0.9858	1.9224
40	-0.0619	0.4187	1.6144	0.2103	1.1890	2.0398
41	-1.7148	0.3293	0.8320	0.3367	0.1510	1.5130
42	-1.5606	1.3678	0.9049	0.3232	0.2513	1.5586
43	-0.6162	0.2443	1.3520	0.2467	0.8530	1.8510
44	-2.6173	0.2700	0.4048	0.4194	-0.4436	1.2531
45	-2.5639	0.4383	0.4300	0.4144	-0.4082	1.2682
46	2.1282	3.4045	2.6511	0.2077	2.2310	3.0712
47	0.6931	4.6240	1.9718	0.1794	1.6088	2.3347
48	0.0953	3.9973	1.6888	0.2018	1.2807	2.0969
49	3.6687	3.1739	3.3803	0.3228	2.7274	4.0331
50	3.5467	2.6810	3.3225	0.3122	2.6910	3.9541
51	1.7047	3.6019	2.4506	0.1879	2.0706	2.8307

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	3.1384	2.4918	1.1396	0.1868	4.7968
12	3.8480	2.3888	3.4652	1.1733	1.0919	5.8384
13	0.1823	2.7007	1.7300	1.1406	-0.5771	4.0371
14	3.6788	2.8094	3.3851	1.1691	1.0204	5.7498
15	1.4110	0.9555	2.3116	1.1376	0.0105	4.6126
16	-0.3425	2.4592	1.4816	1.1462	-0.8369	3.8000
17	1.6292	0.7308	2.4149	1.1386	0.1119	4.7179
18	-1.0498	1.0225	1.1467	1.1578	-1.1951	3.4886
19	1.2809	0.7467	2.2500	1.1373	-0.0503	4.5503
20	0.9555	0.6881	2.0960	1.1371	-0.2040	4.3959
21	-0.4155	-0.1165	1.4470	1.1472	-0.8735	3.7675
22	3.8199	3.4372	3.4518	1.1726	1.0801	5.8236
23	1.5041	2.0541	2.3556	1.1380	0.0539	4.6574
24	1.7579	3.6055	2.4758	1.1393	0.1712	4.7803
25	1.9169	3.4144	2.5511	1.1405	0.2442	4.8580
26	2.2192	3.6055	2.6941	1.1434	0.3814	5.0069
27	2.0015	3.9782	2.5911	1.1412	0.2827	4.8995
28	2.3795	3.5056	2.7700	1.1453	0.4535	5.0866
29	1.2809	3.9964	2.2500	1.1373	-0.0503	4.5503
30	2.8959	3.1506	3.0145	1.1529	0.6825	5.3465
31	3.7589	2.9481	3.4230	1.1711	1.0543	5.7916
32	0.6419	1.8050	1.9475	1.1378	-0.3540	4.2490
33	1.3863	3.8774	2.2999	1.1375	-0.0010	4.6008
34	-0.7765	1.3995	1.2761	1.1528	-1.0556	3.6078
35	0.4055	1.0942	1.8356	1.1390	-0.4683	4.1395
36	0.5878	0.6098	1.9219	1.1381	-0.3800	4.2238
37	1.9169	1.0886	2.5511	1.1405	0.2442	4.8580
38	0.3365	1.1663	1.8029	1.1395	-0.5018	4.1077
39	-0.4005	1.0784	1.4541	1.1470	-0.8659	3.7742
40	-0.0619	0.4187	1.6144	1.1429	-0.6974	3.9262
41	-1.7148	0.3293	0.8320	1.1728	-1.5402	3.2041
42	-1.5606	1.3678	0.9049	1.1690	-1.4595	3.2694
43	-0.6162	0.2443	1.3520	1.1502	-0.9744	3.6784
44	-2.6173	0.2700	0.4048	1.1991	-2.0207	2.8303
45	-2.5639	0.4383	0.4300	1.1974	-1.9919	2.8520
46	2.1282	3.4045	2.6511	1.1424	0.3403	4.9619
47	0.6931	4.6240	1.9718	1.1376	-0.3293	4.2729
48	0.0953	3.9973	1.6888	1.1414	-0.6199	3.9974
49	3.6687	3.1739	3.3803	1.1688	1.0160	5.7445
50	3.5467	2.6810	3.3225	1.1660	0.9641	5.6810
51	1.7047	3.6019	2.4506	1.1390	0.1468	4.7545

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	3.1384	2.4918	0.1913	1.9466	3.0370
12	3.8480	2.3888	3.4652	0.3385	2.5004	4.4299
13	0.1823	2.7007	1.7300	0.1975	1.1672	2.2927
14	3.6788	2.8094	3.3851	0.3237	2.4627	4.3074
15	1.4110	0.9555	2.3116	0.1793	1.8007	2.8224
16	-0.3425	2.4592	1.4816	0.2276	0.8328	2.1303
17	1.6292	0.7308	2.4149	0.1852	1.8870	2.9428
18	-1.0498	1.0225	1.1467	0.2801	0.3484	1.9451
19	1.2809	0.7467	2.2500	0.1770	1.7456	2.7544
20	0.9555	0.6881	2.0960	0.1758	1.5951	2.5969
21	-0.4155	-0.1165	1.4470	0.2325	0.7843	2.1097
22	3.8199	3.4372	3.4518	0.3360	2.4942	4.4095
23	1.5041	2.0541	2.3556	0.1815	1.8384	2.8729
24	1.7579	3.6055	2.4758	0.1899	1.9345	3.0171
25	1.9169	3.4144	2.5511	0.1968	1.9901	3.1120
26	2.2192	3.6055	2.6941	0.2129	2.0874	3.3009
27	2.0015	3.9782	2.5911	0.2010	2.0183	3.1638
28	2.3795	3.5056	2.7700	0.2227	2.1353	3.4048
29	1.2809	3.9964	2.2500	0.1770	1.7456	2.7544
30	2.8959	3.1506	3.0145	0.2592	2.2758	3.7531
31	3.7589	2.9481	3.4230	0.3307	2.4806	4.3653
32	0.6419	1.8050	1.9475	0.1806	1.4327	2.4623
33	1.3863	3.8774	2.2999	0.1788	1.7905	2.8093
34	-0.7765	1.3995	1.2761	0.2587	0.5390	2.0133
35	0.4055	1.0942	1.8356	0.1880	1.2999	2.3713
36	0.5878	0.6098	1.9219	0.1820	1.4031	2.4407
37	1.9169	1.0886	2.5511	0.1968	1.9901	3.1120
38	0.3365	1.1663	1.8029	0.1907	1.2596	2.3463
39	-0.4005	1.0784	1.4541	0.2315	0.7943	2.1139
40	-0.0619	0.4187	1.6144	0.2103	1.0151	2.2137
41	-1.7148	0.3293	0.8320	0.3367	-0.1276	1.7915
42	-1.5606	1.3678	0.9049	0.3232	-0.0160	1.8259
43	-0.6162	0.2443	1.3520	0.2467	0.6489	2.0551
44	-2.6173	0.2700	0.4048	0.4194	-0.7905	1.6001
45	-2.5639	0.4383	0.4300	0.4144	-0.7510	1.6110
46	2.1282	3.4045	2.6511	0.2077	2.0592	3.2430
47	0.6931	4.6240	1.9718	0.1794	1.4604	2.4832
48	0.0953	3.9973	1.6888	0.2018	1.1138	2.2638
49	3.6687	3.1739	3.3803	0.3228	2.4604	4.3001
50	3.5467	2.6810	3.3225	0.3122	2.4327	4.2124
51	1.7047	3.6019	2.4506	0.1879	1.9152	2.9861

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	3.1384	2.4918	0.6466	0.5841	20.6021
12	3.8480	2.3888	3.4652	-1.0764	-1.0049	45.0606
13	0.1823	2.7007	1.7300	0.9707	0.8777	35.9430
14	3.6788	2.8094	3.3851	-0.5757	-0.5351	20.4907
15	1.4110	0.9555	2.3116	-1.3561	-1.2228	141.9202
16	-0.3425	2.4592	1.4816	0.9776	0.8887	39.7535
17	1.6292	0.7308	2.4149	-1.6841	-1.5199	230.4605
18	-1.0498	1.0225	1.1467	-0.1243	-0.1142	12.1560
19	1.2809	0.7467	2.2500	-1.5033	-1.3551	201.3326
20	0.9555	0.6881	2.0960	-1.4078	-1.2688	204.5877
21	-0.4155	-0.1165	1.4470	-1.5635	-1.4226	1341.6927
22	3.8199	3.4372	3.4518	-0.0146	-0.0137	0.4260
23	1.5041	2.0541	2.3556	-0.3015	-0.2720	14.6786
24	1.7579	3.6055	2.4758	1.1297	1.0203	31.3335
25	1.9169	3.4144	2.5511	0.8634	0.7806	25.2861
26	2.2192	3.6055	2.6941	0.9113	0.8262	25.2767
27	2.0015	3.9782	2.5911	1.3872	1.2550	34.8686
28	2.3795	3.5056	2.7700	0.7355	0.6680	20.9813
29	1.2809	3.9964	2.2500	1.7464	1.5742	43.6985
30	2.8959	3.1506	3.0145	0.1361	0.1245	4.3206
31	3.7589	2.9481	3.4230	-0.4748	-0.4423	16.1066
32	0.6419	1.8050	1.9475	-0.1425	-0.1285	7.8946
33	1.3863	3.8774	2.2999	1.5775	1.4224	40.6853
34	-0.7765	1.3995	1.2761	0.1234	0.1129	8.8197
35	0.4055	1.0942	1.8356	-0.7414	-0.6694	67.7643
36	0.5878	0.6098	1.9219	-1.3121	-1.1837	215.1883
37	1.9169	1.0886	2.5511	-1.4625	-1.3223	134.3516
38	0.3365	1.1663	1.8029	-0.6367	-0.5751	54.5909
39	-0.4005	1.0784	1.4541	-0.3757	-0.3418	34.8384
40	-0.0619	0.4187	1.6144	-1.1957	-1.0835	285.5623
41	-1.7148	0.3293	0.8320	-0.5027	-0.4690	152.6453
42	-1.5606	1.3678	0.9049	0.4629	0.4302	33.8394
43	-0.6162	0.2443	1.3520	-1.1078	-1.0107	453.5270
44	-2.6173	0.2700	0.4048	-0.1347	-0.1293	49.8995
45	-2.5639	0.4383	0.4300	0.0082	0.0079	1.8789
46	2.1282	3.4045	2.6511	0.7534	0.6824	22.1305
47	0.6931	4.6240	1.9718	2.6522	2.3916	57.3576
48	0.0953	3.9973	1.6888	2.3085	2.0889	57.7515
49	3.6687	3.1739	3.3803	-0.2064	-0.1918	6.5026
50	3.5467	2.6810	3.3225	-0.6415	-0.5945	23.9283
51	1.7047	3.6019	2.4506	1.1512	1.0394	31.9623

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	0.6466	0.5791	0.0290	0.0051	1.2839
12	3.8480	-1.0764	-1.0050	0.0908	0.0504	1.2617
13	0.1823	0.9707	0.8751	0.0309	0.0123	1.2697
14	3.6788	-0.5757	-0.5302	0.0830	0.0130	1.2857
15	1.4110	-1.3561	-1.2308	0.0255	0.0195	1.2456
16	-0.3425	0.9776	0.8862	0.0411	0.0169	1.2690
17	1.6292	-1.6841	-1.5468	0.0272	0.0323	1.2185
18	-1.0498	-0.1243	-0.1128	0.0622	0.0004	1.2948
19	1.2809	-1.5033	-1.3703	0.0248	0.0234	1.2343
20	0.9555	-1.4078	-1.2791	0.0245	0.0202	1.2418
21	-0.4155	-1.5635	-1.4422	0.0428	0.0453	1.2280
22	3.8199	-0.0146	-0.0135	0.0895	0.0000	1.2952
23	1.5041	-0.3015	-0.2687	0.0261	0.0010	1.2928
24	1.7579	1.1297	1.0209	0.0286	0.0153	1.2607
25	1.9169	0.8634	0.7766	0.0307	0.0097	1.2750
26	2.2192	0.9113	0.8228	0.0359	0.0127	1.2726
27	2.0015	1.3872	1.2646	0.0320	0.0260	1.2429
28	2.3795	0.7355	0.6632	0.0393	0.0091	1.2804
29	1.2809	1.7464	1.6057	0.0248	0.0315	1.2129
30	2.8959	0.1361	0.1230	0.0532	0.0004	1.2947
31	3.7589	-0.4748	-0.4377	0.0866	0.0093	1.2887
32	0.6419	-0.1425	-0.1269	0.0259	0.0002	1.2947
33	1.3863	1.5775	1.4419	0.0253	0.0263	1.2280
34	-0.7765	0.1234	0.1115	0.0530	0.0004	1.2948
35	0.4055	-0.7414	-0.6646	0.0280	0.0065	1.2804
36	0.5878	-1.3121	-1.1900	0.0263	0.0189	1.2487
37	1.9169	-1.4625	-1.3355	0.0307	0.0277	1.2372
38	0.3365	-0.6367	-0.5701	0.0288	0.0049	1.2843
39	-0.4005	-0.3757	-0.3379	0.0425	0.0026	1.2914
40	-0.0619	-1.1957	-1.0860	0.0350	0.0213	1.2563
41	-1.7148	-0.5027	-0.4643	0.0898	0.0109	1.2879
42	-1.5606	0.4629	0.4257	0.0827	0.0083	1.2891
43	-0.6162	-1.1078	-1.0110	0.0482	0.0259	1.2613
44	-2.6173	-0.1347	*-0.1276	0.1394	0.0014	1.2947
45	-2.5639	0.0082	*0.0078	0.1361	0.0000	1.2952
46	2.1282	0.7534	0.6777	0.0342	0.0082	1.2798
47	0.6931	2.6522	*2.5555	0.0255	0.0749	1.1053
48	0.0953	2.3085	*2.1880	0.0323	0.0727	1.1503
49	3.6687	-0.2064	-0.1894	0.0826	0.0017	1.2940
50	3.5467	-0.6415	-0.5895	0.0772	0.0148	1.2835
51	1.7047	1.1512	1.0405	0.0280	0.0155	1.2594

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.5791	0.1001	0.0051	1.0659	0.0567	0.0399
12	-1.0050	-0.3176	0.0504	1.0993	0.0042	-0.2716
13	0.8751	0.1563	0.0123	1.0444	0.1557	-0.0717
14	-0.5302	-0.1595	0.0130	1.1319	-0.0024	-0.1340
15	-1.2308	-0.1990	0.0195	0.9996	-0.1435	-0.0408
16	0.8862	0.1834	0.0169	1.0544	0.1818	-0.1168
17	-1.5468	-0.2586	0.0323	0.9583	-0.1638	-0.0830
18	-0.1128	-0.0290	0.0004	1.1224	-0.0274	0.0226
19	-1.3703	-0.2186	0.0234	0.9808	-0.1686	-0.0288
20	-1.2791	-0.2026	0.0202	0.9924	-0.1779	0.0120
21	-1.4422	-0.3051	0.0453	0.9892	-0.3013	0.2003
22	-0.0135	-0.0042	0.0000	* 1.1568	0.0000	-0.0036
23	-0.2687	-0.0440	0.0010	1.0775	-0.0301	-0.0113
24	1.0209	0.1751	0.0153	1.0272	0.1017	0.0671
25	0.7766	0.1382	0.0097	1.0530	0.0713	0.0627
26	0.8228	0.1588	0.0127	1.0547	0.0634	0.0900
27	1.2646	0.2300	0.0260	1.0020	0.1109	0.1122
28	0.6632	0.1342	0.0091	1.0715	0.0459	0.0827
29	1.6057	0.2562	0.0315	0.9472	0.1975	0.0337
30	0.1230	0.0292	0.0004	1.1117	0.0054	0.0215
31	-0.4377	-0.1348	0.0093	1.1417	-0.0002	-0.1143
32	-0.1269	-0.0207	0.0002	1.0804	-0.0196	0.0049
33	1.4419	0.2324	0.0263	0.9715	0.1699	0.0445
34	0.1115	0.0264	0.0004	1.1116	0.0254	-0.0194
35	-0.6646	-0.1128	0.0065	1.0589	-0.1108	0.0405
36	-1.1900	-0.1954	0.0189	1.0054	-0.1874	0.0521
37	-1.3355	-0.2377	0.0277	0.9914	-0.1226	-0.1078
38	-0.5701	-0.0982	0.0049	1.0662	-0.0970	0.0384
39	-0.3379	-0.0712	0.0026	1.0935	-0.0703	0.0464
40	-1.0860	-0.2070	0.0213	1.0268	-0.2069	0.1141
41	-0.4643	-0.1458	0.0109	1.1443	-0.1304	0.1245
42	0.4257	0.1278	0.0083	1.1375	0.1157	-0.1074
43	-1.0110	-0.2276	0.0259	1.0495	-0.2220	0.1600
44	-0.1276	-0.0514	0.0014	* 1.2229	-0.0429	0.0467
45	0.0078	0.0031	0.0000	* 1.2192	0.0026	-0.0028
46	0.6777	0.1275	0.0082	1.0647	0.0552	0.0682
47	* 2.5555	0.4135	0.0749	0.7871	0.3889	-0.0868
48	* 2.1880	0.3995	0.0727	0.8585	0.3991	-0.1973
49	-0.1894	-0.0568	0.0017	1.1459	-0.0009	-0.0477
50	-0.5895	-0.1706	0.0148	1.1209	-0.0066	-0.1411
51	1.0405	0.1765	0.0155	1.0244	0.1064	0.0632

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	0.6466	|||.....	0.5841	|||.....	0.5791	|||.....
12	3.8480	-1.0764	||||||.....	-1.0049	||||||.....	-1.0050	|||||.....
13	0.1823	0.9707	|||||.....	0.8777	|||||.....	0.8751	|||||.....
14	3.6788	-0.5757	|||.....	-0.5351	|||.....	-0.5302	|||.....
15	1.4110	-1.3561	|||||||.....	-1.2228	|||||||.....	-1.2308	|||||||.....
16	-0.3425	0.9776	|||||.....	0.8887	|||||.....	0.8862	|||||.....
17	1.6292	-1.6841	||||||||.....	-1.5199	||||||||.....	-1.5468	||||||||.....
18	-1.0498	-0.1243	|.....	-0.1142	|.....	-0.1128	|.....
19	1.2809	-1.5033	|||||||.....	-1.3551	|||||||.....	-1.3703	|||||||.....
20	0.9555	-1.4078	||||||.....	-1.2688	||||||.....	-1.2791	||||||.....
21	-0.4155	-1.5635	|||||||.....	-1.4226	|||||||.....	-1.4422	|||||||.....
22	3.8199	-0.0146	|.....	-0.0137	|.....	-0.0135	|.....
23	1.5041	-0.3015	|.....	-0.2720	|.....	-0.2687	|.....
24	1.7579	1.1297	||||||.....	1.0203	||||||.....	1.0209	|||||.....
25	1.9169	0.8634	||||.....	0.7806	||||.....	0.7766	||||.....
26	2.2192	0.9113	|||||.....	0.8262	|||||.....	0.8228	||||.....
27	2.0015	1.3872	|||||||.....	1.2550	|||||||.....	1.2646	|||||||.....
28	2.3795	0.7355	||||.....	0.6680	||||.....	0.6632	|||.....
29	1.2809	1.7464	||||||||.....	1.5742	||||||||.....	1.6057	||||||||.....
30	2.8959	0.1361	|.....	0.1245	|.....	0.1230	|.....
31	3.7589	-0.4748	||.....	-0.4423	||.....	-0.4377	||.....
32	0.6419	-0.1425	|.....	-0.1285	|.....	-0.1269	|.....
33	1.3863	1.5775	|||||||.....	1.4224	|||||||.....	1.4419	|||||||.....
34	-0.7765	0.1234	|.....	0.1129	|.....	0.1115	|.....
35	0.4055	-0.7414	||||.....	-0.6694	||||.....	-0.6646	|||.....
36	0.5878	-1.3121	|||||||.....	-1.1837	|||||||.....	-1.1900	||||||.....
37	1.9169	-1.4625	||||||||.....	-1.3223	||||||||.....	-1.3355	|||||||.....
38	0.3365	-0.6367	|||.....	-0.5751	|||.....	-0.5701	|||.....
39	-0.4005	-0.3757	||.....	-0.3418	||.....	-0.3379	|.....
40	-0.0619	-1.1957	||||||.....	-1.0835	||||||.....	-1.0860	||||||.....
41	-1.7148	-0.5027	||.....	-0.4690	||.....	-0.4643	||.....
42	-1.5606	0.4629	||.....	0.4302	||.....	0.4257	||.....
43	-0.6162	-1.1078	||||||.....	-1.0107	||||||.....	-1.0110	|||||.....
44	-2.6173	-0.1347	|.....	-0.1293	|.....	-0.1276	|.....
45	-2.5639	0.0082	|.....	0.0079	|.....	0.0078	|.....
46	2.1282	0.7534	||||.....	0.6824	||||.....	0.6777	|||.....
47	0.6931	2.6522	||||||||||||||	2.3916	||||||||||||||	* 2.5555	||||||||||||||
48	0.0953	2.3085	||||||||||||..	2.0889	||||||||||||..	* 2.1880	|||||||||||...
49	3.6687	-0.2064	|.....	-0.1918	|.....	-0.1894	|.....
50	3.5467	-0.6415	|||.....	-0.5945	|||.....	-0.5895	|||.....
51	1.7047	1.1512	||||||.....	1.0394	||||||.....	1.0405	||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.1001	|||.....	0.0051	|.....	0.0399	||.....
12	3.8480	-0.3176	||||||||||....	0.0504	|||||||||.....	-0.2716	||||||||||||||
13	0.1823	0.1563	|||||.....	0.0123	||.....	-0.0717	|||.....
14	3.6788	-0.1595	|||||.....	0.0130	||.....	-0.1340	||||||.....
15	1.4110	-0.1990	||||||.....	0.0195	|||.....	-0.0408	||.....
16	-0.3425	0.1834	||||||.....	0.0169	|||.....	-0.1168	||||||.....
17	1.6292	-0.2586	||||||||.....	0.0323	||||||.....	-0.0830	||||.....
18	-1.0498	-0.0290	|.....	0.0004	|.....	0.0226	|.....
19	1.2809	-0.2186	|||||||.....	0.0234	||||.....	-0.0288	|.....
20	0.9555	-0.2026	|||||||.....	0.0202	||||.....	0.0120	|.....
21	-0.4155	-0.3051	||||||||||....	0.0453	||||||||.....	0.2003	||||||||||....
22	3.8199	-0.0042	|.....	0.0000	|.....	-0.0036	|.....
23	1.5041	-0.0440	|.....	0.0010	|.....	-0.0113	|.....
24	1.7579	0.1751	||||||.....	0.0153	|||.....	0.0671	|||.....
25	1.9169	0.1382	||||.....	0.0097	|.....	0.0627	|||.....
26	2.2192	0.1588	|||||.....	0.0127	||.....	0.0900	||||.....
27	2.0015	0.2300	|||||||.....	0.0260	|||||.....	0.1122	||||||.....
28	2.3795	0.1342	||||.....	0.0091	|.....	0.0827	||||.....
29	1.2809	0.2562	||||||||.....	0.0315	||||||.....	0.0337	|.....
30	2.8959	0.0292	|.....	0.0004	|.....	0.0215	|.....
31	3.7589	-0.1348	||||.....	0.0093	|.....	-0.1143	||||||.....
32	0.6419	-0.0207	|.....	0.0002	|.....	0.0049	|.....
33	1.3863	0.2324	|||||||.....	0.0263	|||||.....	0.0445	||.....
34	-0.7765	0.0264	|.....	0.0004	|.....	-0.0194	|.....
35	0.4055	-0.1128	||||.....	0.0065	|.....	0.0405	||.....
36	0.5878	-0.1954	||||||.....	0.0189	|||.....	0.0521	||.....
37	1.9169	-0.2377	|||||||.....	0.0277	|||||.....	-0.1078	|||||.....
38	0.3365	-0.0982	|||.....	0.0049	|.....	0.0384	|.....
39	-0.4005	-0.0712	||.....	0.0026	|.....	0.0464	||.....
40	-0.0619	-0.2070	||||||.....	0.0213	||||.....	0.1141	||||||.....
41	-1.7148	-0.1458	|||||.....	0.0109	||.....	0.1245	||||||.....
42	-1.5606	0.1278	||||.....	0.0083	|.....	-0.1074	|||||.....
43	-0.6162	-0.2276	|||||||.....	0.0259	|||||.....	0.1600	|||||||.....
44	-2.6173	-0.0514	|.....	0.0014	|.....	0.0467	||.....
45	-2.5639	0.0031	|.....	0.0000	|.....	-0.0028	|.....
46	2.1282	0.1275	||||.....	0.0082	|.....	0.0682	|||.....
47	0.6931	0.4135	||||||||||||||	0.0749	||||||||||||||	-0.0868	||||.....
48	0.0953	0.3995	|||||||||||||.	0.0727	|||||||||||||.	-0.1973	|||||||||.....
49	3.6687	-0.0568	|.....	0.0017	|.....	-0.0477	||.....
50	3.5467	-0.1706	||||||.....	0.0148	||.....	-0.1411	|||||||.....
51	1.7047	0.1765	||||||.....	0.0155	|||.....	0.0632	|||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	0.5791	|||.....	0.0051	|.....	0.0290	|.....
12	3.8480	-1.0050	|||||.....	0.0504	|||||||||.....	0.0908	|||||||.....
13	0.1823	0.8751	|||||.....	0.0123	||.....	0.0309	|.....
14	3.6788	-0.5302	|||.....	0.0130	||.....	0.0830	||||||.....
15	1.4110	-1.2308	||||||.....	0.0195	|||.....	0.0255	|.....
16	-0.3425	0.8862	|||||.....	0.0169	|||.....	0.0411	||.....
17	1.6292	-1.5468	||||||||.....	0.0323	|||||.....	0.0272	|.....
18	-1.0498	-0.1128	|.....	0.0004	|.....	0.0622	||||.....
19	1.2809	-1.3703	|||||||.....	0.0234	||||.....	0.0248	|.....
20	0.9555	-1.2791	||||||.....	0.0202	||||.....	0.0245	|.....
21	-0.4155	-1.4422	|||||||.....	0.0453	||||||||.....	0.0428	||.....
22	3.8199	-0.0135	|.....	0.0000	|.....	0.0895	|||||||.....
23	1.5041	-0.2687	|.....	0.0010	|.....	0.0261	|.....
24	1.7579	1.0209	|||||.....	0.0153	|||.....	0.0286	|.....
25	1.9169	0.7766	||||.....	0.0097	|.....	0.0307	|.....
26	2.2192	0.8228	||||.....	0.0127	||.....	0.0359	|.....
27	2.0015	1.2646	||||||.....	0.0260	|||||.....	0.0320	|.....
28	2.3795	0.6632	|||.....	0.0091	|.....	0.0393	|.....
29	1.2809	1.6057	||||||||.....	0.0315	|||||.....	0.0248	|.....
30	2.8959	0.1230	|.....	0.0004	|.....	0.0532	|||.....
31	3.7589	-0.4377	||.....	0.0093	|.....	0.0866	|||||||.....
32	0.6419	-0.1269	|.....	0.0002	|.....	0.0259	|.....
33	1.3863	1.4419	|||||||.....	0.0263	|||||.....	0.0253	|.....
34	-0.7765	0.1115	|.....	0.0004	|.....	0.0530	|||.....
35	0.4055	-0.6646	|||.....	0.0065	|.....	0.0280	|.....
36	0.5878	-1.1900	|||||.....	0.0189	|||.....	0.0263	|.....
37	1.9169	-1.3355	||||||.....	0.0277	|||||.....	0.0307	|.....
38	0.3365	-0.5701	|||.....	0.0049	|.....	0.0288	|.....
39	-0.4005	-0.3379	|.....	0.0026	|.....	0.0425	||.....
40	-0.0619	-1.0860	|||||.....	0.0213	||||.....	0.0350	|.....
41	-1.7148	-0.4643	||.....	0.0109	||.....	0.0898	|||||||.....
42	-1.5606	0.4257	||.....	0.0083	|.....	0.0827	||||||.....
43	-0.6162	-1.0110	|||||.....	0.0259	|||||.....	0.0482	|||.....
44	-2.6173	-0.1276	|.....	0.0014	|.....	0.1394	|||||||||||||
45	-2.5639	0.0078	|.....	0.0000	|.....	0.1361	||||||||||||.
46	2.1282	0.6777	|||.....	0.0082	|.....	0.0342	|.....
47	0.6931	* 2.5555	||||||||||||||	0.0749	||||||||||||||	0.0255	|.....
48	0.0953	* 2.1880	|||||||||||...	0.0727	|||||||||||||.	0.0323	|.....
49	3.6687	-0.1894	|.....	0.0017	|.....	0.0826	||||||.....
50	3.5467	-0.5895	|||.....	0.0148	||.....	0.0772	|||||.....
51	1.7047	1.0405	|||||.....	0.0155	|||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Means

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	3.1384	1.7918	3.1577	-1.3659	2.2421	5.1003
12	2.3888	3.8480	1.5741	2.2740	0.8169	2.5843
13	2.7007	0.1823	2.2330	-2.0507	1.4621	3.5791
14	2.8094	3.6788	2.4627	1.2161	1.6658	3.9469
15	0.9555	1.4110	-1.4538	2.8648	-3.6843	-0.4500
16	2.4592	-0.3425	1.7228	-2.0653	0.9722	2.7992
17	0.7308	1.6292	-1.9286	3.5578	-4.5041	-0.8118
18	1.0225	-1.0498	-1.3124	0.2626	-3.4421	-0.3403
19	0.7467	1.2809	-1.8950	3.1759	-4.4458	-0.7865
20	0.6881	0.9555	-2.0187	2.9742	-4.6606	-0.8795
21	-0.1165	-0.4155	-3.7186	3.3031	-7.6479	-2.1228
22	3.4372	3.8199	3.7890	0.0309	2.7333	6.1802
23	2.0541	1.5041	0.8671	0.6370	-0.0219	1.6637
24	3.6055	1.7579	4.1445	-2.3866	3.0019	6.7964
25	3.4144	1.9169	3.7409	-1.8240	2.6966	6.0972
26	3.6055	2.2192	4.1445	-1.9253	3.0019	6.7964
27	3.9782	2.0015	4.9320	-2.9305	3.5841	8.1740
28	3.5056	2.3795	3.9334	-1.5538	2.8430	6.4299
29	3.9964	1.2809	4.9702	-3.6893	3.6120	8.2413
30	3.1506	2.8959	3.1835	-0.2876	2.2627	5.1439
31	2.9481	3.7589	2.7557	1.0031	1.9150	4.4271
32	1.8050	0.6419	0.3408	0.3010	-0.7587	1.0907
33	3.8774	1.3863	4.7190	-3.3327	3.4280	7.8001
34	1.3995	-0.7765	-0.5158	-0.2608	-2.1044	0.3046
35	1.0942	0.4055	-1.1609	1.5664	-3.1839	-0.2214
36	0.6098	0.5878	-2.1842	2.7720	-4.9489	-1.0032
37	1.0886	1.9169	-1.1727	3.0897	-3.2040	-0.2308
38	1.1663	0.3365	-1.0086	1.3450	-2.9258	-0.1004
39	1.0784	-0.4005	-1.1942	0.7937	-3.2405	-0.2477
40	0.4187	-0.0619	-2.5878	2.5260	-5.6548	-1.3018
41	0.3293	-1.7148	-2.7767	1.0619	-5.9863	-1.4403
42	1.3678	-1.5606	-0.5828	-0.9778	-2.2147	0.2480
43	0.2443	-0.6162	-2.9564	2.3402	-6.3023	-1.5715
44	0.2700	-2.6173	-2.9019	0.2847	-6.2065	-1.5318
45	0.4383	-2.5639	-2.5466	-0.0174	-5.5824	-1.2714
46	3.4045	2.1282	3.7199	-1.5917	2.6806	6.0611
47	4.6240	0.6931	6.2962	-5.6030	4.5686	10.5846
48	3.9973	0.0953	4.9722	-4.8769	3.6134	8.2447
49	3.1739	3.6687	3.2327	0.4360	2.3017	5.2273
50	2.6810	3.5467	2.1915	1.3553	1.4242	3.5135
51	3.6019	1.7047	4.1368	-2.4321	2.9962	6.7830

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Individuals

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	3.1384	1.7918	3.1577	-1.3659	-1.8711	9.2135
12	2.3888	3.8480	1.5741	2.2740	-3.7267	7.1279
13	2.7007	0.1823	2.2330	-2.0507	-2.9379	7.9791
14	2.8094	3.6788	2.4627	1.2161	-2.6686	8.2814
15	0.9555	1.4110	-1.4538	2.8648	-7.6609	3.5266
16	2.4592	-0.3425	1.7228	-2.0653	-3.5466	7.3179
17	0.7308	1.6292	-1.9286	3.5578	-8.3222	3.0062
18	1.0225	-1.0498	-1.3124	0.2626	-7.4661	3.6838
19	0.7467	1.2809	-1.8950	3.1759	-8.2749	3.0427
20	0.6881	0.9555	-2.0187	2.9742	-8.4489	2.9088
21	-0.1165	-0.4155	-3.7186	3.3031	-10.9108	1.1401
22	3.4372	3.8199	3.7890	0.0309	-1.1686	10.0821
23	2.0541	1.5041	0.8671	0.6370	-4.5999	6.2417
24	3.6055	1.7579	4.1445	-2.3866	-0.7819	10.5802
25	3.4144	1.9169	3.7409	-1.8240	-1.2214	10.0152
26	3.6055	2.2192	4.1445	-1.9253	-0.7819	10.5802
27	3.9782	2.0015	4.9320	-2.9305	0.0531	11.7050
28	3.5056	2.3795	3.9334	-1.5538	-1.0108	10.2837
29	3.9964	1.2809	4.9702	-3.6893	0.0929	11.7604
30	3.1506	2.8959	3.1835	-0.2876	-1.8420	9.2486
31	2.9481	3.7589	2.7557	1.0031	-2.3292	8.6712
32	1.8050	0.6419	0.3408	0.3010	-5.2681	5.6001
33	3.8774	1.3863	4.7190	-3.3327	-0.1699	11.3979
34	1.3995	-0.7765	-0.5158	-0.2608	-6.3886	4.5888
35	1.0942	0.4055	-1.1609	1.5664	-7.2586	3.8533
36	0.6098	0.5878	-2.1842	2.7720	-8.6828	2.7307
37	1.0886	1.9169	-1.1727	3.0897	-7.2748	3.8400
38	1.1663	0.3365	-1.0086	1.3450	-7.0512	4.0250
39	1.0784	-0.4005	-1.1942	0.7937	-7.3041	3.8160
40	0.4187	-0.0619	-2.5878	2.5260	-9.2586	2.3020
41	0.3293	-1.7148	-2.7767	1.0619	-9.5307	2.1040
42	1.3678	-1.5606	-0.5828	-0.9778	-6.4780	4.5113
43	0.2443	-0.6162	-2.9564	2.3402	-9.7910	1.9171
44	0.2700	-2.6173	-2.9019	0.2847	-9.7119	1.9736
45	0.4383	-2.5639	-2.5466	-0.0174	-9.1993	2.3455
46	3.4045	2.1282	3.7199	-1.5917	-1.2445	9.9861
47	4.6240	0.6931	6.2962	-5.6030	1.4347	13.7185
48	3.9973	0.0953	4.9722	-4.8769	0.0950	11.7632
49	3.1739	3.6687	3.2327	0.4360	-1.7866	9.3156
50	2.6810	3.5467	2.1915	1.3553	-2.9869	7.9247
51	3.6019	1.7047	4.1368	-2.4321	-0.7902	10.5694

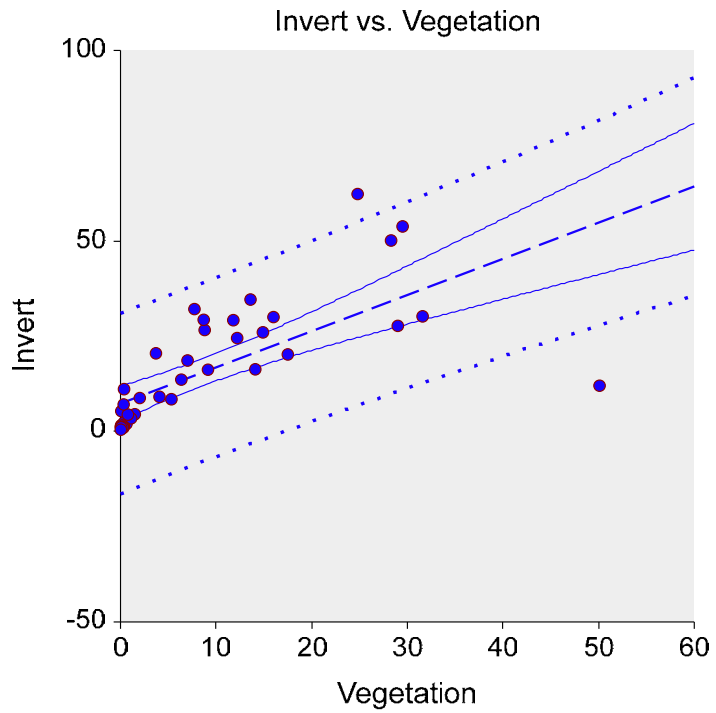
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Vegetation to Prey Tissue Linear Regressions
No Transformation – All Data

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Invert	Rows Processed	58
Independent Variable	Vegetation	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	7.3945	Rows Prediction Only	0
Slope	0.9466	Sum of Frequencies	42
R-Squared	0.4778	Sum of Weights	42.0000
Correlation	0.6912	Coefficient of Variation	0.7378
Mean Square Error	132.2355	Square Root of MSE	11.49937

Linear Regression Report

Y = Invert X = Vegetation

Summary Statement
The equation of the straight line relating Invert and Vegetation is estimated as: Invert = (7.3945) + (0.9466) Vegetation using the 42 observations in this dataset. The y-intercept, the estimated value of Invert when Vegetation is zero, is 7.3945 with a standard error of 2.2321. The slope, the estimated change in Invert per unit change in Vegetation, is 0.9466 with a standard error of 0.1565. The value of R-Squared, the proportion of the variation in Invert that can be accounted for by variation in Vegetation, is 0.4778. The correlation between Invert and Vegetation is 0.6912.

A significance test that the slope is zero resulted in a t-value of 6.0497. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.9466. The lower limit of the 95% confidence interval for the slope is 0.6304 and the upper limit is 1.2628. The estimated intercept is 7.3945. The lower limit of the 95% confidence interval for the intercept is 2.8832 and the upper limit is 11.9057.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Invert	Vegetation
Count	42	42
Mean	15.5869	8.6545
Standard Deviation	15.7178	11.4775
Minimum	0.4500	0.0300
Maximum	62.3000	50.1000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	7.3945	0.9466
Lower 95% Confidence Limit	2.8832	0.6304
Upper 95% Confidence Limit	11.9057	1.2628
Standard Error	2.2321	0.1565
Standardized Coefficient	0.0000	0.6912
T Value	3.3128	6.0497
Prob Level (T Test)	0.0020	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.8984	1.0000
Regression of Y on X	7.3945	0.9466
Inverse Regression from X on Y	-1.5593	1.9812
Orthogonal Regression of Y and X	2.0502	1.5641

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(7.39448462746372) + (0.946605534255479) * (Vegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	7.3945	0.9000	4.3433	11.5246
Bootstrap Mean	6.8016	0.9500	3.5408	11.8692
Bias (BM - OV)	-0.5929	0.9900	1.9916	12.5177
Bias Corrected	7.9874			
Standard Error	2.2465			
Slope				
Original Value	0.9466	0.9000	0.1819	1.3754
Bootstrap Mean	1.0565	0.9500	0.0715	1.4380
Bias (BM - OV)	0.1099	0.9900	-0.1486	1.5713
Bias Corrected	0.8367			
Standard Error	0.3807			
Correlation				
Original Value	0.6912	0.9000	0.4682	0.8847
Bootstrap Mean	0.7217	0.9500	0.4512	0.9249
Bias (BM - OV)	0.0304	0.9900	0.4276	1.0000
Bias Corrected	0.6608			
Standard Error	0.1374			
R-Squared				
Original Value	0.4778	0.9000	0.1197	0.7078
Bootstrap Mean	0.5397	0.9500	0.0884	0.7462
Bias (BM - OV)	0.0619	0.9900	0.0438	0.8125
Bias Corrected	0.4159			
Standard Error	0.1953			
Standard Error of Estimate				
Original Value	11.4994	0.9000	8.9351	16.7478
Bootstrap Mean	10.2197	0.9500	8.2761	17.2981
Bias (BM - OV)	-1.2796	0.9900	7.3088	18.3358
Bias Corrected	12.7790			
Standard Error	2.4893			
Orthogonal Intercept				
Original Value	2.0502	0.9000	-0.5567	3.8141
Bootstrap Mean	2.3301	0.9500	-1.1678	4.1940
Bias (BM - OV)	0.2799	0.9900	-3.2541	5.3749
Bias Corrected	1.7703			
Standard Error	1.3574			
Orthogonal Slope				
Original Value	1.5641	0.9000	1.0845	2.1195
Bootstrap Mean	1.5621	0.9500	1.0023	2.2356
Bias (BM - OV)	-0.0021	0.9900	0.8251	2.5146
Bias Corrected	1.5662			
Standard Error	0.3164			

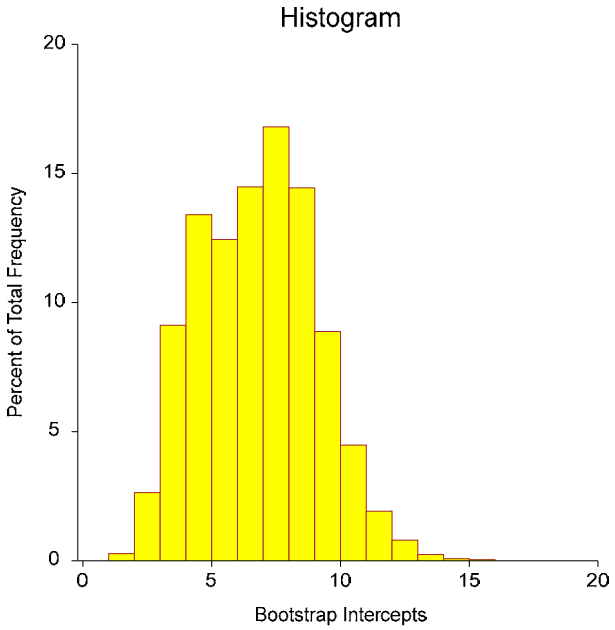
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

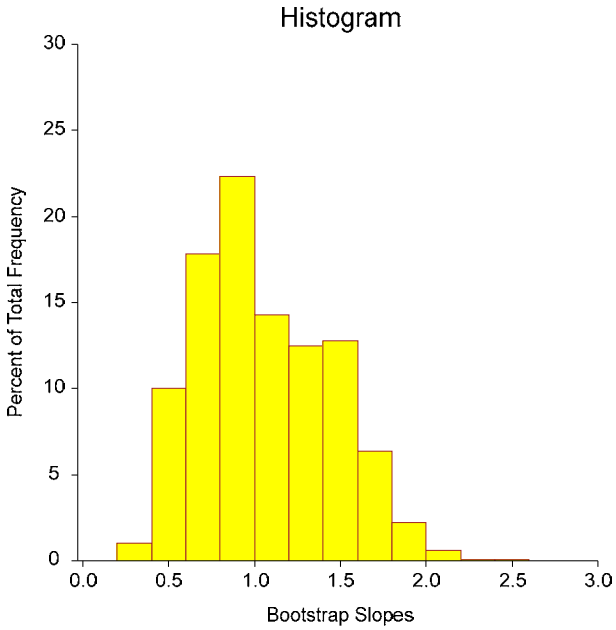
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

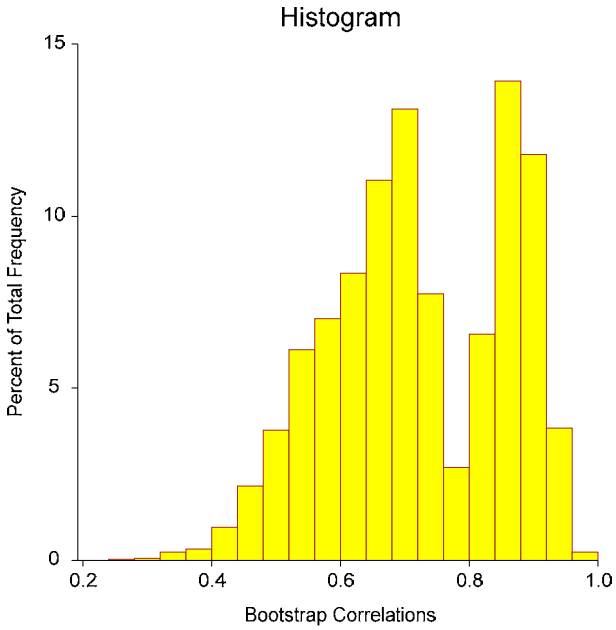
Linear Regression Report

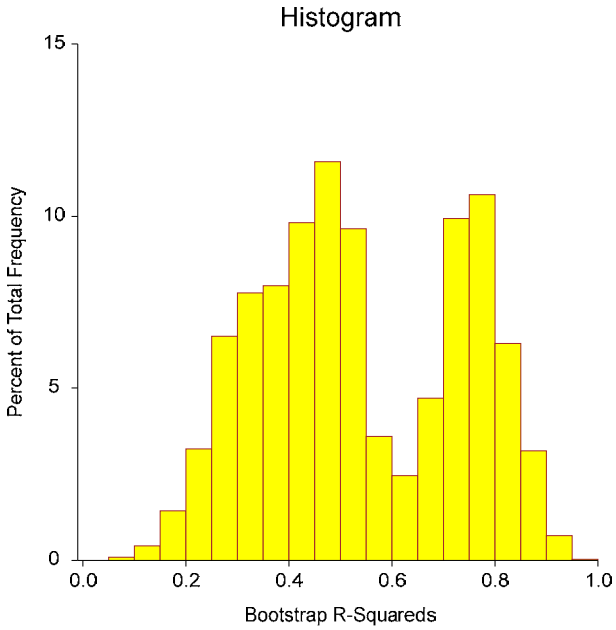
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Bootstrap Histograms Section



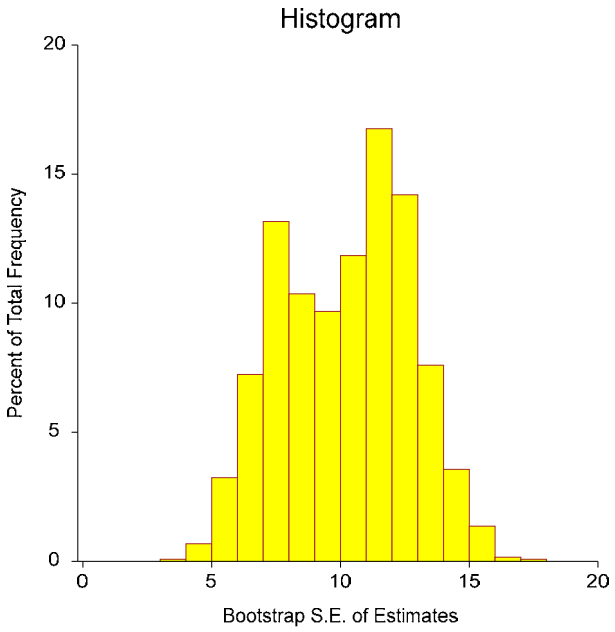


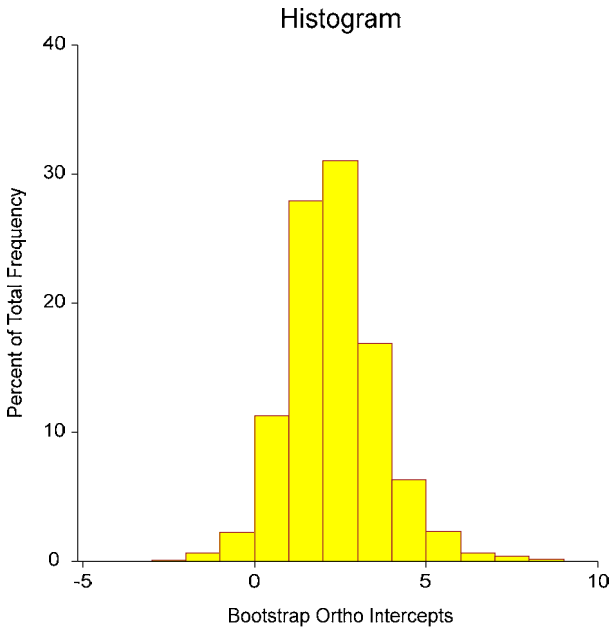


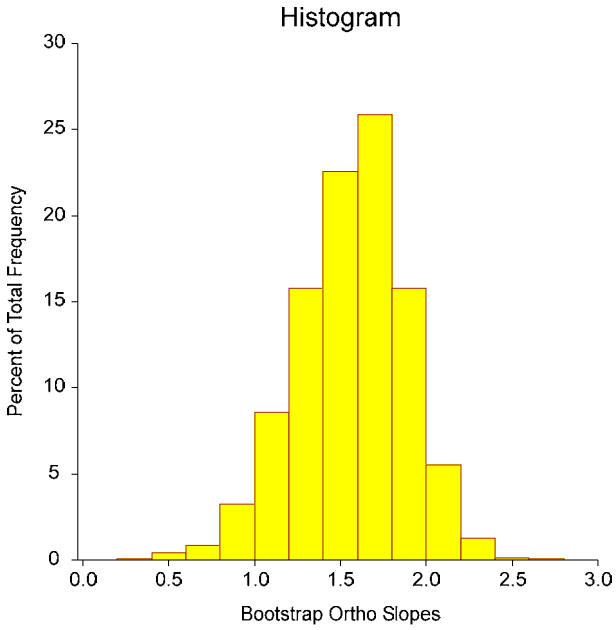


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.6912	0.4778	0.8870
Lower 95% Conf. Limit (r dist'n)	0.4856		
Upper 95% Conf. Limit (r dist'n)	0.8187		
Lower 95% Conf. Limit (Fisher's z)	0.4903		0.7983
Upper 95% Conf. Limit (Fisher's z)	0.8224		0.9381
Adjusted (Rbar)		0.4647	
T-Value for H0: Rho = 0	6.0497	6.0497	12.1508
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	10203.97	10203.97			
Slope	1	4839.642	4839.642	36.5987	0.0000	1.0000
Error	40	5289.42	132.2355			
Lack of Fit	38	5272.773	138.7572	16.6709	0.0581	
Pure Error	2	16.64665	8.323325			
Adj. Total	41	10129.06	247.0503			
Total	42	20333.03				

s = Square Root(132.2355) = 11.49937

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	363.49	654.65	0.03767744	-0.001602389
1	363.49	8546.845	10778.31	-0.001602389	0.0001851505
2 (Y'Y)			20333.03		
Determinant		226842.5			4.408345E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	4.982295	-0.2118927
1	-0.2118927	0.02448347

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.8345	0.000026	No
Anderson Darling	2.3512	0.000006	No
D'Agostino Skewness	-1.2986	0.194096	No
D'Agostino Kurtosis	3.2673	0.001086	No
D'Agostino Omnibus	12.3612	0.002069	No
Constant Residual Variance?			
Modified Levene Test	10.3887	0.002524	No
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	16.6709	0.058132	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

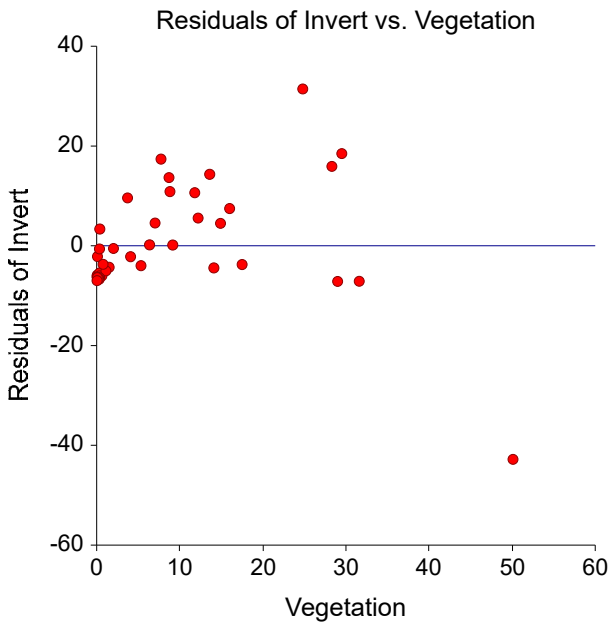
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

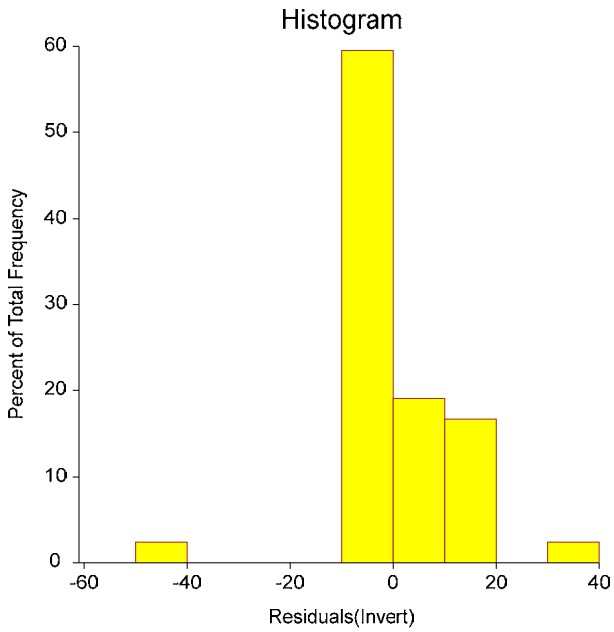
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

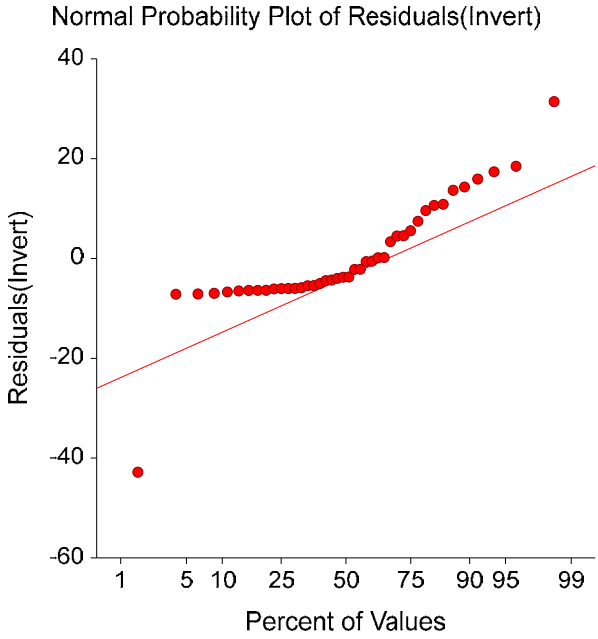
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Original Data Section

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual
10	31.6000	30.2000	37.3072	-7.1072
11	17.5000	20.2000	23.9601	-3.7601
12	50.1000	12.0000	54.8194	-42.8194
13	4.0800	9.0700	11.2566	-2.1866
14	14.1000	16.3000	20.7416	-4.4416
15	0.3700	11.1000	7.7447	3.3553
16	0.0800	1.6100	7.4702	-5.8602
17	0.4300	2.3600	7.8015	-5.4415
18	0.1100	1.5200	7.4986	-5.9786
19	0.6200	1.9700	7.9814	-6.0114
20	1.5000	4.5000	8.8144	-4.3144
21	0.0300	1.3200	7.4229	-6.1029
22	13.6000	34.6000	20.2683	14.3317
23	2.0200	8.7700	9.3066	-0.5366
24	12.2000	24.5000	18.9431	5.5569
25	14.9000	26.0000	21.4989	4.5011
26	29.5000	53.8000	35.3193	18.4807
27	24.8000	62.3000	30.8703	31.4297
28	7.7400	32.1000	14.7212	17.3788
29	28.3000	50.1000	34.1834	15.9166
30	8.8100	26.6000	15.7341	10.8659
31	9.1500	16.2000	16.0559	0.1441
32	5.3300	8.4500	12.4399	-3.9899
33	11.8000	29.2000	18.5644	10.6356
34	0.0900	5.3200	7.4797	-2.1597
35	0.3500	2.2700	7.7258	-5.4558
36	0.3400	1.6800	7.7163	-6.0363
37	1.1100	3.4200	8.4452	-5.0252
38	0.7700	4.4100	8.1234	-3.7134
39	0.3300	1.3100	7.7069	-6.3969
40	0.3300	7.0800	7.7069	-0.6269
41	0.0700	1.0900	7.4607	-6.3707
42	0.3000	0.9700	7.6785	-6.7085
43	0.2300	1.1100	7.6122	-6.5022
44	0.0700	1.0700	7.4607	-6.3907
45	0.0400	0.4500	7.4323	-6.9823
46	3.7100	20.5000	10.9064	9.5936
47	8.7000	29.3000	15.6300	13.6700
48	7.0200	18.6000	14.0397	4.5603
49	29.0000	27.7000	34.8460	-7.1460
50	6.3600	13.6000	13.4149	0.1851
51	16.0000	30.0000	22.5402	7.4598

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Predicted Values and Confidence Limits of Means

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	31.6000	30.2000	37.3072	4.0049	29.2131	45.4013
11	17.5000	20.2000	23.9601	2.2504	19.4119	28.5082
12	50.1000	12.0000	54.8194	6.7234	41.2309	68.4080
13	4.0800	9.0700	11.2566	1.9133	7.3897	15.1236
14	14.1000	16.3000	20.7416	1.9684	16.7634	24.7198
15	0.3700	11.1000	7.7447	2.1975	3.3035	12.1860
16	0.0800	1.6100	7.4702	2.2245	2.9743	11.9662
17	0.4300	2.3600	7.8015	2.1919	3.3715	12.2316
18	0.1100	1.5200	7.4986	2.2217	3.0084	11.9888
19	0.6200	1.9700	7.9814	2.1746	3.5863	12.3764
20	1.5000	4.5000	8.8144	2.0980	4.5741	13.0547
21	0.0300	1.3200	7.4229	2.2293	2.9174	11.9284
22	13.6000	34.6000	20.2683	1.9358	16.3559	24.1807
23	2.0200	8.7700	9.3066	2.0558	5.1518	13.4615
24	12.2000	24.5000	18.9431	1.8591	15.1857	22.7004
25	14.9000	26.0000	21.4989	2.0257	17.4048	25.5930
26	29.5000	53.8000	35.3193	3.7131	27.8148	42.8239
27	24.8000	62.3000	30.8703	3.0872	24.6309	37.1097
28	7.7400	32.1000	14.7212	1.7802	11.1234	18.3190
29	28.3000	50.1000	34.1834	3.5493	27.0100	41.3569
30	8.8100	26.6000	15.7341	1.7746	12.1476	19.3206
31	9.1500	16.2000	16.0559	1.7761	12.4663	19.6455
32	5.3300	8.4500	12.4399	1.8491	8.7028	16.1770
33	11.8000	29.2000	18.5644	1.8414	14.8428	22.2860
34	0.0900	5.3200	7.4797	2.2236	2.9856	11.9737
35	0.3500	2.2700	7.7258	2.1993	3.2808	12.1708
36	0.3400	1.6800	7.7163	2.2002	3.2695	12.1632
37	1.1100	3.4200	8.4452	2.1312	4.1379	12.7526
38	0.7700	4.4100	8.1234	2.1611	3.7556	12.4912
39	0.3300	1.3100	7.7069	2.2012	3.2582	12.1556
40	0.3300	7.0800	7.7069	2.2012	3.2582	12.1556
41	0.0700	1.0900	7.4607	2.2255	2.9629	11.9586
42	0.3000	0.9700	7.6785	2.2039	3.2241	12.1328
43	0.2300	1.1100	7.6122	2.2105	3.1447	12.0797
44	0.0700	1.0700	7.4607	2.2255	2.9629	11.9586
45	0.0400	0.4500	7.4323	2.2283	2.9288	11.9359
46	3.7100	20.5000	10.9064	1.9357	6.9941	14.8186
47	8.7000	29.3000	15.6300	1.7744	12.0437	19.2162
48	7.0200	18.6000	14.0397	1.7927	10.4164	17.6629
49	29.0000	27.7000	34.8460	3.6446	27.4800	42.2121
50	6.3600	13.6000	13.4149	1.8103	9.7560	17.0737
51	16.0000	30.0000	22.5402	2.1141	18.2674	26.8130

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Predicted Values and Prediction Limits

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	31.6000	30.2000	37.3072	12.1768	12.6970	61.9174
11	17.5000	20.2000	23.9601	11.7175	0.2781	47.6420
12	50.1000	12.0000	54.8194	13.3207	27.8974	81.7415
13	4.0800	9.0700	11.2566	11.6575	-12.3040	34.8172
14	14.1000	16.3000	20.7416	11.6666	-2.8375	44.3207
15	0.3700	11.1000	7.7447	11.7074	-15.9169	31.4064
16	0.0800	1.6100	7.4702	11.7126	-16.2018	31.1422
17	0.4300	2.3600	7.8015	11.7064	-15.8580	31.4611
18	0.1100	1.5200	7.4986	11.7120	-16.1723	31.1695
19	0.6200	1.9700	7.9814	11.7032	-15.6716	31.6344
20	1.5000	4.5000	8.8144	11.6892	-14.8103	32.4391
21	0.0300	1.3200	7.4229	11.7135	-16.2509	31.0967
22	13.6000	34.6000	20.2683	11.6612	-3.2998	43.8364
23	2.0200	8.7700	9.3066	11.6817	-14.3029	32.9162
24	12.2000	24.5000	18.9431	11.6487	-4.5998	42.4859
25	14.9000	26.0000	21.4989	11.6764	-2.1000	45.0978
26	29.5000	53.8000	35.3193	12.0840	10.8967	59.7420
27	24.8000	62.3000	30.8703	11.9066	6.8062	54.9344
28	7.7400	32.1000	14.7212	11.6363	-8.7967	38.2391
29	28.3000	50.1000	34.1834	12.0347	9.8605	58.5064
30	8.8100	26.6000	15.7341	11.6355	-7.7821	39.2503
31	9.1500	16.2000	16.0559	11.6357	-7.4607	39.5726
32	5.3300	8.4500	12.4399	11.6471	-11.0997	35.9795
33	11.8000	29.2000	18.5644	11.6459	-4.9727	42.1016
34	0.0900	5.3200	7.4797	11.7124	-16.1919	31.1513
35	0.3500	2.2700	7.7258	11.7078	-15.9365	31.3881
36	0.3400	1.6800	7.7163	11.7080	-15.9464	31.3790
37	1.1100	3.4200	8.4452	11.6952	-15.1917	32.0821
38	0.7700	4.4100	8.1234	11.7007	-15.5246	31.7713
39	0.3300	1.3100	7.7069	11.7081	-15.9562	31.3699
40	0.3300	7.0800	7.7069	11.7081	-15.9562	31.3699
41	0.0700	1.0900	7.4607	11.7127	-16.2116	31.1331
42	0.3000	0.9700	7.6785	11.7087	-15.9856	31.3426
43	0.2300	1.1100	7.6122	11.7099	-16.0544	31.2788
44	0.0700	1.0700	7.4607	11.7127	-16.2116	31.1331
45	0.0400	0.4500	7.4323	11.7133	-16.2411	31.1058
46	3.7100	20.5000	10.9064	11.6612	-12.6617	34.4745
47	8.7000	29.3000	15.6300	11.6355	-7.8862	39.1461
48	7.0200	18.6000	14.0397	11.6383	-9.4822	37.5615
49	29.0000	27.7000	34.8460	12.0631	10.4656	59.2265
50	6.3600	13.6000	13.4149	11.6410	-10.1124	36.9422
51	16.0000	30.0000	22.5402	11.6921	-1.0904	46.1708

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Working-Hotelling Simultaneous Confidence Band

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	31.6000	30.2000	37.3072	4.0049	25.9078	48.7066
11	17.5000	20.2000	23.9601	2.2504	17.5547	30.3655
12	50.1000	12.0000	54.8194	6.7234	35.6819	73.9570
13	4.0800	9.0700	11.2566	1.9133	5.8106	16.7027
14	14.1000	16.3000	20.7416	1.9684	15.1389	26.3444
15	0.3700	11.1000	7.7447	2.1975	1.4899	13.9996
16	0.0800	1.6100	7.4702	2.2245	1.1383	13.8021
17	0.4300	2.3600	7.8015	2.1919	1.5624	14.0407
18	0.1100	1.5200	7.4986	2.2217	1.1748	13.8225
19	0.6200	1.9700	7.9814	2.1746	1.7916	14.1712
20	1.5000	4.5000	8.8144	2.0980	2.8426	14.7862
21	0.0300	1.3200	7.4229	2.2293	1.0775	13.7682
22	13.6000	34.6000	20.2683	1.9358	14.7583	25.7783
23	2.0200	8.7700	9.3066	2.0558	3.4551	15.1581
24	12.2000	24.5000	18.9431	1.8591	13.6513	24.2348
25	14.9000	26.0000	21.4989	2.0257	15.7330	27.2649
26	29.5000	53.8000	35.3193	3.7131	24.7503	45.8884
27	24.8000	62.3000	30.8703	3.0872	22.0829	39.6577
28	7.7400	32.1000	14.7212	1.7802	9.6542	19.7882
29	28.3000	50.1000	34.1834	3.5493	24.0806	44.2862
30	8.8100	26.6000	15.7341	1.7746	10.6830	20.7852
31	9.1500	16.2000	16.0559	1.7761	11.0005	21.1114
32	5.3300	8.4500	12.4399	1.8491	7.1767	17.7031
33	11.8000	29.2000	18.5644	1.8414	13.3231	23.8057
34	0.0900	5.3200	7.4797	2.2236	1.1505	13.8089
35	0.3500	2.2700	7.7258	2.1993	1.4657	13.9859
36	0.3400	1.6800	7.7163	2.2002	1.4536	13.9791
37	1.1100	3.4200	8.4452	2.1312	2.3789	14.5115
38	0.7700	4.4100	8.1234	2.1611	1.9719	14.2748
39	0.3300	1.3100	7.7069	2.2012	1.4415	13.9722
40	0.3300	7.0800	7.7069	2.2012	1.4415	13.9722
41	0.0700	1.0900	7.4607	2.2255	1.1262	13.7953
42	0.3000	0.9700	7.6785	2.2039	1.4052	13.9518
43	0.2300	1.1100	7.6122	2.2105	1.3204	13.9040
44	0.0700	1.0700	7.4607	2.2255	1.1262	13.7953
45	0.0400	0.4500	7.4323	2.2283	1.0897	13.7750
46	3.7100	20.5000	10.9064	1.9357	5.3965	16.4162
47	8.7000	29.3000	15.6300	1.7744	10.5793	20.6806
48	7.0200	18.6000	14.0397	1.7927	8.9368	19.1425
49	29.0000	27.7000	34.8460	3.6446	24.4721	45.2200
50	6.3600	13.6000	13.4149	1.8103	8.2619	18.5679
51	16.0000	30.0000	22.5402	2.1141	16.5226	28.5578

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Section

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	31.6000	30.2000	37.3072	-7.1072	-0.6593	23.5338
11	17.5000	20.2000	23.9601	-3.7601	-0.3334	18.6143
12	50.1000	12.0000	54.8194	-42.8194	-4.5899	356.8285
13	4.0800	9.0700	11.2566	-2.1866	-0.1928	24.1084
14	14.1000	16.3000	20.7416	-4.4416	-0.3920	27.2492
15	0.3700	11.1000	7.7447	3.3553	0.2973	30.2277
16	0.0800	1.6100	7.4702	-5.8602	-0.5194	363.9884
17	0.4300	2.3600	7.8015	-5.4415	-0.4820	230.5731
18	0.1100	1.5200	7.4986	-5.9786	-0.5299	393.3297
19	0.6200	1.9700	7.9814	-6.0114	-0.5324	305.1462
20	1.5000	4.5000	8.8144	-4.3144	-0.3816	95.8754
21	0.0300	1.3200	7.4229	-6.1029	-0.5410	462.3396
22	13.6000	34.6000	20.2683	14.3317	1.2643	41.4210
23	2.0200	8.7700	9.3066	-0.5366	-0.0474	6.1189
24	12.2000	24.5000	18.9431	5.5569	0.4897	22.6813
25	14.9000	26.0000	21.4989	4.5011	0.3976	17.3119
26	29.5000	53.8000	35.3193	18.4807	1.6981	34.3507
27	24.8000	62.3000	30.8703	31.4297	2.8373	50.4490
28	7.7400	32.1000	14.7212	17.3788	1.5297	54.1395
29	28.3000	50.1000	34.1834	15.9166	1.4552	31.7696
30	8.8100	26.6000	15.7341	10.8659	0.9564	40.8493
31	9.1500	16.2000	16.0559	0.1441	0.0127	0.8894
32	5.3300	8.4500	12.4399	-3.9899	-0.3515	47.2177
33	11.8000	29.2000	18.5644	10.6356	0.9370	36.4232
34	0.0900	5.3200	7.4797	-2.1597	-0.1914	40.5955
35	0.3500	2.2700	7.7258	-5.4558	-0.4834	240.3435
36	0.3400	1.6800	7.7163	-6.0363	-0.5348	359.3054
37	1.1100	3.4200	8.4452	-5.0252	-0.4447	146.9362
38	0.7700	4.4100	8.1234	-3.7134	-0.3288	84.2034
39	0.3300	1.3100	7.7069	-6.3969	-0.5668	488.3103
40	0.3300	7.0800	7.7069	-0.6269	-0.0555	8.8540
41	0.0700	1.0900	7.4607	-6.3707	-0.5647	584.4722
42	0.3000	0.9700	7.6785	-6.7085	-0.5944	691.5945
43	0.2300	1.1100	7.6122	-6.5022	-0.5762	585.7841
44	0.0700	1.0700	7.4607	-6.3907	-0.5665	597.2661
45	0.0400	0.4500	7.4323	-6.9823	-0.6189	1551.6331
46	3.7100	20.5000	10.9064	9.5936	0.8463	46.7981
47	8.7000	29.3000	15.6300	13.6700	1.2032	46.6555
48	7.0200	18.6000	14.0397	4.5603	0.4015	24.5180
49	29.0000	27.7000	34.8460	-7.1460	-0.6552	25.7980
50	6.3600	13.6000	13.4149	0.1851	0.0163	1.3611
51	16.0000	30.0000	22.5402	7.4598	0.6600	24.8661

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Diagnostics Section

Row	Vegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	31.6000	-7.1072	*-0.6546	0.1213	0.0300	134.1522
11	17.5000	-3.7601	-0.3297	0.0383	0.0022	135.2492
12	50.1000	-42.8194	**-6.5876	0.3418	*5.4712	64.1945
13	4.0800	-2.1866	-0.1905	0.0277	0.0005	135.5001
14	14.1000	-4.4416	-0.3878	0.0293	0.0023	135.1050
15	0.3700	3.3553	0.2938	0.0365	0.0017	135.3265
16	0.0800	-5.8602	-0.5146	0.0374	0.0052	134.7113
17	0.4300	-5.4415	-0.4774	0.0363	0.0044	134.8383
18	0.1100	-5.9786	-0.5251	0.0373	0.0054	134.6741
19	0.6200	-6.0114	-0.5275	0.0358	0.0053	134.6652
20	1.5000	-4.3144	-0.3775	0.0333	0.0025	135.1324
21	0.0300	-6.1029	-0.5361	0.0376	0.0057	134.6339
22	13.6000	14.3317	1.2742	0.0283	0.0233	130.2060
23	2.0200	-0.5366	-0.0468	0.0320	0.0000	135.6185
24	12.2000	5.5569	0.4850	0.0261	0.0032	134.8131
25	14.9000	4.5011	0.3934	0.0310	0.0025	135.0900
26	29.5000	18.4807	*1.7406	0.1043	0.1678	125.8495
27	24.8000	31.4297	*3.1348	0.0721	0.3126	108.3299
28	7.7400	17.3788	1.5567	0.0240	0.0287	127.6918
29	28.3000	15.9166	*1.4765	0.0953	0.1115	128.4463
30	8.8100	10.8659	0.9553	0.0238	0.0112	132.5249
31	9.1500	0.1441	0.0125	0.0239	0.0000	135.6256
32	5.3300	-3.9899	-0.3477	0.0259	0.0016	135.2071
33	11.8000	10.6356	0.9355	0.0256	0.0116	132.6494
34	0.0900	-2.1597	-0.1891	0.0374	0.0007	135.5019
35	0.3500	-5.4558	-0.4787	0.0366	0.0044	134.8339
36	0.3400	-6.0363	-0.5300	0.0366	0.0054	134.6564
37	1.1100	-5.0252	-0.4402	0.0343	0.0035	134.9556
38	0.7700	-3.7134	-0.3251	0.0353	0.0020	135.2596
39	0.3300	-6.3969	-0.5619	0.0366	0.0061	134.5370
40	0.3300	-0.6269	-0.0548	0.0366	0.0001	135.6157
41	0.0700	-6.3707	-0.5598	0.0375	0.0062	134.5450
42	0.3000	-6.7085	-0.5895	0.0367	0.0067	134.4282
43	0.2300	-6.5022	-0.5713	0.0370	0.0064	134.5005
44	0.0700	-6.3907	-0.5616	0.0375	0.0062	134.5382
45	0.0400	-6.9823	-0.6141	0.0375	0.0075	134.3273
46	3.7100	9.5936	0.8433	0.0283	0.0104	133.1974
47	8.7000	13.6700	1.2101	0.0238	0.0177	130.7177
48	7.0200	4.5603	0.3972	0.0243	0.0020	135.0796
49	29.0000	-7.1460	*-0.6505	0.1005	0.0240	134.1706
50	6.3600	0.1851	0.0161	0.0248	0.0000	135.6252
51	16.0000	7.4598	0.6552	0.0338	0.0076	134.1493

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.6546	-0.2432	0.0300	* 1.1713	0.0466	-0.2180
11	-0.3297	-0.0658	0.0022	1.0878	-0.0167	-0.0405
12	* -6.5876	-4.7477	** 5.4712	0.3581	1.7822	-4.5794
13	-0.1905	-0.0321	0.0005	1.0799	-0.0310	0.0120
14	-0.3878	-0.0674	0.0023	1.0754	-0.0306	-0.0292
15	0.2938	0.0572	0.0017	1.0870	0.0572	-0.0337
16	-0.5146	-0.1015	0.0052	1.0781	-0.1015	0.0612
17	-0.4774	-0.0927	0.0044	1.0790	-0.0927	0.0544
18	-0.5251	-0.1034	0.0054	1.0774	-0.1034	0.0622
19	-0.5275	-0.1016	0.0053	1.0755	-0.1015	0.0587
20	-0.3775	-0.0700	0.0025	1.0803	-0.0698	0.0374
21	-0.5361	-0.1059	0.0057	1.0771	-0.1059	0.0641
22	1.2742	0.2176	0.0233	0.9978	0.1058	0.0870
23	-0.0468	-0.0085	0.0000	1.0865	-0.0084	0.0043
24	0.4850	0.0795	0.0032	1.0673	0.0459	0.0237
25	0.3934	0.0704	0.0025	1.0771	0.0284	0.0340
26	1.7406	0.5939	0.1678	1.0112	-0.0909	0.5217
27	* 3.1348	0.8737	0.3126	0.7232	-0.0346	0.7149
28	1.5567	0.2439	0.0287	0.9554	0.2052	-0.0196
29	1.4765	0.4791	0.1115	1.0429	-0.0613	0.4149
30	0.9553	0.1492	0.0112	1.0289	0.1174	0.0020
31	0.0125	0.0020	0.0000	1.0776	0.0015	0.0001
32	-0.3477	-0.0566	0.0016	1.0732	-0.0529	0.0159
33	0.9355	0.1518	0.0116	1.0328	0.0916	0.0406
34	-0.1891	-0.0373	0.0007	1.0908	-0.0373	0.0225
35	-0.4787	-0.0933	0.0044	1.0792	-0.0933	0.0551
36	-0.5300	-0.1033	0.0054	1.0764	-0.1033	0.0611
37	-0.4402	-0.0830	0.0035	1.0786	-0.0828	0.0460
38	-0.3251	-0.0622	0.0020	1.0846	-0.0621	0.0355
39	-0.5619	-0.1096	0.0061	1.0745	-0.1096	0.0648
40	-0.0548	-0.0107	0.0001	1.0918	-0.0107	0.0063
41	-0.5598	-0.1104	0.0062	1.0755	-0.1104	0.0667
42	-0.5895	-0.1151	0.0067	1.0728	-0.1151	0.0683
43	-0.5713	-0.1119	0.0064	1.0742	-0.1119	0.0667
44	-0.5616	-0.1108	0.0062	1.0754	-0.1108	0.0669
45	-0.6141	-0.1213	0.0075	1.0721	-0.1213	0.0734
46	0.8433	0.1440	0.0104	1.0442	0.1399	-0.0576
47	1.2101	0.1890	0.0177	1.0010	0.1498	0.0008
48	0.3972	0.0627	0.0020	1.0695	0.0548	-0.0089
49	-0.6505	-0.2174	0.0240	* 1.1444	0.0311	-0.1899
50	0.0161	0.0026	0.0000	1.0787	0.0023	-0.0005
51	0.6552	0.1226	0.0076	1.0652	0.0413	0.0666

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Outlier Detection Chart

Row	Vegetation (X)	Residual		Standardized Residual		RStudent	
10	31.6000	-7.1072	||.....	-0.6593	||.....	-0.6546	|.....
11	17.5000	-3.7601	|.....	-0.3334	|.....	-0.3297	|.....
12	50.1000	-42.8194	|||||||||||||||	-4.5899	|||||||||||||||	* -6.5876	|||||||||||||||
13	4.0800	-2.1866	|.....	-0.1928	|.....	-0.1905	|.....
14	14.1000	-4.4416	|.....	-0.3920	|.....	-0.3878	|.....
15	0.3700	3.3553	|.....	0.2973	|.....	0.2938	|.....
16	0.0800	-5.8602	||.....	-0.5194	|.....	-0.5146	|.....
17	0.4300	-5.4415	|.....	-0.4820	|.....	-0.4774	|.....
18	0.1100	-5.9786	||.....	-0.5299	|.....	-0.5251	|.....
19	0.6200	-6.0114	||.....	-0.5324	|.....	-0.5275	|.....
20	1.5000	-4.3144	|.....	-0.3816	|.....	-0.3775	|.....
21	0.0300	-6.1029	||.....	-0.5410	|.....	-0.5361	|.....
22	13.6000	14.3317	||||.....	1.2643	||||.....	1.2742	||.....
23	2.0200	-0.5366	|.....	-0.0474	|.....	-0.0468	|.....
24	12.2000	5.5569	|.....	0.4897	|.....	0.4850	|.....
25	14.9000	4.5011	|.....	0.3976	|.....	0.3934	|.....
26	29.5000	18.4807	||||||.....	1.6981	|||||.....	1.7406	|||.....
27	24.8000	31.4297	|||||||||.....	2.8373	|||||||||.....	* 3.1348	|||||||.....
28	7.7400	17.3788	||||||.....	1.5297	||||.....	1.5567	|||.....
29	28.3000	15.9166	|||||.....	1.4552	||||.....	1.4765	|||.....
30	8.8100	10.8659	|||.....	0.9564	|||.....	0.9553	||.....
31	9.1500	0.1441	|.....	0.0127	|.....	0.0125	|.....
32	5.3300	-3.9899	|.....	-0.3515	|.....	-0.3477	|.....
33	11.8000	10.6356	|||.....	0.9370	|||.....	0.9355	||.....
34	0.0900	-2.1597	|.....	-0.1914	|.....	-0.1891	|.....
35	0.3500	-5.4558	|.....	-0.4834	|.....	-0.4787	|.....
36	0.3400	-6.0363	||.....	-0.5348	|.....	-0.5300	|.....
37	1.1100	-5.0252	|.....	-0.4447	|.....	-0.4402	|.....
38	0.7700	-3.7134	|.....	-0.3288	|.....	-0.3251	|.....
39	0.3300	-6.3969	||.....	-0.5668	|.....	-0.5619	|.....
40	0.3300	-0.6269	|.....	-0.0555	|.....	-0.0548	|.....
41	0.0700	-6.3707	||.....	-0.5647	|.....	-0.5598	|.....
42	0.3000	-6.7085	||.....	-0.5944	|.....	-0.5895	|.....
43	0.2300	-6.5022	||.....	-0.5762	|.....	-0.5713	|.....
44	0.0700	-6.3907	||.....	-0.5665	|.....	-0.5616	|.....
45	0.0400	-6.9823	||.....	-0.6189	|.....	-0.6141	|.....
46	3.7100	9.5936	|||.....	0.8463	||.....	0.8433	|.....
47	8.7000	13.6700	||||.....	1.2032	|||.....	1.2101	||.....
48	7.0200	4.5603	|.....	0.4015	|.....	0.3972	|.....
49	29.0000	-7.1460	||.....	-0.6552	||.....	-0.6505	|.....
50	6.3600	0.1851	|.....	0.0163	|.....	0.0161	|.....
51	16.0000	7.4598	||.....	0.6600	||.....	0.6552	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Influence Detection Chart

Row	Vegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	31.6000	-0.2432	|.....	0.0300	|.....	-0.2180	|.....
11	17.5000	-0.0658	|.....	0.0022	|.....	-0.0405	|.....
12	50.1000	-4.7477	|||||||||||||||	** 5.4712	|||||||||||||||	-4.5794	|||||||||||||||
13	4.0800	-0.0321	|.....	0.0005	|.....	0.0120	|.....
14	14.1000	-0.0674	|.....	0.0023	|.....	-0.0292	|.....
15	0.3700	0.0572	|.....	0.0017	|.....	-0.0337	|.....
16	0.0800	-0.1015	|.....	0.0052	|.....	0.0612	|.....
17	0.4300	-0.0927	|.....	0.0044	|.....	0.0544	|.....
18	0.1100	-0.1034	|.....	0.0054	|.....	0.0622	|.....
19	0.6200	-0.1016	|.....	0.0053	|.....	0.0587	|.....
20	1.5000	-0.0700	|.....	0.0025	|.....	0.0374	|.....
21	0.0300	-0.1059	|.....	0.0057	|.....	0.0641	|.....
22	13.6000	0.2176	|.....	0.0233	|.....	0.0870	|.....
23	2.0200	-0.0085	|.....	0.0000	|.....	0.0043	|.....
24	12.2000	0.0795	|.....	0.0032	|.....	0.0237	|.....
25	14.9000	0.0704	|.....	0.0025	|.....	0.0340	|.....
26	29.5000	0.5939	|.....	0.1678	|.....	0.5217	|.....
27	24.8000	0.8737	||.....	0.3126	|.....	0.7149	||.....
28	7.7400	0.2439	|.....	0.0287	|.....	-0.0196	|.....
29	28.3000	0.4791	|.....	0.1115	|.....	0.4149	|.....
30	8.8100	0.1492	|.....	0.0112	|.....	0.0020	|.....
31	9.1500	0.0020	|.....	0.0000	|.....	0.0001	|.....
32	5.3300	-0.0566	|.....	0.0016	|.....	0.0159	|.....
33	11.8000	0.1518	|.....	0.0116	|.....	0.0406	|.....
34	0.0900	-0.0373	|.....	0.0007	|.....	0.0225	|.....
35	0.3500	-0.0933	|.....	0.0044	|.....	0.0551	|.....
36	0.3400	-0.1033	|.....	0.0054	|.....	0.0611	|.....
37	1.1100	-0.0830	|.....	0.0035	|.....	0.0460	|.....
38	0.7700	-0.0622	|.....	0.0020	|.....	0.0355	|.....
39	0.3300	-0.1096	|.....	0.0061	|.....	0.0648	|.....
40	0.3300	-0.0107	|.....	0.0001	|.....	0.0063	|.....
41	0.0700	-0.1104	|.....	0.0062	|.....	0.0667	|.....
42	0.3000	-0.1151	|.....	0.0067	|.....	0.0683	|.....
43	0.2300	-0.1119	|.....	0.0064	|.....	0.0667	|.....
44	0.0700	-0.1108	|.....	0.0062	|.....	0.0669	|.....
45	0.0400	-0.1213	|.....	0.0075	|.....	0.0734	|.....
46	3.7100	0.1440	|.....	0.0104	|.....	-0.0576	|.....
47	8.7000	0.1890	|.....	0.0177	|.....	0.0008	|.....
48	7.0200	0.0627	|.....	0.0020	|.....	-0.0089	|.....
49	29.0000	-0.2174	|.....	0.0240	|.....	-0.1899	|.....
50	6.3600	0.0026	|.....	0.0000	|.....	-0.0005	|.....
51	16.0000	0.1226	|.....	0.0076	|.....	0.0666	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Outlier & Influence Chart

Row	Vegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	31.6000	-0.6546	|.....	0.0300	|.....	0.1213	||||.....
11	17.5000	-0.3297	|.....	0.0022	|.....	0.0383	|.....
12	50.1000	* -6.5876	|||||||||||||||	** 5.4712	|||||||||||||||	0.3418	|||||||||||||||
13	4.0800	-0.1905	|.....	0.0005	|.....	0.0277	|.....
14	14.1000	-0.3878	|.....	0.0023	|.....	0.0293	|.....
15	0.3700	0.2938	|.....	0.0017	|.....	0.0365	|.....
16	0.0800	-0.5146	|.....	0.0052	|.....	0.0374	|.....
17	0.4300	-0.4774	|.....	0.0044	|.....	0.0363	|.....
18	0.1100	-0.5251	|.....	0.0054	|.....	0.0373	|.....
19	0.6200	-0.5275	|.....	0.0053	|.....	0.0358	|.....
20	1.5000	-0.3775	|.....	0.0025	|.....	0.0333	|.....
21	0.0300	-0.5361	|.....	0.0057	|.....	0.0376	|.....
22	13.6000	1.2742	||.....	0.0233	|.....	0.0283	|.....
23	2.0200	-0.0468	|.....	0.0000	|.....	0.0320	|.....
24	12.2000	0.4850	|.....	0.0032	|.....	0.0261	|.....
25	14.9000	0.3934	|.....	0.0025	|.....	0.0310	|.....
26	29.5000	1.7406	|||.....	0.1678	|.....	0.1043	|||.....
27	24.8000	* 3.1348	|||||||.....	0.3126	|.....	0.0721	||.....
28	7.7400	1.5567	|||.....	0.0287	|.....	0.0240	|.....
29	28.3000	1.4765	|||.....	0.1115	|.....	0.0953	|||.....
30	8.8100	0.9553	||.....	0.0112	|.....	0.0238	|.....
31	9.1500	0.0125	|.....	0.0000	|.....	0.0239	|.....
32	5.3300	-0.3477	|.....	0.0016	|.....	0.0259	|.....
33	11.8000	0.9355	||.....	0.0116	|.....	0.0256	|.....
34	0.0900	-0.1891	|.....	0.0007	|.....	0.0374	|.....
35	0.3500	-0.4787	|.....	0.0044	|.....	0.0366	|.....
36	0.3400	-0.5300	|.....	0.0054	|.....	0.0366	|.....
37	1.1100	-0.4402	|.....	0.0035	|.....	0.0343	|.....
38	0.7700	-0.3251	|.....	0.0020	|.....	0.0353	|.....
39	0.3300	-0.5619	|.....	0.0061	|.....	0.0366	|.....
40	0.3300	-0.0548	|.....	0.0001	|.....	0.0366	|.....
41	0.0700	-0.5598	|.....	0.0062	|.....	0.0375	|.....
42	0.3000	-0.5895	|.....	0.0067	|.....	0.0367	|.....
43	0.2300	-0.5713	|.....	0.0064	|.....	0.0370	|.....
44	0.0700	-0.5616	|.....	0.0062	|.....	0.0375	|.....
45	0.0400	-0.6141	|.....	0.0075	|.....	0.0375	|.....
46	3.7100	0.8433	|.....	0.0104	|.....	0.0283	|.....
47	8.7000	1.2101	||.....	0.0177	|.....	0.0238	|.....
48	7.0200	0.3972	|.....	0.0020	|.....	0.0243	|.....
49	29.0000	-0.6505	|.....	0.0240	|.....	0.1005	|||.....
50	6.3600	0.0161	|.....	0.0000	|.....	0.0248	|.....
51	16.0000	0.6552	|.....	0.0076	|.....	0.0338	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Inverse Prediction of X Means

Row	Invert (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	30.2000	31.6000	24.0919	7.5081	18.9704	33.0922
11	20.2000	17.5000	13.5278	3.9722	9.7226	18.5575
12	12.0000	50.1000	4.8653	45.2347	0.1247	8.6538
13	9.0700	4.0800	1.7700	2.3100	-3.8759	5.6861
14	16.3000	14.1000	9.4078	4.6922	5.4731	13.5318
15	11.1000	0.3700	3.9145	-3.5445	-1.0779	7.7159
16	1.6100	0.0800	-6.1108	6.1908	-14.8204	-1.1111
17	2.3600	0.4300	-5.3185	5.7485	-13.6895	-0.4583
18	1.5200	0.1100	-6.2058	6.3158	-14.9564	-1.1892
19	1.9700	0.6200	-5.7305	6.3505	-14.2769	-0.7984
20	4.5000	1.5000	-3.0578	4.5578	-10.4919	1.4336
21	1.3200	0.0300	-6.4171	6.4471	-15.2588	-1.3623
22	34.6000	13.6000	28.7401	-15.1401	22.7074	39.8195
23	8.7700	2.0200	1.4531	0.5669	-4.2982	5.3950
24	24.5000	12.2000	18.0704	-5.8704	13.8967	24.6099
25	26.0000	14.9000	19.6550	-4.7550	15.2691	26.8048
26	53.8000	29.5000	49.0231	-19.5231	38.3909	69.7983
27	62.3000	24.8000	58.0025	-33.2025	45.2145	83.1898
28	32.1000	7.7400	26.0991	-18.3591	20.5972	35.9841
29	50.1000	28.3000	45.1144	-16.8144	35.4071	63.9826
30	26.6000	8.8100	20.2888	-11.4788	15.8093	27.6916
31	16.2000	9.1500	9.3022	-0.1522	5.3568	13.4103
32	8.4500	5.3300	1.1151	4.2149	-4.7509	5.0866
33	29.2000	11.8000	23.0355	-11.2355	18.1041	31.5802
34	5.3200	0.0900	-2.1915	2.2815	-9.2804	2.1722
35	2.2700	0.3500	-5.4135	5.7635	-13.8249	-0.5369
36	1.6800	0.3400	-6.0368	6.3768	-14.7146	-1.0504
37	3.4200	1.1100	-4.1987	5.3087	-12.0997	0.4729
38	4.4100	0.7700	-3.1528	3.9228	-10.6254	1.3530
39	1.3100	0.3300	-6.4277	6.7577	-15.2740	-1.3710
40	7.0800	0.3300	-0.3322	0.6622	-6.7126	3.7901
41	1.0900	0.0700	-6.6601	6.7301	-15.6071	-1.5611
42	0.9700	0.3000	-6.7869	7.0869	-15.7889	-1.6646
43	1.1100	0.2300	-6.6390	6.8690	-15.5768	-1.5438
44	1.0700	0.0700	-6.6812	6.7512	-15.6374	-1.5784
45	0.4500	0.0400	-7.3362	7.3762	-16.5781	-2.1122
46	20.5000	3.7100	13.8447	-10.1347	10.0286	18.9650
47	29.3000	8.7000	23.1411	-14.4411	18.1911	31.7311
48	18.6000	7.0200	11.8376	-4.8176	8.0436	16.4313
49	27.7000	29.0000	21.4509	7.5491	16.7886	29.3284
50	13.6000	6.3600	6.5555	-0.1955	2.1957	10.3880
51	30.0000	16.0000	23.8806	-7.8806	18.7978	32.7892

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Inverse Prediction of X Individuals

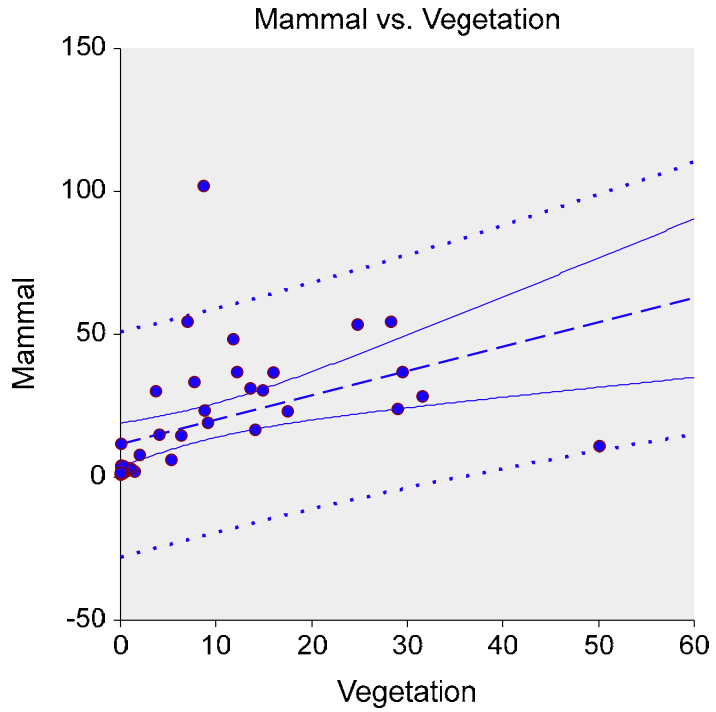
Row	Invert (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	30.2000	31.6000	24.0919	7.5081	-0.9574	53.0200
11	20.2000	17.5000	13.5278	3.9722	-12.2805	40.5606
12	12.0000	50.1000	4.8653	45.2347	-22.0062	30.7847
13	9.0700	4.0800	1.7700	2.3100	-25.5787	27.3889
14	16.3000	14.1000	9.4078	4.6922	-16.8560	35.8609
15	11.1000	0.3700	3.9145	-3.5445	-23.0981	29.7362
16	1.6100	0.0800	-6.1108	6.1908	-34.9012	18.9697
17	2.3600	0.4300	-5.3185	5.7485	-33.9495	19.8017
18	1.5200	0.1100	-6.2058	6.3158	-35.0156	18.8701
19	1.9700	0.6200	-5.7305	6.3505	-34.4440	19.3687
20	4.5000	1.5000	-3.0578	4.5578	-31.2516	22.1932
21	1.3200	0.0300	-6.4171	6.4471	-35.2700	18.6489
22	34.6000	13.6000	28.7401	-15.1401	3.8456	58.6813
23	8.7700	2.0200	1.4531	0.5669	-25.9473	27.0441
24	24.5000	12.2000	18.0704	-5.8704	-7.3404	45.8470
25	26.0000	14.9000	19.6550	-4.7550	-5.6426	47.7166
26	53.8000	29.5000	49.0231	-19.5231	23.6785	84.5107
27	62.3000	24.8000	58.0025	-33.2025	31.9677	96.4367
28	32.1000	7.7400	26.0991	-18.3591	1.1296	55.4517
29	50.1000	28.3000	45.1144	-16.8144	19.9850	79.4047
30	26.6000	8.8100	20.2888	-11.4788	-4.9671	48.4680
31	16.2000	9.1500	9.3022	-0.1522	-16.9745	35.7416
32	8.4500	5.3300	1.1151	4.2149	-26.3411	26.6769
33	29.2000	11.8000	23.0355	-11.2355	-2.0639	51.7482
34	5.3200	0.0900	-2.1915	2.2815	-30.2247	23.1166
35	2.2700	0.3500	-5.4135	5.7635	-34.0635	19.7017
36	1.6800	0.3400	-6.0368	6.3768	-34.8122	19.0472
37	3.4200	1.1100	-4.1987	5.3087	-32.6099	20.9830
38	4.4100	0.7700	-3.1528	3.9228	-31.3645	22.0921
39	1.3100	0.3300	-6.4277	6.7577	-35.2827	18.6378
40	7.0800	0.3300	-0.3322	0.6622	-28.0340	25.1115
41	1.0900	0.0700	-6.6601	6.7301	-35.5629	18.3947
42	0.9700	0.3000	-6.7869	7.0869	-35.7158	18.2622
43	1.1100	0.2300	-6.6390	6.8690	-35.5374	18.4168
44	1.0700	0.0700	-6.6812	6.7512	-35.5884	18.3726
45	0.4500	0.0400	-7.3362	7.3762	-36.3793	17.6891
46	20.5000	3.7100	13.8447	-10.1347	-11.9323	40.9259
47	29.3000	8.7000	23.1411	-14.4411	-1.9530	51.8751
48	18.6000	7.0200	11.8376	-4.8176	-14.1466	38.6216
49	27.7000	29.0000	21.4509	7.5491	-3.7341	49.8511
50	13.6000	6.3600	6.5555	-0.1955	-20.0769	32.6606
51	30.0000	16.0000	23.8806	-7.8806	-1.1782	52.7652

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Vegetation	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	11.4059	Rows Prediction Only	0
Slope	0.8536	Sum of Frequencies	42
R-Squared	0.2115	Sum of Weights	42.0000
Correlation	0.4599	Coefficient of Variation	1.0191
Mean Square Error	366.7991	Square Root of MSE	19.152

Linear Regression Report

Y = Mammal X = Vegetation

Summary Statement
The equation of the straight line relating Mammal and Vegetation is estimated as: Mammal = (11.4059) + (0.8536) Vegetation using the 42 observations in this dataset. The y-intercept, the estimated value of Mammal when Vegetation is zero, is 11.4059 with a standard error of 3.7175. The slope, the estimated change in Mammal per unit change in Vegetation, is 0.8536 with a standard error of 0.2606. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Vegetation, is 0.2115. The correlation between Mammal and Vegetation is 0.4599.

A significance test that the slope is zero resulted in a t-value of 3.2754. The significance level of this t-test is 0.0022. Since 0.0022 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.8536. The lower limit of the 95% confidence interval for the slope is 0.3269 and the upper limit is 1.3803. The estimated intercept is 11.4059. The lower limit of the 95% confidence interval for the intercept is 3.8925 and the upper limit is 18.9193.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Vegetation
Count	42	42
Mean	18.7931	8.6545
Standard Deviation	21.3033	11.4775
Minimum	0.8900	0.0300
Maximum	101.9000	50.1000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	11.4059	0.8536
Lower 95% Confidence Limit	3.8925	0.3269
Upper 95% Confidence Limit	18.9193	1.3803
Standard Error	3.7175	0.2606
Standardized Coefficient	0.0000	0.4599
T Value	3.0681	3.2754
Prob Level (T Test)	0.0039	0.0022
Prob Level (Randomization Test N =1000)		0.0070
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.8494	0.8917
Regression of Y on X	11.4059	0.8536
Inverse Regression from X on Y	-16.1374	4.0361
Orthogonal Regression of Y and X	-8.7206	3.1791

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(11.4058706413247) + (0.853572587226686) * (Vegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Bootstrap Section

---------- Estimation Results	----------	Bootstrap Confidence Limits	----------
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	11.4059	0.9000	5.9146	17.1649
Bootstrap Mean	10.8142	0.9500	4.5388	17.7883
Bias (BM - OV)	-0.5917	0.9900	1.6801	19.0405
Bias Corrected	11.9975			
Standard Error	3.4259			
Slope				
Original Value	0.8536	0.9000	-0.0099	1.2880
Bootstrap Mean	0.9713	0.9500	-0.1684	1.3642
Bias (BM - OV)	0.1177	0.9900	-0.6842	1.4532
Bias Corrected	0.7358			
Standard Error	0.4144			
Correlation				
Original Value	0.4599	0.9000	0.1413	0.6534
Bootstrap Mean	0.5046	0.9500	0.1021	0.6903
Bias (BM - OV)	0.0448	0.9900	0.0396	0.7600
Bias Corrected	0.4151			
Standard Error	0.1529			
R-Squared				
Original Value	0.2115	0.9000	0.0000	0.3520
Bootstrap Mean	0.2780	0.9500	0.0000	0.3703
Bias (BM - OV)	0.0665	0.9900	0.0000	0.3975
Bias Corrected	0.1450			
Standard Error	0.1610			
Standard Error of Estimate				
Original Value	19.1520	0.9000	13.0355	27.8964
Bootstrap Mean	17.8071	0.9500	11.6409	28.8864
Bias (BM - OV)	-1.3449	0.9900	8.9817	30.4559
Bias Corrected	20.4969			
Standard Error	4.5467			
Orthogonal Intercept				
Original Value	-8.7206	0.9000	-19.9590	14.1309
Bootstrap Mean	-9.5050	0.9500	-20.5996	22.9439
Bias (BM - OV)	-0.7844	0.9900	-22.0703	53.3913
Bias Corrected	-7.9361			
Standard Error	12.9600			
Orthogonal Slope				
Original Value	3.1791	0.9000	-0.0235	4.9420
Bootstrap Mean	3.3213	0.9500	-0.9788	5.1243
Bias (BM - OV)	0.1422	0.9900	-3.1648	5.3950
Bias Corrected	3.0369			
Standard Error	1.6164			

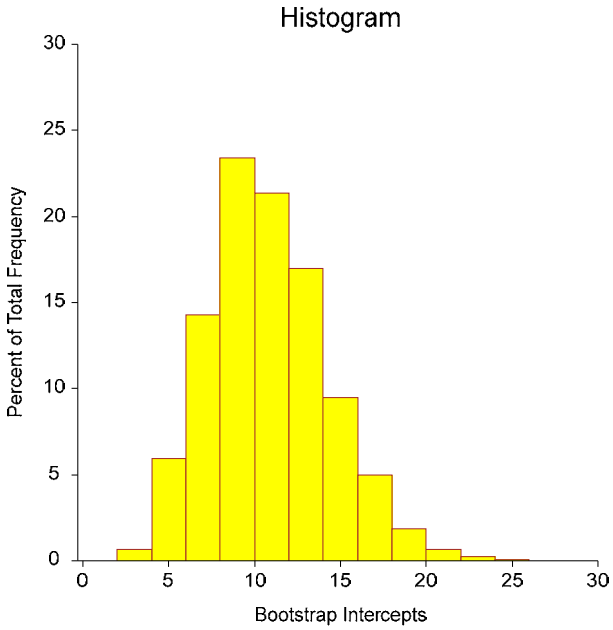
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

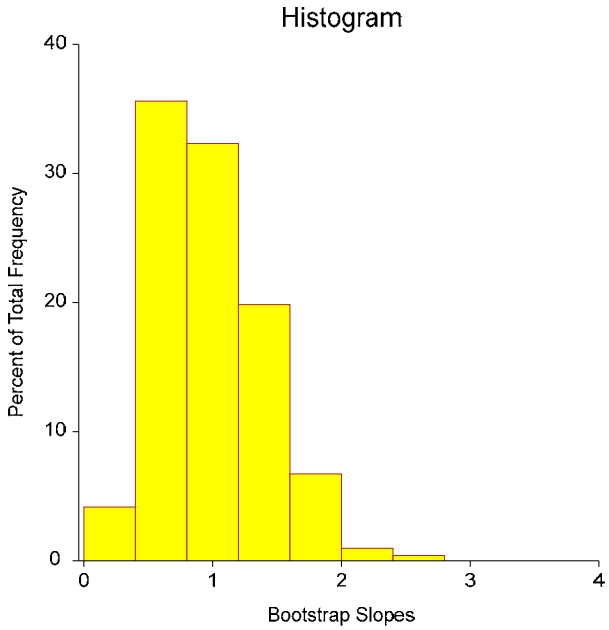
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

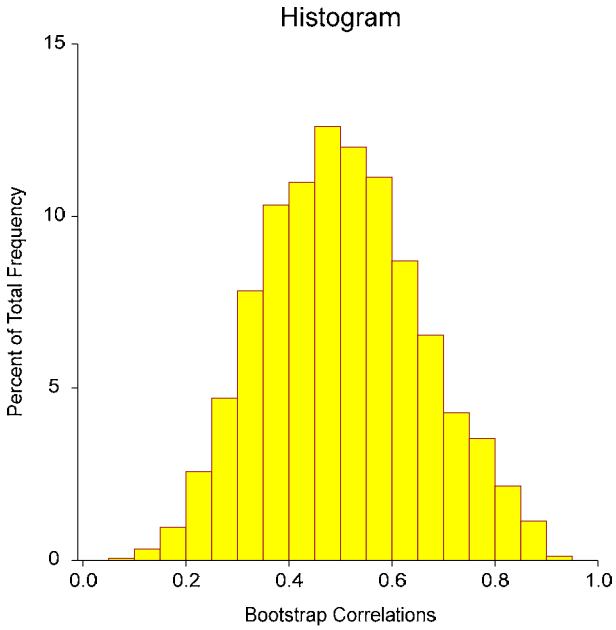
Linear Regression Report

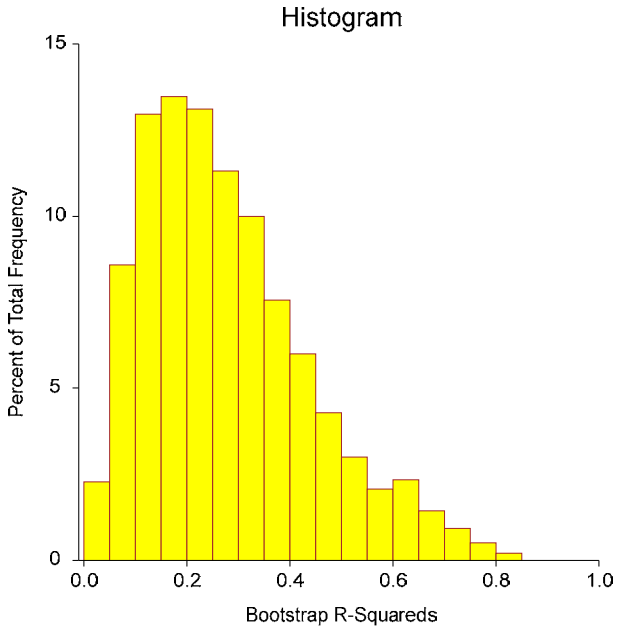
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Bootstrap Histograms Section



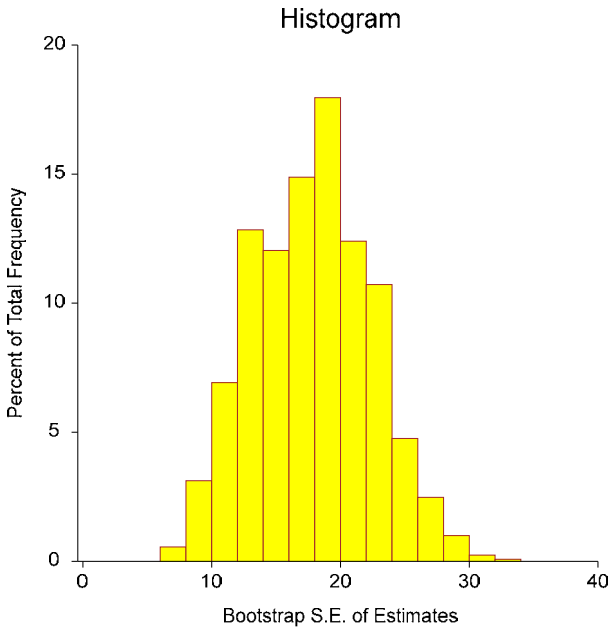


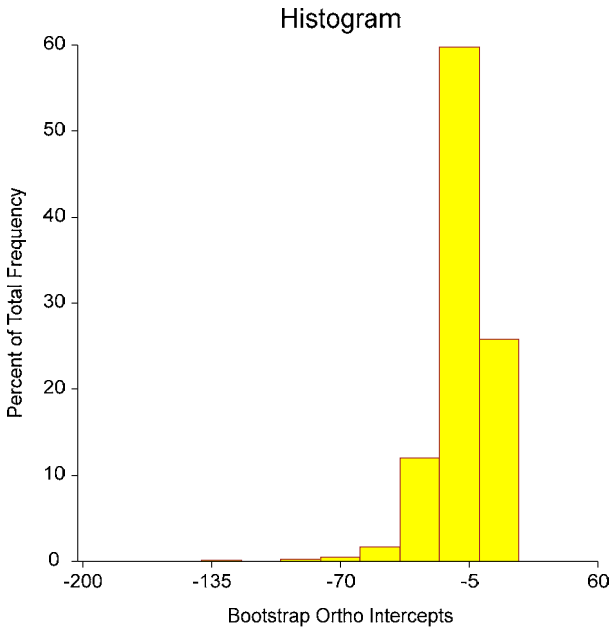


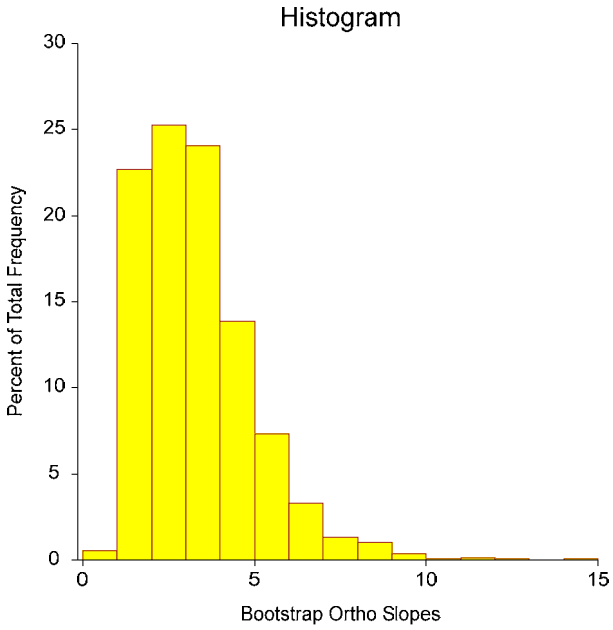


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.4599	0.2115	0.8006
Lower 95% Conf. Limit (r dist'n)	0.1787		
Upper 95% Conf. Limit (r dist'n)	0.6652		
Lower 95% Conf. Limit (Fisher's z)	0.1813		0.6564
Upper 95% Conf. Limit (Fisher's z)	0.6701		0.8884
Adjusted (Rbar)		0.1918	
T-Value for H0: Rho = 0	3.2754	3.2754	8.4503
Prob Level for H0: Rho = 0	0.0022	0.0022	0.0000
Prob Level (Randomization Test N =1000)	0.0070		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14833.64	14833.64			
Slope	1	3935.103	3935.103	10.7282	0.0022	0.8917
Error	40	14671.96	366.7991			
Lack of Fit	38	14670.95	386.0777	763.4521	0.0013	
Pure Error	2	1.0114	0.5057			
Adj. Total	41	18607.07	453.8309			
Total	42	33440.71				

s = Square Root(366.7991) = 19.152

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	363.49	789.3116	0.03767744	-0.001602389
1	363.49	8546.845	11441.27	-0.001602389	0.0001851505
2 (Y'Y)			33440.71		
Determinant		226842.5			4.408345E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	13.82005	-0.587755
1	-0.587755	0.06791303

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7503	0.000000	No
Anderson Darling	3.5029	0.000000	No
D'Agostino Skewness	4.4859	0.000007	No
D'Agostino Kurtosis	4.1061	0.000040	No
D'Agostino Omnibus	36.9834	0.000000	No
Constant Residual Variance?			
Modified Levene Test	10.2581	0.002670	No
Relationship is a Straight Line?			
Lack of Linear Fit F(38, 2) Test	763.4521	0.001309	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

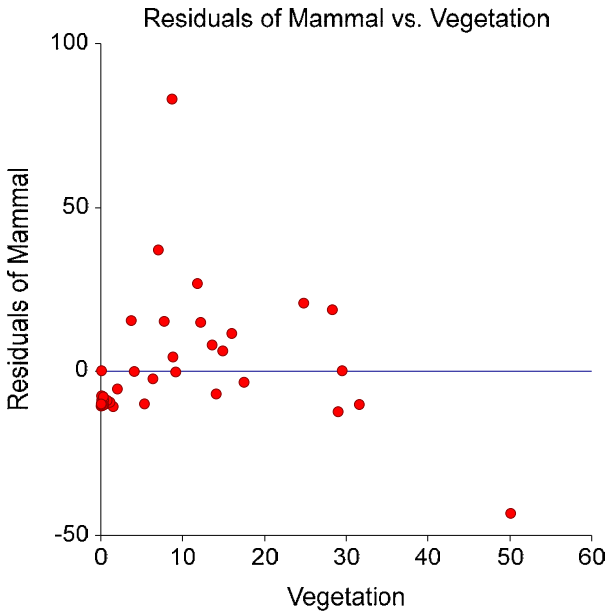
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

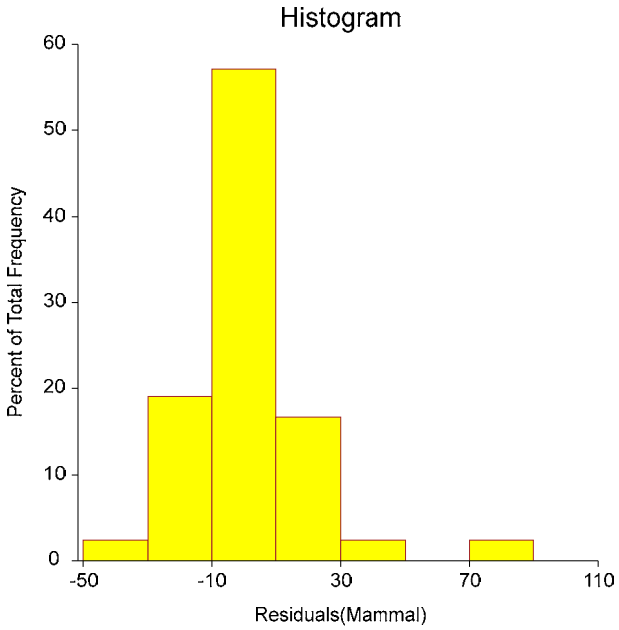
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

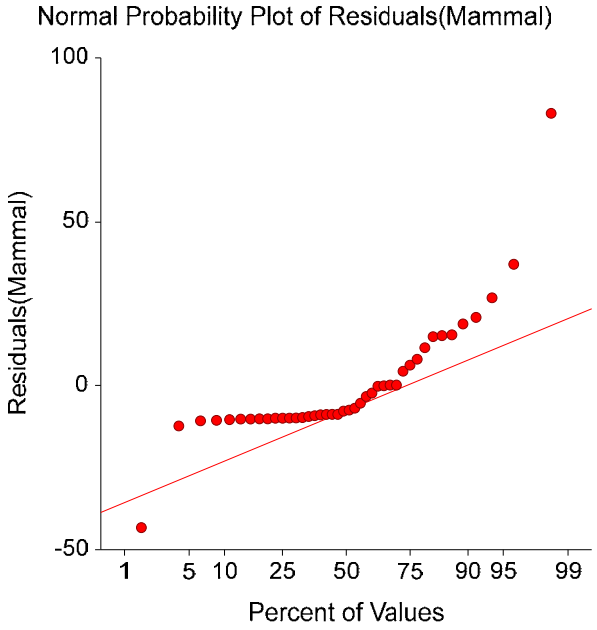
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Original Data Section

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
10	31.6000	28.3000	38.3788	-10.0788
11	17.5000	23.0667	26.3434	-3.2767
12	50.1000	10.9000	54.1699	-43.2699
13	4.0800	14.8900	14.8884	0.0016
14	14.1000	16.6000	23.4412	-6.8412
15	0.3700	2.6000	11.7217	-9.1217
16	0.0800	11.6950	11.4742	0.2208
17	0.4300	2.0767	11.7729	-9.6962
18	0.1100	2.7800	11.4998	-8.7198
19	0.6200	2.1100	11.9351	-9.8251
20	1.5000	1.9900	12.6862	-10.6962
21	0.0300	0.8900	11.4315	-10.5415
22	13.6000	31.1000	23.0145	8.0855
23	2.0200	7.8000	13.1301	-5.3301
24	12.2000	36.8000	21.8195	14.9805
25	14.9000	30.4000	24.1241	6.2759
26	29.5000	36.8000	36.5863	0.2137
27	24.8000	53.4233	32.5745	20.8489
28	7.7400	33.3000	18.0125	15.2875
29	28.3000	54.4000	35.5620	18.8380
30	8.8100	23.3500	18.9258	4.4242
31	9.1500	19.0700	19.2161	-0.1461
32	5.3300	6.0800	15.9554	-9.8754
33	11.8000	48.3000	21.4780	26.8220
34	0.0900	4.0533	11.4827	-7.4294
35	0.3500	2.9867	11.7046	-8.7180
36	0.3400	1.8400	11.6961	-9.8561
37	1.1100	2.9700	12.3533	-9.3833
38	0.7700	3.2100	12.0631	-8.8531
39	0.3300	2.9400	11.6875	-8.7475
40	0.3300	1.5200	11.6875	-10.1675
41	0.0700	1.3900	11.4656	-10.0756
42	0.3000	3.9267	11.6619	-7.7353
43	0.2300	1.2767	11.6022	-10.3255
44	0.0700	1.3100	11.4656	-10.1556
45	0.0400	1.5500	11.4400	-9.8900
46	3.7100	30.1000	14.5726	15.5274
47	8.7000	101.9000	18.8320	83.0680
48	7.0200	54.4500	17.3980	37.0520
49	29.0000	23.9000	36.1595	-12.2595
50	6.3600	14.6000	16.8346	-2.2346
51	16.0000	36.6667	25.0630	11.6036

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Predicted Values and Confidence Limits of Means

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	31.6000	28.3000	38.3788	6.6700	24.8981	51.8594
11	17.5000	23.0667	26.3434	3.7479	18.7685	33.9182
12	50.1000	10.9000	54.1699	11.1977	31.5384	76.8013
13	4.0800	14.8900	14.8884	3.1866	8.4481	21.3288
14	14.1000	16.6000	23.4412	3.2783	16.8156	30.0669
15	0.3700	2.6000	11.7217	3.6598	4.3249	19.1185
16	0.0800	11.6950	11.4742	3.7049	3.9862	18.9621
17	0.4300	2.0767	11.7729	3.6506	4.3947	19.1511
18	0.1100	2.7800	11.4998	3.7002	4.0214	18.9782
19	0.6200	2.1100	11.9351	3.6218	4.6152	19.2550
20	1.5000	1.9900	12.6862	3.4942	5.6241	19.7483
21	0.0300	0.8900	11.4315	3.7128	3.9276	18.9353
22	13.6000	31.1000	23.0145	3.2240	16.4985	29.5304
23	2.0200	7.8000	13.1301	3.4238	6.2103	20.0499
24	12.2000	36.8000	21.8195	3.0963	15.5616	28.0773
25	14.9000	30.4000	24.1241	3.3738	17.3055	30.9427
26	29.5000	36.8000	36.5863	6.1842	24.0876	49.0849
27	24.8000	53.4233	32.5745	5.1417	22.1828	42.9661
28	7.7400	33.3000	18.0125	2.9648	12.0204	24.0046
29	28.3000	54.4000	35.5620	5.9113	23.6147	47.5092
30	8.8100	23.3500	18.9258	2.9555	12.9526	24.8991
31	9.1500	19.0700	19.2161	2.9580	13.2376	25.1945
32	5.3300	6.0800	15.9554	3.0796	9.7313	22.1795
33	11.8000	48.3000	21.4780	3.0668	15.2798	27.6763
34	0.0900	4.0533	11.4827	3.7034	3.9979	18.9674
35	0.3500	2.9867	11.7046	3.6629	4.3016	19.1076
36	0.3400	1.8400	11.6961	3.6645	4.2899	19.1022
37	1.1100	2.9700	12.3533	3.5495	5.1795	19.5271
38	0.7700	3.2100	12.0631	3.5993	4.7886	19.3376
39	0.3300	2.9400	11.6875	3.6660	4.2783	19.0968
40	0.3300	1.5200	11.6875	3.6660	4.2783	19.0968
41	0.0700	1.3900	11.4656	3.7065	3.9745	18.9567
42	0.3000	3.9267	11.6619	3.6706	4.2433	19.0806
43	0.2300	1.2767	11.6022	3.6815	4.1616	19.0427
44	0.0700	1.3100	11.4656	3.7065	3.9745	18.9567
45	0.0400	1.5500	11.4400	3.7112	3.9394	18.9407
46	3.7100	30.1000	14.5726	3.2239	8.0568	21.0884
47	8.7000	101.9000	18.8320	2.9552	12.8592	24.8047
48	7.0200	54.4500	17.3980	2.9858	11.3635	23.4324
49	29.0000	23.9000	36.1595	6.0700	23.8915	48.4274
50	6.3600	14.6000	16.8346	3.0151	10.7408	22.9283
51	16.0000	36.6667	25.0630	3.5210	17.9468	32.1793

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Predicted Values and Prediction Limits

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	31.6000	28.3000	38.3788	20.2802	-2.6091	79.3667
11	17.5000	23.0667	26.3434	19.5153	-13.0985	65.7852
12	50.1000	10.9000	54.1699	22.1853	9.3316	99.0081
13	4.0800	14.8900	14.8884	19.4153	-24.3513	54.1282
14	14.1000	16.6000	23.4412	19.4306	-15.8294	62.7119
15	0.3700	2.6000	11.7217	19.4986	-27.6864	51.1297
16	0.0800	11.6950	11.4742	19.5071	-27.9511	50.8994
17	0.4300	2.0767	11.7729	19.4968	-27.6317	51.1775
18	0.1100	2.7800	11.4998	19.5062	-27.9237	50.9232
19	0.6200	2.1100	11.9351	19.4914	-27.4586	51.3288
20	1.5000	1.9900	12.6862	19.4681	-26.6604	52.0328
21	0.0300	0.8900	11.4315	19.5086	-27.9968	50.8598
22	13.6000	31.1000	23.0145	19.4215	-16.2378	62.2667
23	2.0200	7.8000	13.1301	19.4556	-26.1912	52.4514
24	12.2000	36.8000	21.8195	19.4007	-17.3908	61.0297
25	14.9000	30.4000	24.1241	19.4469	-15.1795	63.4277
26	29.5000	36.8000	36.5863	20.1257	-4.0893	77.2618
27	24.8000	53.4233	32.5745	19.8302	-7.5038	72.6527
28	7.7400	33.3000	18.0125	19.3801	-21.1562	57.1812
29	28.3000	54.4000	35.5620	20.0435	-4.9475	76.0715
30	8.8100	23.3500	18.9258	19.3787	-20.2400	58.0917
31	9.1500	19.0700	19.2161	19.3791	-19.9505	58.3827
32	5.3300	6.0800	15.9554	19.3980	-23.2494	55.1603
33	11.8000	48.3000	21.4780	19.3960	-17.7227	60.6788
34	0.0900	4.0533	11.4827	19.5068	-27.9420	50.9073
35	0.3500	2.9867	11.7046	19.4991	-27.7046	51.1138
36	0.3400	1.8400	11.6961	19.4994	-27.7137	51.1059
37	1.1100	2.9700	12.3533	19.4781	-27.0135	51.7201
38	0.7700	3.2100	12.0631	19.4873	-27.3222	51.4484
39	0.3300	2.9400	11.6875	19.4997	-27.7228	51.0979
40	0.3300	1.5200	11.6875	19.4997	-27.7228	51.0979
41	0.0700	1.3900	11.4656	19.5074	-27.9602	50.8915
42	0.3000	3.9267	11.6619	19.5006	-27.7502	51.0741
43	0.2300	1.2767	11.6022	19.5026	-27.8141	51.0185
44	0.0700	1.3100	11.4656	19.5074	-27.9602	50.8915
45	0.0400	1.5500	11.4400	19.5083	-27.9877	50.8677
46	3.7100	30.1000	14.5726	19.4215	-24.6796	53.8248
47	8.7000	101.9000	18.8320	19.3787	-20.3338	57.9977
48	7.0200	54.4500	17.3980	19.3833	-21.7772	56.5731
49	29.0000	23.9000	36.1595	20.0909	-4.4457	76.7647
50	6.3600	14.6000	16.8346	19.3879	-22.3498	56.0190
51	16.0000	36.6667	25.0630	19.4730	-14.2933	64.4194

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Working-Hotelling Simultaneous Confidence Band

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	31.6000	28.3000	38.3788	6.6700	19.3932	57.3643
11	17.5000	23.0667	26.3434	3.7479	15.6753	37.0115
12	50.1000	10.9000	54.1699	11.1977	22.2966	86.0431
13	4.0800	14.8900	14.8884	3.1866	5.8181	23.9588
14	14.1000	16.6000	23.4412	3.2783	14.1099	32.7725
15	0.3700	2.6000	11.7217	3.6598	1.3043	22.1390
16	0.0800	11.6950	11.4742	3.7049	0.9285	22.0198
17	0.4300	2.0767	11.7729	3.6506	1.3817	22.1641
18	0.1100	2.7800	11.4998	3.7002	0.9675	22.0320
19	0.6200	2.1100	11.9351	3.6218	1.6260	22.2441
20	1.5000	1.9900	12.6862	3.4942	2.7403	22.6322
21	0.0300	0.8900	11.4315	3.7128	0.8634	21.9996
22	13.6000	31.1000	23.0145	3.2240	13.8376	32.1913
23	2.0200	7.8000	13.1301	3.4238	3.3845	22.8757
24	12.2000	36.8000	21.8195	3.0963	13.0062	30.6327
25	14.9000	30.4000	24.1241	3.3738	14.5210	33.7272
26	29.5000	36.8000	36.5863	6.1842	18.9837	54.1888
27	24.8000	53.4233	32.5745	5.1417	17.9393	47.2097
28	7.7400	33.3000	18.0125	2.9648	9.5735	26.4516
29	28.3000	54.4000	35.5620	5.9113	18.7359	52.3880
30	8.8100	23.3500	18.9258	2.9555	10.5133	27.3384
31	9.1500	19.0700	19.2161	2.9580	10.7963	27.6358
32	5.3300	6.0800	15.9554	3.0796	7.1897	24.7212
33	11.8000	48.3000	21.4780	3.0668	12.7487	30.2074
34	0.0900	4.0533	11.4827	3.7034	0.9415	22.0239
35	0.3500	2.9867	11.7046	3.6629	1.2785	22.1307
36	0.3400	1.8400	11.6961	3.6645	1.2656	22.1266
37	1.1100	2.9700	12.3533	3.5495	2.2501	22.4566
38	0.7700	3.2100	12.0631	3.5993	1.8180	22.3082
39	0.3300	2.9400	11.6875	3.6660	1.2527	22.1224
40	0.3300	1.5200	11.6875	3.6660	1.2527	22.1224
41	0.0700	1.3900	11.4656	3.7065	0.9155	22.0158
42	0.3000	3.9267	11.6619	3.6706	1.2139	22.1100
43	0.2300	1.2767	11.6022	3.6815	1.1232	22.0811
44	0.0700	1.3100	11.4656	3.7065	0.9155	22.0158
45	0.0400	1.5500	11.4400	3.7112	0.8764	22.0036
46	3.7100	30.1000	14.5726	3.2239	5.3961	23.7492
47	8.7000	101.9000	18.8320	2.9552	10.4202	27.2437
48	7.0200	54.4500	17.3980	2.9858	8.8993	25.8966
49	29.0000	23.9000	36.1595	6.0700	18.8818	53.4372
50	6.3600	14.6000	16.8346	3.0151	8.2524	25.4168
51	16.0000	36.6667	25.0630	3.5210	15.0408	35.0853

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Section

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	31.6000	28.3000	38.3788	-10.0788	-0.5614	35.6140
11	17.5000	23.0667	26.3434	-3.2767	-0.1745	14.2055
12	50.1000	10.9000	54.1699	-43.2699	-2.7849	396.9712
13	4.0800	14.8900	14.8884	0.0016	0.0001	0.0104
14	14.1000	16.6000	23.4412	-6.8412	-0.3626	41.2123
15	0.3700	2.6000	11.7217	-9.1217	-0.4852	350.8343
16	0.0800	11.6950	11.4742	0.2208	0.0118	1.8884
17	0.4300	2.0767	11.7729	-9.6962	-0.5157	466.9137
18	0.1100	2.7800	11.4998	-8.7198	-0.4640	313.6606
19	0.6200	2.1100	11.9351	-9.8251	-0.5224	465.6439
20	1.5000	1.9900	12.6862	-10.6962	-0.5680	537.4990
21	0.0300	0.8900	11.4315	-10.5415	-0.5611	1184.4357
22	13.6000	31.1000	23.0145	8.0855	0.4283	25.9985
23	2.0200	7.8000	13.1301	-5.3301	-0.2829	68.3345
24	12.2000	36.8000	21.8195	14.9805	0.7926	40.7080
25	14.9000	30.4000	24.1241	6.2759	0.3329	20.6444
26	29.5000	36.8000	36.5863	0.2137	0.0118	0.5808
27	24.8000	53.4233	32.5745	20.8489	1.1301	39.0258
28	7.7400	33.3000	18.0125	15.2875	0.8080	45.9083
29	28.3000	54.4000	35.5620	18.8380	1.0341	34.6287
30	8.8100	23.3500	18.9258	4.4242	0.2338	18.9471
31	9.1500	19.0700	19.2161	-0.1461	-0.0077	0.7659
32	5.3300	6.0800	15.9554	-9.8754	-0.5224	162.4245
33	11.8000	48.3000	21.4780	26.8220	1.4188	55.5320
34	0.0900	4.0533	11.4827	-7.4294	-0.3954	183.2901
35	0.3500	2.9867	11.7046	-8.7180	-0.4638	291.8958
36	0.3400	1.8400	11.6961	-9.8561	-0.5243	535.6568
37	1.1100	2.9700	12.3533	-9.3833	-0.4986	315.9372
38	0.7700	3.2100	12.0631	-8.8531	-0.4706	275.7982
39	0.3300	2.9400	11.6875	-8.7475	-0.4653	297.5357
40	0.3300	1.5200	11.6875	-10.1675	-0.5409	668.9177
41	0.0700	1.3900	11.4656	-10.0756	-0.5362	724.8648
42	0.3000	3.9267	11.6619	-7.7353	-0.4115	196.9934
43	0.2300	1.2767	11.6022	-10.3255	-0.5494	808.7879
44	0.0700	1.3100	11.4656	-10.1556	-0.5405	775.2382
45	0.0400	1.5500	11.4400	-9.8900	-0.5264	638.0654
46	3.7100	30.1000	14.5726	15.5274	0.8225	51.5860
47	8.7000	101.9000	18.8320	83.0680	4.3899	81.5192
48	7.0200	54.4500	17.3980	37.0520	1.9586	68.0478
49	29.0000	23.9000	36.1595	-12.2595	-0.6749	51.2949
50	6.3600	14.6000	16.8346	-2.2346	-0.1182	15.3054
51	16.0000	36.6667	25.0630	11.6036	0.6164	31.6463

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Diagnostics Section

Row	Vegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	31.6000	-10.0788	*-0.5565	0.1213	0.0218	373.2401
11	17.5000	-3.2767	-0.1723	0.0383	0.0006	375.9180
12	50.1000	-43.2699	**-3.0628	0.3418	*2.0142	303.2619
13	4.0800	0.0016	0.0001	0.0277	0.0000	376.2042
14	14.1000	-6.8412	-0.3586	0.0293	0.0020	374.9679
15	0.3700	-9.1217	-0.4805	0.0365	0.0045	373.9899
16	0.0800	0.2208	0.0116	0.0374	0.0000	376.2029
17	0.4300	-9.6962	-0.5109	0.0363	0.0050	373.7026
18	0.1100	-8.7198	-0.4594	0.0373	0.0042	374.1790
19	0.6200	-9.8251	-0.5176	0.0358	0.0051	373.6372
20	1.5000	-10.6962	-0.5632	0.0333	0.0056	373.1696
21	0.0300	-10.5415	-0.5562	0.0376	0.0061	373.2437
22	13.6000	8.0855	0.4239	0.0283	0.0027	374.4790
23	2.0200	-5.3301	-0.2796	0.0320	0.0013	375.4517
24	12.2000	14.9805	0.7889	0.0261	0.0084	370.2955
25	14.9000	6.2759	0.3292	0.0310	0.0018	375.1620
26	29.5000	0.2137	*0.0116	0.1043	0.0000	376.2029
27	24.8000	20.8489	1.1341	0.0721	0.0496	364.1930
28	7.7400	15.2875	0.8044	0.0240	0.0080	370.0646
29	28.3000	18.8380	*1.0350	0.0953	0.0563	366.1468
30	8.8100	4.4242	0.2310	0.0238	0.0007	375.6901
31	9.1500	-0.1461	-0.0076	0.0239	0.0000	376.2037
32	5.3300	-9.8754	-0.5176	0.0259	0.0036	373.6373
33	11.8000	26.8220	1.4376	0.0256	0.0265	357.2722
34	0.0900	-7.4294	-0.3912	0.0374	0.0030	374.7340
35	0.3500	-8.7180	-0.4592	0.0366	0.0041	374.1815
36	0.3400	-9.8561	-0.5195	0.0366	0.0052	373.6187
37	1.1100	-9.3833	-0.4938	0.0343	0.0044	373.8663
38	0.7700	-8.8531	-0.4660	0.0353	0.0041	374.1210
39	0.3300	-8.7475	-0.4607	0.0366	0.0041	374.1676
40	0.3300	-10.1675	-0.5360	0.0366	0.0056	373.4527
41	0.0700	-10.0756	-0.5314	0.0375	0.0056	373.4999
42	0.3000	-7.7353	-0.4072	0.0367	0.0032	374.6115
43	0.2300	-10.3255	-0.5445	0.0370	0.0058	373.3656
44	0.0700	-10.1556	-0.5356	0.0375	0.0057	373.4568
45	0.0400	-9.8900	-0.5216	0.0375	0.0054	373.5984
46	3.7100	15.5274	0.8191	0.0283	0.0099	369.8419
47	8.7000	83.0680	*6.0214	0.0238	0.2350	194.9580
48	7.0200	37.0520	*2.0339	0.0243	0.0478	340.1260
49	29.0000	-12.2595	*-0.6702	0.1005	0.0254	371.9202
50	6.3600	-2.2346	-0.1167	0.0248	0.0002	376.0729
51	16.0000	11.6036	0.6115	0.0338	0.0066	372.6310

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.5565	-0.2068	0.0218	* 1.1784	0.0396	-0.1854
11	-0.1723	-0.0344	0.0006	1.0922	-0.0087	-0.0212
12	* -3.0628	-2.2073	** 2.0142	1.0386	0.8286	-2.1291
13	0.0001	0.0000	0.0000	1.0819	0.0000	0.0000
14	-0.3586	-0.0623	0.0020	1.0766	-0.0283	-0.0270
15	-0.4805	-0.0936	0.0045	1.0790	-0.0935	0.0552
16	0.0116	0.0023	0.0000	1.0928	0.0023	-0.0014
17	-0.5109	-0.0992	0.0050	1.0771	-0.0992	0.0582
18	-0.4594	-0.0905	0.0042	1.0810	-0.0905	0.0544
19	-0.5176	-0.0997	0.0051	1.0761	-0.0996	0.0576
20	-0.5632	-0.1045	0.0056	1.0707	-0.1041	0.0558
21	-0.5562	-0.1099	0.0061	1.0759	-0.1099	0.0665
22	0.4239	0.0724	0.0027	1.0727	0.0352	0.0289
23	-0.2796	-0.0508	0.0013	1.0823	-0.0504	0.0257
24	0.7889	0.1292	0.0084	1.0465	0.0747	0.0386
25	0.3292	0.0589	0.0018	1.0796	0.0238	0.0284
26	0.0116	0.0040	0.0000	* 1.1744	-0.0006	0.0035
27	1.1341	0.3161	0.0496	1.0624	-0.0125	0.2587
28	0.8044	0.1260	0.0080	1.0429	0.1060	-0.0101
29	1.0350	0.3359	0.0563	1.1014	-0.0430	0.2909
30	0.2310	0.0361	0.0007	1.0747	0.0284	0.0005
31	-0.0076	-0.0012	0.0000	1.0776	-0.0009	-0.0001
32	-0.5176	-0.0843	0.0036	1.0652	-0.0787	0.0237
33	1.4376	0.2332	0.0265	0.9737	0.1408	0.0623
34	-0.3912	-0.0771	0.0030	1.0843	-0.0771	0.0465
35	-0.4592	-0.0895	0.0041	1.0802	-0.0895	0.0529
36	-0.5195	-0.1013	0.0052	1.0770	-0.1013	0.0599
37	-0.4938	-0.0931	0.0044	1.0759	-0.0929	0.0516
38	-0.4660	-0.0892	0.0041	1.0784	-0.0891	0.0509
39	-0.4607	-0.0899	0.0041	1.0802	-0.0898	0.0532
40	-0.5360	-0.1045	0.0056	1.0760	-0.1045	0.0619
41	-0.5314	-0.1048	0.0056	1.0772	-0.1048	0.0633
42	-0.4072	-0.0795	0.0032	1.0828	-0.0795	0.0472
43	-0.5445	-0.1067	0.0058	1.0759	-0.1067	0.0636
44	-0.5356	-0.1057	0.0057	1.0770	-0.1057	0.0638
45	-0.5216	-0.1030	0.0054	1.0779	-0.1030	0.0623
46	0.8191	0.1399	0.0099	1.0463	0.1358	-0.0559
47	* 6.0214	0.9404	0.2350	0.2894	0.7453	0.0038
48	* 2.0339	0.3210	0.0478	0.8813	0.2804	-0.0458
49	-0.6702	-0.2240	0.0254	* 1.1429	0.0320	-0.1956
50	-0.1167	-0.0186	0.0002	1.0779	-0.0167	0.0037
51	0.6115	0.1144	0.0066	1.0682	0.0386	0.0622

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Outlier Detection Chart

Row	Vegetation (X)	Residual		Standardized Residual		RStudent	
10	31.6000	-10.0788	|.....	-0.5614	|.....	-0.5565	|.....
11	17.5000	-3.2767	|.....	-0.1745	|.....	-0.1723	|.....
12	50.1000	-43.2699	|||||||.....	-2.7849	||||||||.....	* -3.0628	|||||||.....
13	4.0800	0.0016	|.....	0.0001	|.....	0.0001	|.....
14	14.1000	-6.8412	|.....	-0.3626	|.....	-0.3586	|.....
15	0.3700	-9.1217	|.....	-0.4852	|.....	-0.4805	|.....
16	0.0800	0.2208	|.....	0.0118	|.....	0.0116	|.....
17	0.4300	-9.6962	|.....	-0.5157	|.....	-0.5109	|.....
18	0.1100	-8.7198	|.....	-0.4640	|.....	-0.4594	|.....
19	0.6200	-9.8251	|.....	-0.5224	|.....	-0.5176	|.....
20	1.5000	-10.6962	|.....	-0.5680	|.....	-0.5632	|.....
21	0.0300	-10.5415	|.....	-0.5611	|.....	-0.5562	|.....
22	13.6000	8.0855	|.....	0.4283	|.....	0.4239	|.....
23	2.0200	-5.3301	|.....	-0.2829	|.....	-0.2796	|.....
24	12.2000	14.9805	||.....	0.7926	||.....	0.7889	|.....
25	14.9000	6.2759	|.....	0.3329	|.....	0.3292	|.....
26	29.5000	0.2137	|.....	0.0118	|.....	0.0116	|.....
27	24.8000	20.8489	|||.....	1.1301	|||.....	1.1341	||.....
28	7.7400	15.2875	||.....	0.8080	||.....	0.8044	||.....
29	28.3000	18.8380	|||.....	1.0341	|||.....	1.0350	||.....
30	8.8100	4.4242	|.....	0.2338	|.....	0.2310	|.....
31	9.1500	-0.1461	|.....	-0.0077	|.....	-0.0076	|.....
32	5.3300	-9.8754	|.....	-0.5224	|.....	-0.5176	|.....
33	11.8000	26.8220	||||.....	1.4188	||||.....	1.4376	|||.....
34	0.0900	-7.4294	|.....	-0.3954	|.....	-0.3912	|.....
35	0.3500	-8.7180	|.....	-0.4638	|.....	-0.4592	|.....
36	0.3400	-9.8561	|.....	-0.5243	|.....	-0.5195	|.....
37	1.1100	-9.3833	|.....	-0.4986	|.....	-0.4938	|.....
38	0.7700	-8.8531	|.....	-0.4706	|.....	-0.4660	|.....
39	0.3300	-8.7475	|.....	-0.4653	|.....	-0.4607	|.....
40	0.3300	-10.1675	|.....	-0.5409	|.....	-0.5360	|.....
41	0.0700	-10.0756	|.....	-0.5362	|.....	-0.5314	|.....
42	0.3000	-7.7353	|.....	-0.4115	|.....	-0.4072	|.....
43	0.2300	-10.3255	|.....	-0.5494	|.....	-0.5445	|.....
44	0.0700	-10.1556	|.....	-0.5405	|.....	-0.5356	|.....
45	0.0400	-9.8900	|.....	-0.5264	|.....	-0.5216	|.....
46	3.7100	15.5274	||.....	0.8225	||.....	0.8191	||.....
47	8.7000	83.0680	|||||||||||||||	4.3899	||||||||||||||	* 6.0214	||||||||||||||
48	7.0200	37.0520	||||||.....	1.9586	||||||.....	* 2.0339	|||||.....
49	29.0000	-12.2595	||.....	-0.6749	||.....	-0.6702	|.....
50	6.3600	-2.2346	|.....	-0.1182	|.....	-0.1167	|.....
51	16.0000	11.6036	||.....	0.6164	||.....	0.6115	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Influence Detection Chart

Row	Vegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	31.6000	-0.2068	|.....	0.0218	|.....	-0.1854	|.....
11	17.5000	-0.0344	|.....	0.0006	|.....	-0.0212	|.....
12	50.1000	-2.2073	||||||||||||||	** 2.0142	||||||||||||||	-2.1291	||||||||||||||
13	4.0800	0.0000	|.....	0.0000	|.....	0.0000	|.....
14	14.1000	-0.0623	|.....	0.0020	|.....	-0.0270	|.....
15	0.3700	-0.0936	|.....	0.0045	|.....	0.0552	|.....
16	0.0800	0.0023	|.....	0.0000	|.....	-0.0014	|.....
17	0.4300	-0.0992	|.....	0.0050	|.....	0.0582	|.....
18	0.1100	-0.0905	|.....	0.0042	|.....	0.0544	|.....
19	0.6200	-0.0997	|.....	0.0051	|.....	0.0576	|.....
20	1.5000	-0.1045	|.....	0.0056	|.....	0.0558	|.....
21	0.0300	-0.1099	|.....	0.0061	|.....	0.0665	|.....
22	13.6000	0.0724	|.....	0.0027	|.....	0.0289	|.....
23	2.0200	-0.0508	|.....	0.0013	|.....	0.0257	|.....
24	12.2000	0.1292	|.....	0.0084	|.....	0.0386	|.....
25	14.9000	0.0589	|.....	0.0018	|.....	0.0284	|.....
26	29.5000	0.0040	|.....	0.0000	|.....	0.0035	|.....
27	24.8000	0.3161	||.....	0.0496	|.....	0.2587	|.....
28	7.7400	0.1260	|.....	0.0080	|.....	-0.0101	|.....
29	28.3000	0.3359	||.....	0.0563	|.....	0.2909	||.....
30	8.8100	0.0361	|.....	0.0007	|.....	0.0005	|.....
31	9.1500	-0.0012	|.....	0.0000	|.....	-0.0001	|.....
32	5.3300	-0.0843	|.....	0.0036	|.....	0.0237	|.....
33	11.8000	0.2332	|.....	0.0265	|.....	0.0623	|.....
34	0.0900	-0.0771	|.....	0.0030	|.....	0.0465	|.....
35	0.3500	-0.0895	|.....	0.0041	|.....	0.0529	|.....
36	0.3400	-0.1013	|.....	0.0052	|.....	0.0599	|.....
37	1.1100	-0.0931	|.....	0.0044	|.....	0.0516	|.....
38	0.7700	-0.0892	|.....	0.0041	|.....	0.0509	|.....
39	0.3300	-0.0899	|.....	0.0041	|.....	0.0532	|.....
40	0.3300	-0.1045	|.....	0.0056	|.....	0.0619	|.....
41	0.0700	-0.1048	|.....	0.0056	|.....	0.0633	|.....
42	0.3000	-0.0795	|.....	0.0032	|.....	0.0472	|.....
43	0.2300	-0.1067	|.....	0.0058	|.....	0.0636	|.....
44	0.0700	-0.1057	|.....	0.0057	|.....	0.0638	|.....
45	0.0400	-0.1030	|.....	0.0054	|.....	0.0623	|.....
46	3.7100	0.1399	|.....	0.0099	|.....	-0.0559	|.....
47	8.7000	0.9404	||||||.....	0.2350	|.....	0.0038	|.....
48	7.0200	0.3210	||.....	0.0478	|.....	-0.0458	|.....
49	29.0000	-0.2240	|.....	0.0254	|.....	-0.1956	|.....
50	6.3600	-0.0186	|.....	0.0002	|.....	0.0037	|.....
51	16.0000	0.1144	|.....	0.0066	|.....	0.0622	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Outlier & Influence Chart

Row	Vegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	31.6000	-0.5565	|.....	0.0218	|.....	0.1213	||||.....
11	17.5000	-0.1723	|.....	0.0006	|.....	0.0383	|.....
12	50.1000	* -3.0628	|||||||.....	** 2.0142	||||||||||||||	0.3418	||||||||||||||
13	4.0800	0.0001	|.....	0.0000	|.....	0.0277	|.....
14	14.1000	-0.3586	|.....	0.0020	|.....	0.0293	|.....
15	0.3700	-0.4805	|.....	0.0045	|.....	0.0365	|.....
16	0.0800	0.0116	|.....	0.0000	|.....	0.0374	|.....
17	0.4300	-0.5109	|.....	0.0050	|.....	0.0363	|.....
18	0.1100	-0.4594	|.....	0.0042	|.....	0.0373	|.....
19	0.6200	-0.5176	|.....	0.0051	|.....	0.0358	|.....
20	1.5000	-0.5632	|.....	0.0056	|.....	0.0333	|.....
21	0.0300	-0.5562	|.....	0.0061	|.....	0.0376	|.....
22	13.6000	0.4239	|.....	0.0027	|.....	0.0283	|.....
23	2.0200	-0.2796	|.....	0.0013	|.....	0.0320	|.....
24	12.2000	0.7889	|.....	0.0084	|.....	0.0261	|.....
25	14.9000	0.3292	|.....	0.0018	|.....	0.0310	|.....
26	29.5000	0.0116	|.....	0.0000	|.....	0.1043	|||.....
27	24.8000	1.1341	||.....	0.0496	|.....	0.0721	||.....
28	7.7400	0.8044	||.....	0.0080	|.....	0.0240	|.....
29	28.3000	1.0350	||.....	0.0563	|.....	0.0953	|||.....
30	8.8100	0.2310	|.....	0.0007	|.....	0.0238	|.....
31	9.1500	-0.0076	|.....	0.0000	|.....	0.0239	|.....
32	5.3300	-0.5176	|.....	0.0036	|.....	0.0259	|.....
33	11.8000	1.4376	|||.....	0.0265	|.....	0.0256	|.....
34	0.0900	-0.3912	|.....	0.0030	|.....	0.0374	|.....
35	0.3500	-0.4592	|.....	0.0041	|.....	0.0366	|.....
36	0.3400	-0.5195	|.....	0.0052	|.....	0.0366	|.....
37	1.1100	-0.4938	|.....	0.0044	|.....	0.0343	|.....
38	0.7700	-0.4660	|.....	0.0041	|.....	0.0353	|.....
39	0.3300	-0.4607	|.....	0.0041	|.....	0.0366	|.....
40	0.3300	-0.5360	|.....	0.0056	|.....	0.0366	|.....
41	0.0700	-0.5314	|.....	0.0056	|.....	0.0375	|.....
42	0.3000	-0.4072	|.....	0.0032	|.....	0.0367	|.....
43	0.2300	-0.5445	|.....	0.0058	|.....	0.0370	|.....
44	0.0700	-0.5356	|.....	0.0057	|.....	0.0375	|.....
45	0.0400	-0.5216	|.....	0.0054	|.....	0.0375	|.....
46	3.7100	0.8191	||.....	0.0099	|.....	0.0283	|.....
47	8.7000	* 6.0214	|||||||||||||||	0.2350	|.....	0.0238	|.....
48	7.0200	* 2.0339	|||||.....	0.0478	|.....	0.0243	|.....
49	29.0000	-0.6702	|.....	0.0254	|.....	0.1005	|||.....
50	6.3600	-0.1167	|.....	0.0002	|.....	0.0248	|.....
51	16.0000	0.6115	|.....	0.0066	|.....	0.0338	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Inverse Prediction of X Means

Row	Mammal (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	28.3000	31.6000	19.7923	11.8077	12.4194	40.8612
11	23.0667	17.5000	13.6612	3.8388	6.5437	26.9353
12	10.9000	50.1000	-0.5927	50.6927	-19.0833	6.5268
13	14.8900	4.0800	4.0818	-0.0018	-8.7211	11.2617
14	16.6000	14.1000	6.0852	8.0148	-4.7478	13.7586
15	2.6000	0.3700	-10.3165	10.6865	-42.8712	-1.0904
16	11.6950	0.0800	0.3387	-0.2587	-16.9286	7.3801
17	2.0767	0.4300	-10.9296	11.3596	-44.4157	-1.5261
18	2.7800	0.1100	-10.1056	10.2156	-42.3407	-0.9399
19	2.1100	0.6200	-10.8905	11.5105	-44.3172	-1.4985
20	1.9900	1.5000	-11.0311	12.5311	-44.6718	-1.5980
21	0.8900	0.0300	-12.3198	12.3498	-47.9286	-2.5033
22	31.1000	13.6000	23.0726	-9.4726	15.0417	48.8334
23	7.8000	2.0200	-4.2244	6.2444	-27.7558	3.4696
24	36.8000	12.2000	29.7504	-17.5504	19.8971	65.5453
25	30.4000	14.9000	22.2525	-7.3525	14.4065	46.8200
26	36.8000	29.5000	29.7504	-0.2504	19.8971	65.5453
27	53.4233	24.8000	49.2254	-24.4254	32.7776	115.5633
28	33.3000	7.7400	25.6500	-17.9100	16.9722	55.2271
29	54.4000	28.3000	50.3696	-22.0696	33.5112	118.5252
30	23.3500	8.8100	13.9931	-5.1831	6.9138	27.6372
31	19.0700	9.1500	8.9789	0.1711	0.2805	18.0762
32	6.0800	5.3300	-6.2395	11.5695	-32.6980	1.9038
33	48.3000	11.8000	43.2232	-31.4232	28.9030	100.0525
34	4.0533	0.0900	-8.6138	8.7038	-38.5999	0.1373
35	2.9867	0.3500	-9.8635	10.2135	-41.7321	-0.7665
36	1.8400	0.3400	-11.2069	11.5469	-45.1151	-1.7222
37	2.9700	1.1100	-9.8830	10.9930	-41.7812	-0.7805
38	3.2100	0.7700	-9.6018	10.3718	-41.0751	-0.5785
39	2.9400	0.3300	-9.9182	10.2482	-41.8695	-0.8057
40	1.5200	0.3300	-11.5818	11.9118	-46.0618	-1.9863
41	1.3900	0.0700	-11.7341	11.8041	-46.4467	-2.0933
42	3.9267	0.3000	-8.7622	9.0622	-38.9711	0.0292
43	1.2767	0.2300	-11.8668	12.0968	-46.7824	-2.1864
44	1.3100	0.0700	-11.8278	11.8978	-46.6836	-2.1590
45	1.5500	0.0400	-11.5466	11.5866	-45.9730	-1.9616
46	30.1000	3.7100	21.9010	-18.1910	14.1306	45.9608
47	101.9000	8.7000	106.0181	-97.3181	68.4586	263.3057
48	54.4500	7.0200	50.4282	-43.4082	33.5487	118.6769
49	23.9000	29.0000	14.6375	14.3625	7.6105	29.0216
50	14.6000	6.3600	3.7421	2.6179	-9.4286	10.8719
51	36.6667	16.0000	29.5942	-13.5942	19.7881	65.1498

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Inverse Prediction of X Individuals

Row	Mammal (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	28.3000	31.6000	19.7923	11.8077	-32.7150	85.9956
11	23.0667	17.5000	13.6612	3.8388	-41.7820	75.2610
12	10.9000	50.1000	-0.5927	50.6927	-65.3103	52.7538
13	14.8900	4.0800	4.0818	-0.0018	-57.2160	59.7566
14	16.6000	14.1000	6.0852	8.0148	-53.8593	62.8701
15	2.6000	0.3700	-10.3165	10.6865	-83.2770	39.3154
16	11.6950	0.0800	0.3387	-0.2587	-63.6686	54.1201
17	2.0767	0.4300	-10.9296	11.3596	-84.4583	38.5164
18	2.7800	0.1100	-10.1056	10.2156	-82.8720	39.5914
19	2.1100	0.6200	-10.8905	11.5105	-84.3829	38.5672
20	1.9900	1.5000	-11.0311	12.5311	-84.6544	38.3847
21	0.8900	0.0300	-12.3198	12.3498	-87.1569	36.7250
22	31.1000	13.6000	23.0726	-9.4726	-28.1148	91.9899
23	7.8000	2.0200	-4.2244	6.2444	-71.8471	47.5609
24	36.8000	12.2000	29.7504	-17.5504	-19.2607	104.7031
25	30.4000	14.9000	22.2525	-7.3525	-29.2489	90.4754
26	36.8000	29.5000	29.7504	-0.2504	-19.2607	104.7031
27	53.4233	24.8000	49.2254	-24.4254	3.2185	145.1224
28	33.3000	7.7400	25.6500	-17.9100	-24.6183	96.8177
29	54.4000	28.3000	50.3696	-22.0696	4.4105	147.6259
30	23.3500	8.8100	13.9931	-5.1831	-41.2751	75.8262
31	19.0700	9.1500	8.9789	0.1711	-49.1311	67.4877
32	6.0800	5.3300	-6.2395	11.5695	-75.5647	44.7705
33	48.3000	11.8000	43.2232	-31.4232	-3.2451	132.2006
34	4.0533	0.0900	-8.6138	8.7038	-80.0257	41.5631
35	2.9867	0.3500	-9.8635	10.2135	-82.4078	39.9092
36	1.8400	0.3400	-11.2069	11.5469	-84.9942	38.1569
37	2.9700	1.1100	-9.8830	10.9930	-82.4452	39.8835
38	3.2100	0.7700	-9.6018	10.3718	-81.9071	40.2536
39	2.9400	0.3300	-9.9182	10.2482	-82.5125	39.8374
40	1.5200	0.3300	-11.5818	11.9118	-85.7207	37.6726
41	1.3900	0.0700	-11.7341	11.8041	-86.0164	37.4764
42	3.9267	0.3000	-8.7622	9.0622	-80.3074	41.3655
43	1.2767	0.2300	-11.8668	12.0968	-86.2745	37.3057
44	1.3100	0.0700	-11.8278	11.8978	-86.1986	37.3559
45	1.5500	0.0400	-11.5466	11.5866	-85.6525	37.7179
46	30.1000	3.7100	21.9010	-18.1910	-29.7382	89.8295
47	101.9000	8.7000	106.0181	-97.3181	52.6913	279.0730
48	54.4500	7.0200	50.4282	-43.4082	4.4712	147.7544
49	23.9000	29.0000	14.6375	14.3625	-40.2964	76.9285
50	14.6000	6.3600	3.7421	2.6179	-57.7920	59.2353
51	36.6667	16.0000	29.5942	-13.5942	-19.4603	104.3983

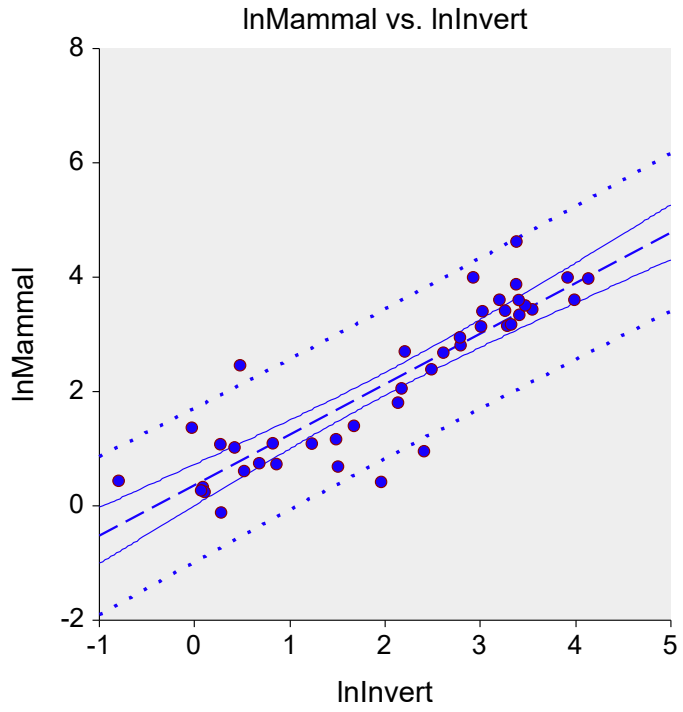
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Invertebrate to Small Mammal Tissue Linear Regressions
In Transformation – All Data

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnMammal	Rows Processed	58
Independent Variable	lnInvert	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	0.3654	Rows Prediction Only	0
Slope	0.8845	Sum of Frequencies	42
R-Squared	0.7867	Sum of Weights	42.0000
Correlation	0.8869	Coefficient of Variation	0.2949
Mean Square Error	0.4102131	Square Root of MSE	0.6404788

Linear Regression Report

Y = lnMammal X = lnInvert

Summary Statement

The equation of the straight line relating lnMammal and lnInvert is estimated as: lnMammal = (0.3654) + (0.8845) lnInvert using the 42 observations in this dataset. The y-intercept, the estimated value of lnMammal when lnInvert is zero, is 0.3654 with a standard error of 0.1786. The slope, the estimated change in lnMammal per unit change in lnInvert, is 0.8845 with a standard error of 0.0728. The value of R-Squared, the proportion of the variation in lnMammal that can be accounted for by variation in lnInvert, is 0.7867. The correlation between lnMammal and lnInvert is 0.8869.

A significance test that the slope is zero resulted in a t-value of 12.1451. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.8845. The lower limit of the 95% confidence interval for the slope is 0.7373 and the upper limit is 1.0317. The estimated intercept is 0.3654. The lower limit of the 95% confidence interval for the intercept is 0.0044 and the upper limit is 0.7263.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnMammal	lnInvert
Count	42	42
Mean	2.1722	2.0427
Standard Deviation	1.3697	1.3734
Minimum	-0.1165	-0.7985
Maximum	4.6240	4.1320

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	0.3654	0.8845
Lower 95% Confidence Limit	0.0044	0.7373
Upper 95% Confidence Limit	0.7263	1.0317
Standard Error	0.1786	0.0728
Standardized Coefficient	0.0000	0.8869
T Value	2.0457	12.1451
Prob Level (T Test)	0.0474	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.5146	1.0000
Regression of Y on X	0.3654	0.8845
Inverse Regression from X on Y	-0.1246	1.1244
Orthogonal Regression of Y and X	0.1358	0.9969

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(0.365366347344721) + (0.884509090571269) * (lnInvert)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	0.3654	0.9000	0.0713	0.7040
Bootstrap Mean	0.3576	0.9500	0.0067	0.7915
Bias (BM - OV)	-0.0078	0.9900	-0.1058	0.9153
Bias Corrected	0.3731			
Standard Error	0.1946			
Slope				
Original Value	0.8845	0.9000	0.7612	0.9920
Bootstrap Mean	0.8872	0.9500	0.7394	1.0115
Bias (BM - OV)	0.0026	0.9900	0.6879	1.0527
Bias Corrected	0.8819			
Standard Error	0.0690			
Correlation				
Original Value	0.8869	0.9000	0.8356	0.9498
Bootstrap Mean	0.8865	0.9500	0.8285	0.9649
Bias (BM - OV)	-0.0005	0.9900	0.8119	1.0000
Bias Corrected	0.8874			
Standard Error	0.0359			
R-Squared				
Original Value	0.7867	0.9000	0.6929	0.8942
Bootstrap Mean	0.7871	0.9500	0.6795	0.9189
Bias (BM - OV)	0.0004	0.9900	0.6479	0.9875
Bias Corrected	0.7862			
Standard Error	0.0628			
Standard Error of Estimate				
Original Value	0.6405	0.9000	0.5109	0.8139
Bootstrap Mean	0.6216	0.9500	0.4862	0.8415
Bias (BM - OV)	-0.0189	0.9900	0.4277	0.9120
Bias Corrected	0.6593			
Standard Error	0.0922			
Orthogonal Intercept				
Original Value	0.1358	0.9000	-0.1861	0.5382
Bootstrap Mean	0.1238	0.9500	-0.2526	0.6370
Bias (BM - OV)	-0.0120	0.9900	-0.3722	0.8510
Bias Corrected	0.1477			
Standard Error	0.2225			
Orthogonal Slope				
Original Value	0.9969	0.9000	0.8543	1.1097
Bootstrap Mean	1.0015	0.9500	0.8240	1.1310
Bias (BM - OV)	0.0046	0.9900	0.7573	1.1640
Bias Corrected	0.9923			
Standard Error	0.0777			

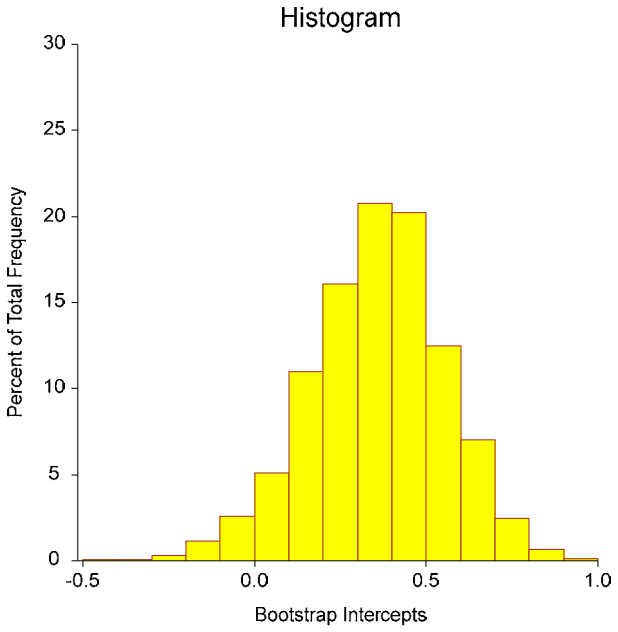
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

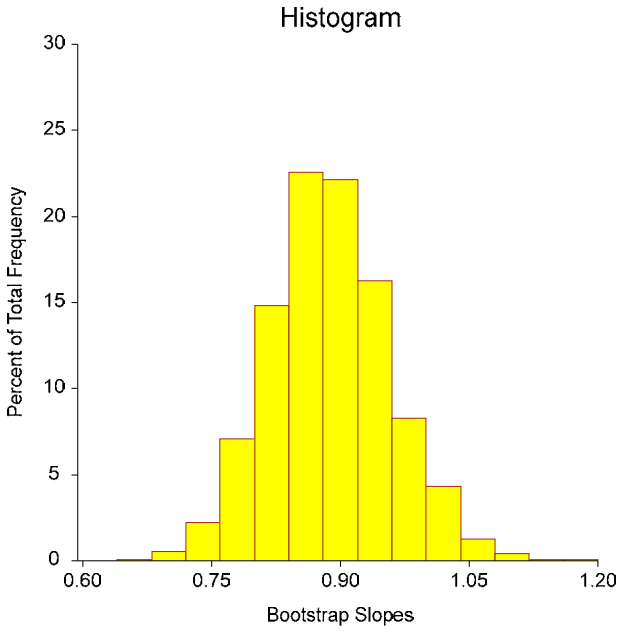
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

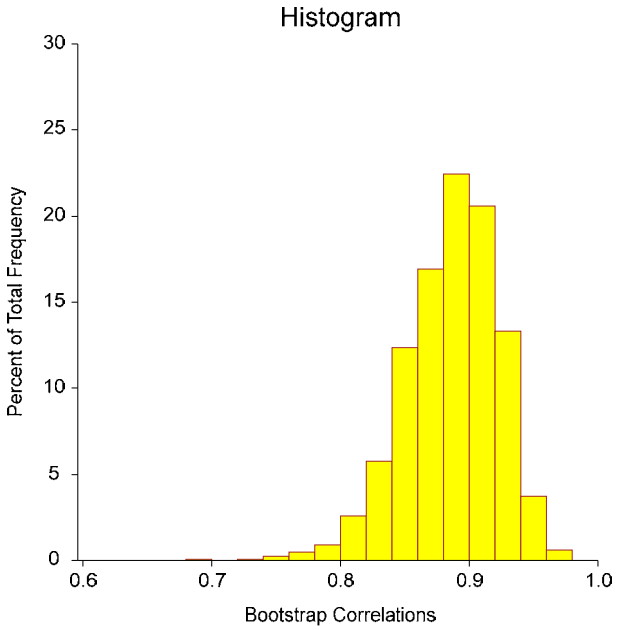
Linear Regression Report

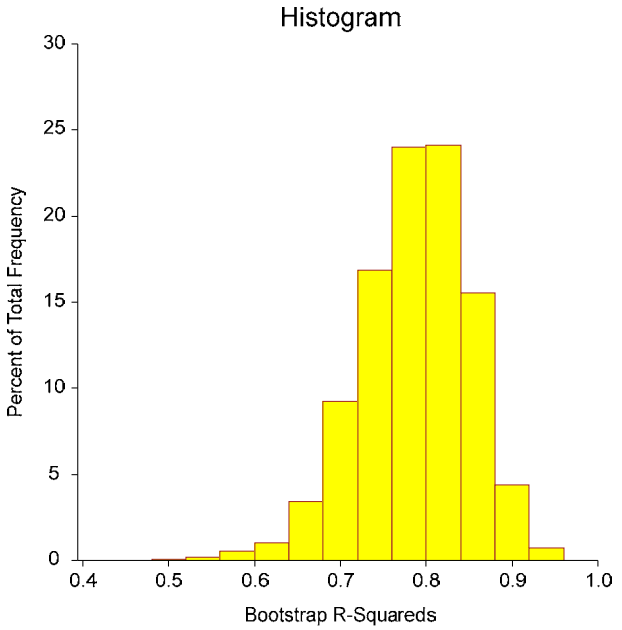
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Bootstrap Histograms Section



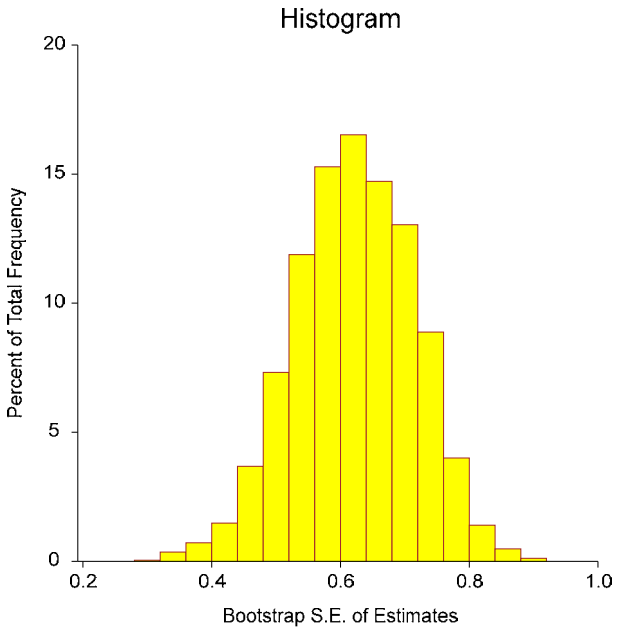


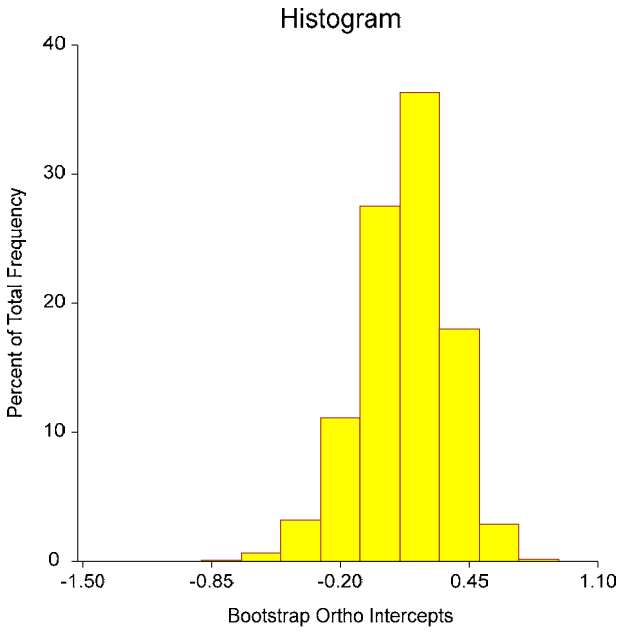


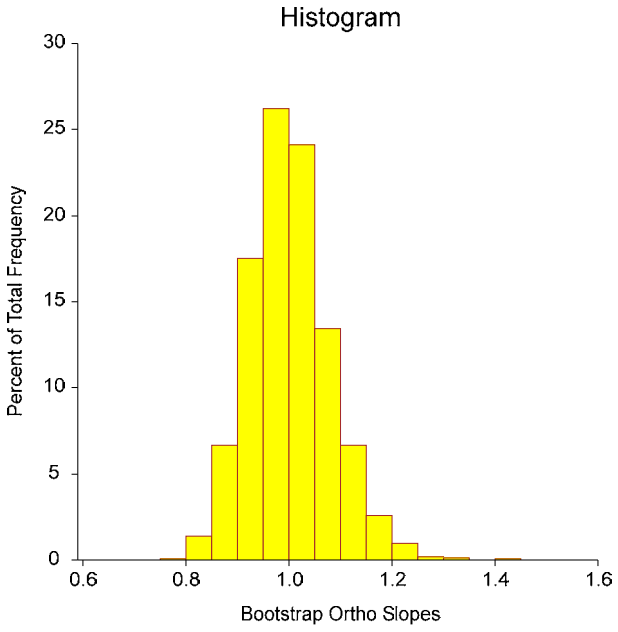


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8869	0.7867	0.8859
Lower 95% Conf. Limit (r dist'n)	0.7947		
Upper 95% Conf. Limit (r dist'n)	0.9364		
Lower 95% Conf. Limit (Fisher's z)	0.7982		0.7963
Upper 95% Conf. Limit (Fisher's z)	0.9380		0.9374
Adjusted (Rbar)		0.7813	
T-Value for H0: Rho = 0	12.1451	12.1451	12.0762
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	198.1732	198.1732			
Slope	1	60.50791	60.50791	147.5036	0.0000	1.0000
Error	40	16.40852	0.4102131			
Adj. Total	41	76.91644	1.876011			
Total	42	275.0897				

s = Square Root(0.4102131) = 0.6404788

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	85.79516	91.23199	0.077763	-0.02641228
1	85.79516	252.598	254.7719	-0.02641228	0.01292982
2 (Y'Y)			275.0897		
Determinant		3248.305			0.0003078528

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.0318994	-0.01083466
1	-0.01083466	0.005303981

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9454	0.044122	No
Anderson Darling	0.9994	0.012359	No
D'Agostino Skewness	-0.1041	0.917051	Yes
D'Agostino Kurtosis	1.9505	0.051122	No
D'Agostino Omnibus	3.8151	0.148443	No
Constant Residual Variance?			
Modified Levene Test	1.1699	0.285894	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(0, 0) Test	0.0000	0.000000	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

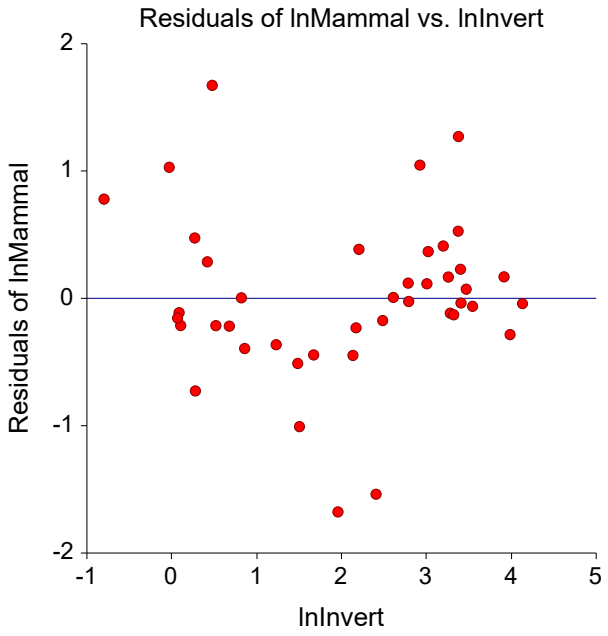
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

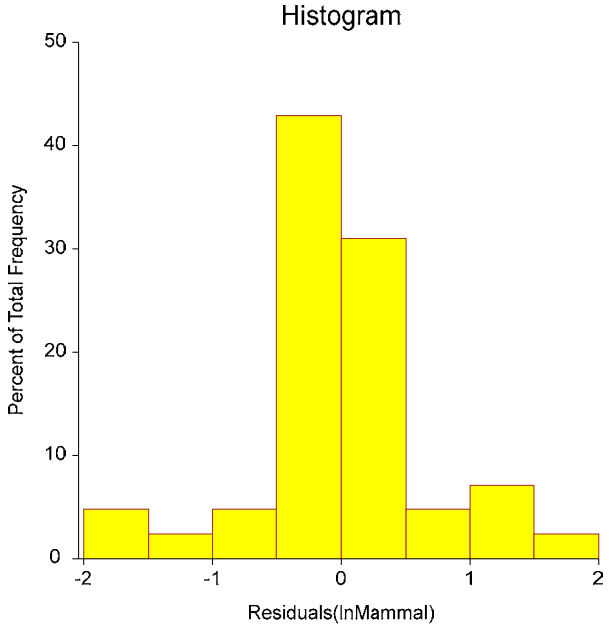
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

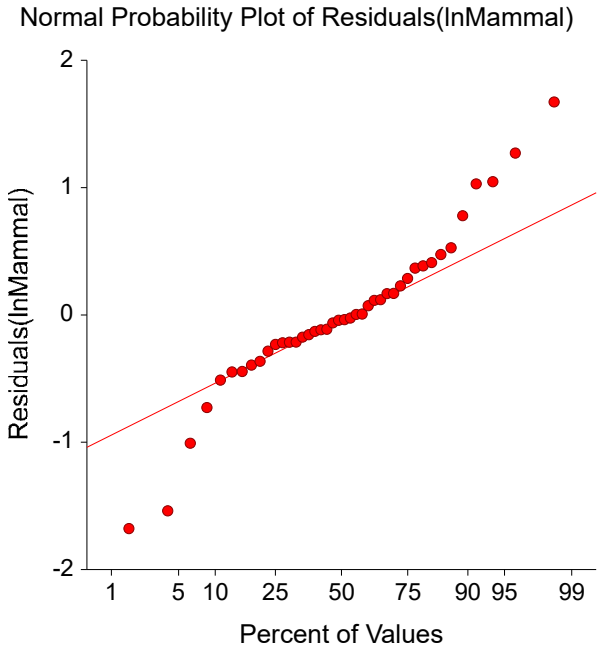
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Original Data Section

Row	lnInvert (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual
10	3.4078	3.3429	3.3796	-0.0368
11	3.0057	3.1384	3.0239	0.1145
12	2.4849	2.3888	2.5633	-0.1745
13	2.2050	2.7007	2.3157	0.3850
14	2.7912	2.8094	2.8342	-0.0248
15	2.4069	0.9555	2.4943	-1.5388
16	0.4762	2.4592	0.7866	1.6726
17	0.8587	0.7308	1.1249	-0.3941
18	0.4187	1.0225	0.7357	0.2867
19	0.6780	0.7467	0.9651	-0.2184
20	1.5041	0.6881	1.6957	-1.0076
21	0.2776	-0.1165	0.6109	-0.7275
22	3.5439	3.4372	3.4999	-0.0627
23	2.1713	2.0541	2.2859	-0.2318
24	3.1987	3.6055	3.1946	0.4109
25	3.2581	3.4144	3.2472	0.1673
26	3.9853	3.6055	3.8904	-0.2849
27	4.1320	3.9782	4.0201	-0.0419
28	3.4689	3.5056	3.4336	0.0720
29	3.9140	3.9964	3.8274	0.1690
30	3.2809	3.1506	3.2674	-0.1168
31	2.7850	2.9481	2.8287	0.1194
32	2.1342	1.8050	2.2531	-0.4481
33	3.3742	3.8774	3.3498	0.5276
34	1.6715	1.3995	1.8438	-0.4443
35	0.8198	1.0942	1.0905	0.0037
36	0.5188	0.6098	0.8242	-0.2145
37	1.2296	1.0886	1.4530	-0.3644
38	1.4839	1.1663	1.6779	-0.5116
39	0.2700	1.0784	0.6042	0.4742
40	1.9573	0.4187	2.0966	-1.6779
41	0.0862	0.3293	0.4416	-0.1123
42	-0.0305	1.3678	0.3384	1.0294
43	0.1044	0.2443	0.4577	-0.2134
44	0.0677	0.2700	0.4252	-0.1552
45	-0.7985	0.4383	-0.3409	0.7792
46	3.0204	3.4045	3.0370	0.3676
47	3.3776	4.6240	3.3529	1.2711
48	2.9232	3.9973	2.9509	1.0464
49	3.3214	3.1739	3.3032	-0.1293
50	2.6101	2.6810	2.6740	0.0070
51	3.4012	3.6019	3.3738	0.2281

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Predicted Values and Confidence Limits of Means

Row	lnInvert (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	3.4078	3.3429	3.3796	0.1402	3.0963	3.6630
11	3.0057	3.1384	3.0239	0.1212	2.7790	3.2688
12	2.4849	2.3888	2.5633	0.1039	2.3532	2.7734
13	2.2050	2.7007	2.3157	0.0995	2.1145	2.5168
14	2.7912	2.8094	2.8342	0.1129	2.6061	3.0623
15	2.4069	0.9555	2.4943	0.1023	2.2875	2.7011
16	0.4762	2.4592	0.7866	0.1509	0.4815	1.0917
17	0.8587	0.7308	1.1249	0.1312	0.8598	1.3899
18	0.4187	1.0225	0.7357	0.1541	0.4242	1.0472
19	0.6780	0.7467	0.9651	0.1402	0.6818	1.2484
20	1.5041	0.6881	1.6957	0.1063	1.4808	1.9106
21	0.2776	-0.1165	0.6109	0.1621	0.2832	0.9386
22	3.5439	3.4372	3.4999	0.1474	3.2021	3.7978
23	2.1713	2.0541	2.2859	0.0993	2.0853	2.4866
24	3.1987	3.6055	3.1946	0.1298	2.9322	3.4570
25	3.2581	3.4144	3.2472	0.1327	2.9790	3.5153
26	3.9853	3.6055	3.8904	0.1726	3.5416	4.2392
27	4.1320	3.9782	4.0201	0.1814	3.6534	4.3868
28	3.4689	3.5056	3.4336	0.1434	3.1438	3.7234
29	3.9140	3.9964	3.8274	0.1683	3.4871	4.1676
30	3.2809	3.1506	3.2674	0.1338	2.9970	3.5378
31	2.7850	2.9481	2.8287	0.1126	2.6011	3.0564
32	2.1342	1.8050	2.2531	0.0991	2.0529	2.4532
33	3.3742	3.8774	3.3498	0.1385	3.0700	3.6297
34	1.6715	1.3995	1.8438	0.1025	1.6367	2.0509
35	0.8198	1.0942	1.0905	0.1330	0.8216	1.3594
36	0.5188	0.6098	0.8242	0.1486	0.5239	1.1246
37	1.2296	1.0886	1.4530	0.1152	1.2201	1.6858
38	1.4839	1.1663	1.6779	0.1069	1.4619	1.8939
39	0.2700	1.0784	0.6042	0.1626	0.2756	0.9328
40	1.9573	0.4187	2.0966	0.0990	1.8965	2.2967
41	0.0862	0.3293	0.4416	0.1734	0.0911	0.7921
42	-0.0305	1.3678	0.3384	0.1805	-0.0263	0.7031
43	0.1044	0.2443	0.4577	0.1723	0.1094	0.8060
44	0.0677	0.2700	0.4252	0.1745	0.0725	0.7779
45	-0.7985	0.4383	-0.3409	0.2293	-0.8044	0.1225
46	3.0204	3.4045	3.0370	0.1218	2.7908	3.2831
47	3.3776	4.6240	3.3529	0.1386	3.0727	3.6331
48	2.9232	3.9973	2.9509	0.1178	2.7128	3.1890
49	3.3214	3.1739	3.3032	0.1358	3.0288	3.5776
50	2.6101	2.6810	2.6740	0.1071	2.4575	2.8905
51	3.4012	3.6019	3.3738	0.1398	3.0911	3.6564

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Predicted Values and Prediction Limits

Row	lnInvert (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	3.4078	3.3429	3.3796	0.6556	2.0545	4.7047
11	3.0057	3.1384	3.0239	0.6518	1.7065	4.3413
12	2.4849	2.3888	2.5633	0.6489	1.2519	3.8747
13	2.2050	2.7007	2.3157	0.6482	1.0057	3.6257
14	2.7912	2.8094	2.8342	0.6503	1.5198	4.1486
15	2.4069	0.9555	2.4943	0.6486	1.1835	3.8052
16	0.4762	2.4592	0.7866	0.6580	-0.5433	2.1165
17	0.8587	0.7308	1.1249	0.6538	-0.1965	2.4462
18	0.4187	1.0225	0.7357	0.6588	-0.5957	2.0671
19	0.6780	0.7467	0.9651	0.6556	-0.3600	2.2902
20	1.5041	0.6881	1.6957	0.6492	0.3836	3.0079
21	0.2776	-0.1165	0.6109	0.6607	-0.7244	1.9462
22	3.5439	3.4372	3.4999	0.6572	2.1717	4.8282
23	2.1713	2.0541	2.2859	0.6481	0.9760	3.5958
24	3.1987	3.6055	3.1946	0.6535	1.8738	4.5154
25	3.2581	3.4144	3.2472	0.6541	1.9252	4.5691
26	3.9853	3.6055	3.8904	0.6633	2.5498	5.2310
27	4.1320	3.9782	4.0201	0.6657	2.6747	5.3655
28	3.4689	3.5056	3.4336	0.6563	2.1071	4.7601
29	3.9140	3.9964	3.8274	0.6622	2.4889	5.1658
30	3.2809	3.1506	3.2674	0.6543	1.9450	4.5898
31	2.7850	2.9481	2.8287	0.6503	1.5144	4.1431
32	2.1342	1.8050	2.2531	0.6481	0.9432	3.5629
33	3.3742	3.8774	3.3498	0.6553	2.0255	4.6742
34	1.6715	1.3995	1.8438	0.6486	0.5329	3.1547
35	0.8198	1.0942	1.0905	0.6542	-0.2316	2.4126
36	0.5188	0.6098	0.8242	0.6575	-0.5046	2.1531
37	1.2296	1.0886	1.4530	0.6508	0.1378	2.7682
38	1.4839	1.1663	1.6779	0.6493	0.3655	2.9902
39	0.2700	1.0784	0.6042	0.6608	-0.7313	1.9397
40	1.9573	0.4187	2.0966	0.6481	0.7868	3.4064
41	0.0862	0.3293	0.4416	0.6635	-0.8995	1.7827
42	-0.0305	1.3678	0.3384	0.6654	-1.0064	1.6833
43	0.1044	0.2443	0.4577	0.6633	-0.8828	1.7982
44	0.0677	0.2700	0.4252	0.6638	-0.9164	1.7669
45	-0.7985	0.4383	-0.3409	0.6803	-1.7158	1.0340
46	3.0204	3.4045	3.0370	0.6520	1.7193	4.3546
47	3.3776	4.6240	3.3529	0.6553	2.0284	4.6773
48	2.9232	3.9973	2.9509	0.6512	1.6348	4.2671
49	3.3214	3.1739	3.3032	0.6547	1.9800	4.6264
50	2.6101	2.6810	2.6740	0.6494	1.3616	3.9864
51	3.4012	3.6019	3.3738	0.6556	2.0488	4.6987

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Working-Hotelling Simultaneous Confidence Band

Row	lnInvert (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	3.4078	3.3429	3.3796	0.1402	2.9806	3.7786
11	3.0057	3.1384	3.0239	0.1212	2.6790	3.3689
12	2.4849	2.3888	2.5633	0.1039	2.2674	2.8591
13	2.2050	2.7007	2.3157	0.0995	2.0324	2.5990
14	2.7912	2.8094	2.8342	0.1129	2.5129	3.1554
15	2.4069	0.9555	2.4943	0.1023	2.2031	2.7856
16	0.4762	2.4592	0.7866	0.1509	0.3570	1.2162
17	0.8587	0.7308	1.1249	0.1312	0.7515	1.4982
18	0.4187	1.0225	0.7357	0.1541	0.2970	1.1744
19	0.6780	0.7467	0.9651	0.1402	0.5661	1.3640
20	1.5041	0.6881	1.6957	0.1063	1.3931	1.9984
21	0.2776	-0.1165	0.6109	0.1621	0.1494	1.0725
22	3.5439	3.4372	3.4999	0.1474	3.0805	3.9194
23	2.1713	2.0541	2.2859	0.0993	2.0034	2.5685
24	3.1987	3.6055	3.1946	0.1298	2.8251	3.5642
25	3.2581	3.4144	3.2472	0.1327	2.8695	3.6248
26	3.9853	3.6055	3.8904	0.1726	3.3992	4.3816
27	4.1320	3.9782	4.0201	0.1814	3.5037	4.5366
28	3.4689	3.5056	3.4336	0.1434	3.0255	3.8417
29	3.9140	3.9964	3.8274	0.1683	3.3482	4.3065
30	3.2809	3.1506	3.2674	0.1338	2.8866	3.6482
31	2.7850	2.9481	2.8287	0.1126	2.5081	3.1494
32	2.1342	1.8050	2.2531	0.0991	1.9711	2.5350
33	3.3742	3.8774	3.3498	0.1385	2.9558	3.7439
34	1.6715	1.3995	1.8438	0.1025	1.5522	2.1354
35	0.8198	1.0942	1.0905	0.1330	0.7118	1.4692
36	0.5188	0.6098	0.8242	0.1486	0.4012	1.2472
37	1.2296	1.0886	1.4530	0.1152	1.1251	1.7809
38	1.4839	1.1663	1.6779	0.1069	1.3736	1.9821
39	0.2700	1.0784	0.6042	0.1626	0.1414	1.0670
40	1.9573	0.4187	2.0966	0.0990	1.8147	2.3785
41	0.0862	0.3293	0.4416	0.1734	-0.0520	0.9352
42	-0.0305	1.3678	0.3384	0.1805	-0.1752	0.8521
43	0.1044	0.2443	0.4577	0.1723	-0.0328	0.9482
44	0.0677	0.2700	0.4252	0.1745	-0.0715	0.9220
45	-0.7985	0.4383	-0.3409	0.2293	-0.9936	0.3118
46	3.0204	3.4045	3.0370	0.1218	2.6902	3.3837
47	3.3776	4.6240	3.3529	0.1386	2.9583	3.7475
48	2.9232	3.9973	2.9509	0.1178	2.6156	3.2863
49	3.3214	3.1739	3.3032	0.1358	2.9167	3.6897
50	2.6101	2.6810	2.6740	0.1071	2.3691	2.9789
51	3.4012	3.6019	3.3738	0.1398	2.9757	3.7718

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Residual Section

Row	lnInvert (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	3.4078	3.3429	3.3796	-0.0368	-0.0588	1.1000
11	3.0057	3.1384	3.0239	0.1145	0.1820	3.6474
12	2.4849	2.3888	2.5633	-0.1745	-0.2762	7.3061
13	2.2050	2.7007	2.3157	0.3850	0.6085	14.2558
14	2.7912	2.8094	2.8342	-0.0248	-0.0393	0.8818
15	2.4069	0.9555	2.4943	-1.5388	-2.4339	161.0467
16	0.4762	2.4592	0.7866	1.6726	2.6871	68.0135
17	0.8587	0.7308	1.1249	-0.3941	-0.6286	53.9294
18	0.4187	1.0225	0.7357	0.2867	0.4612	28.0435
19	0.6780	0.7467	0.9651	-0.2184	-0.3495	29.2499
20	1.5041	0.6881	1.6957	-1.0076	-1.5953	146.4251
21	0.2776	-0.1165	0.6109	-0.7275	-1.1741	624.2548
22	3.5439	3.4372	3.4999	-0.0627	-0.1006	1.8250
23	2.1713	2.0541	2.2859	-0.2318	-0.3664	11.2851
24	3.1987	3.6055	3.1946	0.4109	0.6551	11.3958
25	3.2581	3.4144	3.2472	0.1673	0.2669	4.8986
26	3.9853	3.6055	3.8904	-0.2849	-0.4619	7.9012
27	4.1320	3.9782	4.0201	-0.0419	-0.0682	1.0526
28	3.4689	3.5056	3.4336	0.0720	0.1153	2.0526
29	3.9140	3.9964	3.8274	0.1690	0.2735	4.2291
30	3.2809	3.1506	3.2674	-0.1168	-0.1864	3.7061
31	2.7850	2.9481	2.8287	0.1194	0.1893	4.0494
32	2.1342	1.8050	2.2531	-0.4481	-0.7081	24.8227
33	3.3742	3.8774	3.3498	0.5276	0.8437	13.6065
34	1.6715	1.3995	1.8438	-0.4443	-0.7027	31.7433
35	0.8198	1.0942	1.0905	0.0037	0.0059	0.3371
36	0.5188	0.6098	0.8242	-0.2145	-0.3443	35.1739
37	1.2296	1.0886	1.4530	-0.3644	-0.5784	33.4784
38	1.4839	1.1663	1.6779	-0.5116	-0.8101	43.8660
39	0.2700	1.0784	0.6042	0.4742	0.7655	43.9723
40	1.9573	0.4187	2.0966	-1.6779	-2.6516	400.7263
41	0.0862	0.3293	0.4416	-0.1123	-0.1821	34.0985
42	-0.0305	1.3678	0.3384	1.0294	1.6750	75.2576
43	0.1044	0.2443	0.4577	-0.2134	-0.3460	87.3773
44	0.0677	0.2700	0.4252	-0.1552	-0.2518	57.4697
45	-0.7985	0.4383	-0.3409	0.7792	1.3029	177.7906
46	3.0204	3.4045	3.0370	0.3676	0.5846	10.7964
47	3.3776	4.6240	3.3529	1.2711	2.0328	27.4896
48	2.9232	3.9973	2.9509	1.0464	1.6621	26.1766
49	3.3214	3.1739	3.3032	-0.1293	-0.2066	4.0747
50	2.6101	2.6810	2.6740	0.0070	0.0111	0.2620
51	3.4012	3.6019	3.3738	0.2281	0.3650	6.3332

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Residual Diagnostics Section

Row	lnInvert (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	3.4078	-0.0368	-0.0581	0.0479	0.0001	0.4207
11	3.0057	0.1145	0.1798	0.0358	0.0006	0.4204
12	2.4849	-0.1745	-0.2729	0.0263	0.0010	0.4199
13	2.2050	0.3850	0.6037	0.0241	0.0046	0.4168
14	2.7912	-0.0248	-0.0388	0.0311	0.0000	0.4207
15	2.4069	-1.5388	*-2.6038	0.0255	0.0776	0.3584
16	0.4762	1.6726	*2.9310	0.0555	0.2123	0.3448
17	0.8587	-0.3941	-0.6238	0.0419	0.0086	0.4166
18	0.4187	0.2867	0.4567	0.0579	0.0065	0.4185
19	0.6780	-0.2184	-0.3456	0.0479	0.0031	0.4194
20	1.5041	-1.0076	-1.6279	0.0276	0.0361	0.3940
21	0.2776	-0.7275	-1.1798	0.0641	0.0472	0.4062
22	3.5439	-0.0627	-0.0994	0.0529	0.0003	0.4206
23	2.1713	-0.2318	-0.3624	0.0240	0.0017	0.4193
24	3.1987	0.4109	0.6504	0.0411	0.0092	0.4162
25	3.2581	0.1673	0.2638	0.0429	0.0016	0.4200
26	3.9853	-0.2849	-0.4573	0.0726	0.0083	0.4185
27	4.1320	-0.0419	-0.0673	0.0802	0.0002	0.4207
28	3.4689	0.0720	0.1138	0.0501	0.0004	0.4206
29	3.9140	0.1690	0.2703	0.0691	0.0028	0.4199
30	3.2809	-0.1168	-0.1842	0.0436	0.0008	0.4204
31	2.7850	0.1194	0.1870	0.0309	0.0006	0.4204
32	2.1342	-0.4481	-0.7036	0.0239	0.0061	0.4155
33	3.3742	0.5276	0.8406	0.0467	0.0174	0.4132
34	1.6715	-0.4443	-0.6982	0.0256	0.0065	0.4155
35	0.8198	0.0037	0.0058	0.0431	0.0000	0.4207
36	0.5188	-0.2145	-0.3404	0.0538	0.0034	0.4195
37	1.2296	-0.3644	-0.5736	0.0324	0.0056	0.4172
38	1.4839	-0.5116	-0.8066	0.0278	0.0094	0.4138
39	0.2700	0.4742	0.7614	0.0644	0.0202	0.4146
40	1.9573	-1.6779	*-2.8840	0.0239	0.0861	0.3468
41	0.0862	-0.1123	-0.1799	0.0733	0.0013	0.4204
42	-0.0305	1.0294	1.7152	0.0794	0.1210	0.3912
43	0.1044	-0.2134	-0.3421	0.0724	0.0047	0.4195
44	0.0677	-0.1552	-0.2489	0.0742	0.0025	0.4201
45	-0.7985	0.7792	*1.3147	0.1282	0.1248	0.4029
46	3.0204	0.3676	0.5797	0.0362	0.0064	0.4171
47	3.3776	1.2711	*2.1197	0.0468	0.1016	0.3773
48	2.9232	1.0464	1.7009	0.0338	0.0484	0.3917
49	3.3214	-0.1293	-0.2041	0.0450	0.0010	0.4203
50	2.6101	0.0070	0.0110	0.0280	0.0000	0.4207
51	3.4012	0.2281	0.3610	0.0477	0.0033	0.4193

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.0581	-0.0130	0.0001	1.1047	0.0026	-0.0092
11	0.1798	0.0346	0.0006	1.0892	-0.0011	0.0200
12	-0.2729	-0.0449	0.0010	1.0763	-0.0120	-0.0139
13	0.6037	0.0950	0.0046	1.0581	0.0428	0.0113
14	-0.0388	-0.0069	0.0000	1.0856	-0.0006	-0.0034
15	* -2.6038	-0.4214	0.0776	0.7834	-0.1342	-0.1092
16	* 2.9310	0.7108	0.2123	0.7480	0.7050	-0.5372
17	-0.6238	-0.1305	0.0086	1.0764	-0.1259	0.0858
18	0.4567	0.1132	0.0065	1.1048	0.1125	-0.0869
19	-0.3456	-0.0775	0.0031	1.0981	-0.0760	0.0550
20	-1.6279	-0.2741	0.0361	0.9485	-0.2252	0.1011
21	-1.1798	-0.3087	0.0472	1.0478	-0.3080	0.2448
22	-0.0994	-0.0235	0.0003	1.1102	0.0058	-0.0174
23	-0.3624	-0.0569	0.0017	1.0706	-0.0268	-0.0054
24	0.6504	0.1346	0.0092	1.0736	-0.0160	0.0873
25	0.2638	0.0559	0.0016	1.0952	-0.0080	0.0373
26	-0.4573	-0.1279	0.0083	1.1222	0.0468	-0.1049
27	-0.0673	-0.0199	0.0002	* 1.1435	0.0079	-0.0167
28	0.1138	0.0261	0.0004	1.1067	-0.0058	0.0189
29	0.2703	0.0736	0.0028	1.1258	-0.0257	0.0596
30	-0.1842	-0.0393	0.0008	1.0980	0.0060	-0.0265
31	0.1870	0.0334	0.0006	1.0836	0.0029	0.0160
32	-0.7036	-0.1101	0.0061	1.0509	-0.0546	-0.0074
33	0.8406	0.1861	0.0174	1.0646	-0.0351	0.1303
34	-0.6982	-0.1131	0.0065	1.0531	-0.0853	0.0299
35	0.0058	0.0012	0.0000	1.0994	0.0012	-0.0008
36	-0.3404	-0.0812	0.0034	1.1052	-0.0804	0.0606
37	-0.5736	-0.1049	0.0056	1.0690	-0.0947	0.0539
38	-0.8066	-0.1365	0.0094	1.0469	-0.1131	0.0520
39	0.7614	0.1998	0.0202	1.0917	0.1994	-0.1587
40	* -2.8840	-0.4513	0.0861	0.7321	-0.2729	0.0284
41	-0.1799	-0.0506	0.0013	1.1333	-0.0506	0.0416
42	1.7152	0.5037	0.1210	0.9880	0.5037	-0.4214
43	-0.3421	-0.0956	0.0047	1.1273	-0.0956	0.0783
44	-0.2489	-0.0705	0.0025	1.1327	-0.0705	0.0581
45	1.3147	0.5041	0.1248	1.1064	0.4992	-0.4549
46	0.5797	0.1123	0.0064	1.0728	-0.0043	0.0656
47	* 2.1197	0.4699	0.1016	0.8874	-0.0891	0.3296
48	1.7009	0.3183	0.0484	0.9436	0.0034	0.1732
49	-0.2041	-0.0443	0.0010	1.0991	0.0075	-0.0304
50	0.0110	0.0019	0.0000	1.0822	0.0004	0.0007
51	0.3610	0.0808	0.0033	1.0973	-0.0160	0.0571

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Outlier Detection Chart

Row	lnInvert (X)	Residual		Standardized Residual		RStudent	
10	3.4078	-0.0368	|.....	-0.0588	|.....	-0.0581	|.....
11	3.0057	0.1145	|.....	0.1820	|.....	0.1798	|.....
12	2.4849	-0.1745	|.....	-0.2762	|.....	-0.2729	|.....
13	2.2050	0.3850	|||.....	0.6085	|||.....	0.6037	|||.....
14	2.7912	-0.0248	|.....	-0.0393	|.....	-0.0388	|.....
15	2.4069	-1.5388	||||||||||||..	-2.4339	||||||||||||..	* -2.6038	||||||||||||..
16	0.4762	1.6726	|||||||||||||.	2.6871	||||||||||||||	* 2.9310	||||||||||||||
17	0.8587	-0.3941	|||.....	-0.6286	|||.....	-0.6238	|||.....
18	0.4187	0.2867	||.....	0.4612	||.....	0.4567	||.....
19	0.6780	-0.2184	|.....	-0.3495	|.....	-0.3456	|.....
20	1.5041	-1.0076	||||||||.....	-1.5953	||||||||.....	-1.6279	||||||||.....
21	0.2776	-0.7275	||||||.....	-1.1741	||||||.....	-1.1798	||||||.....
22	3.5439	-0.0627	|.....	-0.1006	|.....	-0.0994	|.....
23	2.1713	-0.2318	||.....	-0.3664	||.....	-0.3624	|.....
24	3.1987	0.4109	|||.....	0.6551	|||.....	0.6504	|||.....
25	3.2581	0.1673	|.....	0.2669	|.....	0.2638	|.....
26	3.9853	-0.2849	||.....	-0.4619	||.....	-0.4573	||.....
27	4.1320	-0.0419	|.....	-0.0682	|.....	-0.0673	|.....
28	3.4689	0.0720	|.....	0.1153	|.....	0.1138	|.....
29	3.9140	0.1690	|.....	0.2735	|.....	0.2703	|.....
30	3.2809	-0.1168	|.....	-0.1864	|.....	-0.1842	|.....
31	2.7850	0.1194	|.....	0.1893	|.....	0.1870	|.....
32	2.1342	-0.4481	|||.....	-0.7081	|||.....	-0.7036	|||.....
33	3.3742	0.5276	||||.....	0.8437	||||.....	0.8406	||||.....
34	1.6715	-0.4443	|||.....	-0.7027	|||.....	-0.6982	|||.....
35	0.8198	0.0037	|.....	0.0059	|.....	0.0058	|.....
36	0.5188	-0.2145	|.....	-0.3443	|.....	-0.3404	|.....
37	1.2296	-0.3644	|||.....	-0.5784	|||.....	-0.5736	||.....
38	1.4839	-0.5116	||||.....	-0.8101	||||.....	-0.8066	||||.....
39	0.2700	0.4742	||||.....	0.7655	||||.....	0.7614	|||.....
40	1.9573	-1.6779	||||||||||||||	-2.6516	|||||||||||||.	* -2.8840	|||||||||||||.
41	0.0862	-0.1123	|.....	-0.1821	|.....	-0.1799	|.....
42	-0.0305	1.0294	||||||||.....	1.6750	||||||||.....	1.7152	||||||||.....
43	0.1044	-0.2134	|.....	-0.3460	|.....	-0.3421	|.....
44	0.0677	-0.1552	|.....	-0.2518	|.....	-0.2489	|.....
45	-0.7985	0.7792	||||||.....	1.3029	||||||.....	1.3147	||||||.....
46	3.0204	0.3676	|||.....	0.5846	|||.....	0.5797	||.....
47	3.3776	1.2711	||||||||||....	2.0328	||||||||||....	* 2.1197	||||||||||.....
48	2.9232	1.0464	||||||||.....	1.6621	||||||||.....	1.7009	|||||||.....
49	3.3214	-0.1293	|.....	-0.2066	|.....	-0.2041	|.....
50	2.6101	0.0070	|.....	0.0111	|.....	0.0110	|.....
51	3.4012	0.2281	||.....	0.3650	||.....	0.3610	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Influence Detection Chart

Row	lnInvert (X)	DFFITS		Cook's D		DFBETAS(1)	
10	3.4078	-0.0130	|.....	0.0001	|.....	-0.0092	|.....
11	3.0057	0.0346	|.....	0.0006	|.....	0.0200	|.....
12	2.4849	-0.0449	|.....	0.0010	|.....	-0.0139	|.....
13	2.2050	0.0950	|.....	0.0046	|.....	0.0113	|.....
14	2.7912	-0.0069	|.....	0.0000	|.....	-0.0034	|.....
15	2.4069	-0.4214	||||||||.....	0.0776	|||||.....	-0.1092	|||.....
16	0.4762	0.7108	||||||||||||||	0.2123	||||||||||||||	-0.5372	||||||||||||||
17	0.8587	-0.1305	||.....	0.0086	|.....	0.0858	||.....
18	0.4187	0.1132	||.....	0.0065	|.....	-0.0869	||.....
19	0.6780	-0.0775	|.....	0.0031	|.....	0.0550	|.....
20	1.5041	-0.2741	|||||.....	0.0361	||.....	0.1011	||.....
21	0.2776	-0.3087	||||||.....	0.0472	|||.....	0.2448	||||||.....
22	3.5439	-0.0235	|.....	0.0003	|.....	-0.0174	|.....
23	2.1713	-0.0569	|.....	0.0017	|.....	-0.0054	|.....
24	3.1987	0.1346	||.....	0.0092	|.....	0.0873	||.....
25	3.2581	0.0559	|.....	0.0016	|.....	0.0373	|.....
26	3.9853	-0.1279	||.....	0.0083	|.....	-0.1049	||.....
27	4.1320	-0.0199	|.....	0.0002	|.....	-0.0167	|.....
28	3.4689	0.0261	|.....	0.0004	|.....	0.0189	|.....
29	3.9140	0.0736	|.....	0.0028	|.....	0.0596	|.....
30	3.2809	-0.0393	|.....	0.0008	|.....	-0.0265	|.....
31	2.7850	0.0334	|.....	0.0006	|.....	0.0160	|.....
32	2.1342	-0.1101	||.....	0.0061	|.....	-0.0074	|.....
33	3.3742	0.1861	|||.....	0.0174	|.....	0.1303	|||.....
34	1.6715	-0.1131	||.....	0.0065	|.....	0.0299	|.....
35	0.8198	0.0012	|.....	0.0000	|.....	-0.0008	|.....
36	0.5188	-0.0812	|.....	0.0034	|.....	0.0606	|.....
37	1.2296	-0.1049	||.....	0.0056	|.....	0.0539	|.....
38	1.4839	-0.1365	||.....	0.0094	|.....	0.0520	|.....
39	0.2700	0.1998	||||.....	0.0202	|.....	-0.1587	||||.....
40	1.9573	-0.4513	||||||||.....	0.0861	|||||.....	0.0284	|.....
41	0.0862	-0.0506	|.....	0.0013	|.....	0.0416	|.....
42	-0.0305	0.5037	|||||||||.....	0.1210	|||||||.....	-0.4214	||||||||||....
43	0.1044	-0.0956	|.....	0.0047	|.....	0.0783	||.....
44	0.0677	-0.0705	|.....	0.0025	|.....	0.0581	|.....
45	-0.7985	0.5041	|||||||||.....	0.1248	|||||||.....	-0.4549	||||||||||...
46	3.0204	0.1123	||.....	0.0064	|.....	0.0656	|.....
47	3.3776	0.4699	||||||||.....	0.1016	||||||.....	0.3296	||||||||.....
48	2.9232	0.3183	||||||.....	0.0484	|||.....	0.1732	||||.....
49	3.3214	-0.0443	|.....	0.0010	|.....	-0.0304	|.....
50	2.6101	0.0019	|.....	0.0000	|.....	0.0007	|.....
51	3.4012	0.0808	|.....	0.0033	|.....	0.0571	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Outlier & Influence Chart

Row	lnInvert (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	3.4078	-0.0581	|.....	0.0001	|.....	0.0479	|||.....
11	3.0057	0.1798	|.....	0.0006	|.....	0.0358	|.....
12	2.4849	-0.2729	|.....	0.0010	|.....	0.0263	|.....
13	2.2050	0.6037	|||.....	0.0046	|.....	0.0241	|.....
14	2.7912	-0.0388	|.....	0.0000	|.....	0.0311	|.....
15	2.4069	* -2.6038	||||||||||||..	0.0776	|||||.....	0.0255	|.....
16	0.4762	* 2.9310	|||||||||||||	0.2123	|||||||||||||	0.0555	||||.....
17	0.8587	-0.6238	|||.....	0.0086	|.....	0.0419	||.....
18	0.4187	0.4567	||.....	0.0065	|.....	0.0579	||||.....
19	0.6780	-0.3456	|.....	0.0031	|.....	0.0479	|||.....
20	1.5041	-1.6279	||||||||.....	0.0361	||.....	0.0276	|.....
21	0.2776	-1.1798	||||||.....	0.0472	|||.....	0.0641	|||||.....
22	3.5439	-0.0994	|.....	0.0003	|.....	0.0529	||||.....
23	2.1713	-0.3624	|.....	0.0017	|.....	0.0240	|.....
24	3.1987	0.6504	|||.....	0.0092	|.....	0.0411	||.....
25	3.2581	0.2638	|.....	0.0016	|.....	0.0429	||.....
26	3.9853	-0.4573	||.....	0.0083	|.....	0.0726	|||||||.....
27	4.1320	-0.0673	|.....	0.0002	|.....	0.0802	|||||||.....
28	3.4689	0.1138	|.....	0.0004	|.....	0.0501	|||.....
29	3.9140	0.2703	|.....	0.0028	|.....	0.0691	|||||.....
30	3.2809	-0.1842	|.....	0.0008	|.....	0.0436	||.....
31	2.7850	0.1870	|.....	0.0006	|.....	0.0309	|.....
32	2.1342	-0.7036	|||.....	0.0061	|.....	0.0239	|.....
33	3.3742	0.8406	||||.....	0.0174	|.....	0.0467	|||.....
34	1.6715	-0.6982	|||.....	0.0065	|.....	0.0256	|.....
35	0.8198	0.0058	|.....	0.0000	|.....	0.0431	||.....
36	0.5188	-0.3404	|.....	0.0034	|.....	0.0538	||||.....
37	1.2296	-0.5736	||.....	0.0056	|.....	0.0324	|.....
38	1.4839	-0.8066	||||.....	0.0094	|.....	0.0278	|.....
39	0.2700	0.7614	|||.....	0.0202	|.....	0.0644	|||||.....
40	1.9573	* -2.8840	|||||||||||||.	0.0861	|||||.....	0.0239	|.....
41	0.0862	-0.1799	|.....	0.0013	|.....	0.0733	|||||||.....
42	-0.0305	1.7152	||||||||.....	0.1210	||||||||.....	0.0794	|||||||.....
43	0.1044	-0.3421	|.....	0.0047	|.....	0.0724	|||||.....
44	0.0677	-0.2489	|.....	0.0025	|.....	0.0742	|||||||.....
45	-0.7985	1.3147	|||||.....	0.1248	||||||||.....	0.1282	|||||||||||||
46	3.0204	0.5797	||.....	0.0064	|.....	0.0362	|.....
47	3.3776	* 2.1197	|||||||||.....	0.1016	|||||||.....	0.0468	|||.....
48	2.9232	1.7009	||||||||.....	0.0484	|||.....	0.0338	|.....
49	3.3214	-0.2041	|.....	0.0010	|.....	0.0450	|||.....
50	2.6101	0.0110	|.....	0.0000	|.....	0.0280	|.....
51	3.4012	0.3610	|.....	0.0033	|.....	0.0477	|||.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Inverse Prediction of X Means

Row	lnMammal (Y)	lnInvert (X)	Predicted lnInvert (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.3429	3.4078	3.3663	0.0416	3.0818	3.7261
11	3.1384	3.0057	3.1351	-0.1294	2.8706	3.4618
12	2.3888	2.4849	2.2876	0.1973	2.0618	2.5274
13	2.7007	2.2050	2.6402	-0.4353	2.4065	2.9081
14	2.8094	2.7912	2.7632	0.0280	2.5236	3.0438
15	0.9555	2.4069	0.6672	1.7397	0.2996	0.9565
16	2.4592	0.4762	2.3672	-1.8909	2.1408	2.6121
17	0.7308	0.8587	0.4131	0.4456	0.0058	0.7276
18	1.0225	0.4187	0.7429	-0.3242	0.3866	1.0251
19	0.7467	0.6780	0.4311	0.2469	0.0267	0.7437
20	0.6881	1.5041	0.3649	1.1392	-0.0502	0.6844
21	-0.1165	0.2776	-0.5448	0.8225	-1.1171	-0.1199
22	3.4372	3.5439	3.4729	0.0709	3.1785	3.8489
23	2.0541	2.1713	1.9093	0.2621	1.6753	2.1356
24	3.6055	3.1987	3.6632	-0.4645	3.3497	4.0690
25	3.4144	3.2581	3.4472	-0.1891	3.1552	3.8192
26	3.6055	3.9853	3.6632	0.3221	3.3497	4.0690
27	3.9782	4.1320	4.0846	0.0473	3.7250	4.5606
28	3.5056	3.4689	3.5502	-0.0814	3.2482	3.9381
29	3.9964	3.9140	4.1051	-0.1911	3.7431	4.5846
30	3.1506	3.2809	3.1489	0.1320	2.8833	3.4775
31	2.9481	2.7850	2.9200	-0.1350	2.6711	3.2188
32	1.8050	2.1342	1.6276	0.5066	1.3760	1.8556
33	3.8774	3.3742	3.9706	-0.5965	3.6239	4.4272
34	1.3995	1.6715	1.1692	0.5023	0.8708	1.4178
35	1.0942	0.8198	0.8240	-0.0042	0.4795	1.0990
36	0.6098	0.5188	0.2763	0.2425	-0.1533	0.6053
37	1.0886	1.2296	0.8176	0.4120	0.4722	1.0932
38	1.1663	1.4839	0.9055	0.5784	0.5725	1.1736
39	1.0784	0.2700	0.8061	-0.5361	0.4591	1.0828
40	0.4187	1.9573	0.0603	1.8970	-0.4055	0.4132
41	0.3293	0.0862	-0.0408	0.1269	-0.5239	0.3237
42	1.3678	-0.0305	1.1333	-1.1638	0.8305	1.3843
43	0.2443	0.1044	-0.1369	0.2413	-0.6367	0.2387
44	0.2700	0.0677	-0.1078	0.1754	-0.6025	0.2645
45	0.4383	-0.7985	0.0824	-0.8809	-0.3796	0.4328
46	3.4045	3.0204	3.4360	-0.4156	3.1450	3.8063
47	4.6240	3.3776	4.8147	-1.4371	4.3668	5.4204
48	3.9973	2.9232	4.1061	-1.1830	3.7440	4.5858
49	3.1739	3.3214	3.1752	0.1462	2.9075	3.5075
50	2.6810	2.6101	2.6180	-0.0079	2.3851	2.8837
51	3.6019	3.4012	3.6591	-0.2579	3.3460	4.0643

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnInvert

Inverse Prediction of X Individuals

Row	lnMammal (Y)	lnInvert (X)	Predicted lnInvert (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.3429	3.4078	3.3663	0.0416	1.8852	4.9227
11	3.1384	3.0057	3.1351	-0.1294	1.6529	4.6795
12	2.3888	2.4849	2.2876	0.1973	0.7922	3.7969
13	2.7007	2.2050	2.6402	-0.4353	1.1521	4.1625
14	2.8094	2.7912	2.7632	0.0280	1.2769	4.2905
15	0.9555	2.4069	0.6672	1.7397	-0.8921	2.1481
16	2.4592	0.4762	2.3672	-1.8909	0.8737	3.8792
17	0.7308	0.8587	0.4131	0.4456	-1.1607	1.8941
18	1.0225	0.4187	0.7429	-0.3242	-0.8123	2.2240
19	0.7467	0.6780	0.4311	0.2469	-1.1416	1.9121
20	0.6881	1.5041	0.3649	1.1392	-1.2118	1.8461
21	-0.1165	0.2776	-0.5448	0.8225	-2.1842	0.9472
22	3.4372	3.5439	3.4729	0.0709	1.9921	5.0352
23	2.0541	2.1713	1.9093	0.2621	0.4036	3.4074
24	3.6055	3.1987	3.6632	-0.4645	2.1822	5.2365
25	3.4144	3.2581	3.4472	-0.1891	1.9663	5.0080
26	3.6055	3.9853	3.6632	0.3221	2.1822	5.2365
27	3.9782	4.1320	4.0846	0.0473	2.6009	5.6846
28	3.5056	3.4689	3.5502	-0.0814	2.0694	5.1169
29	3.9964	3.9140	4.1051	-0.1911	2.6212	5.7065
30	3.1506	3.2809	3.1489	0.1320	1.6668	4.6940
31	2.9481	2.7850	2.9200	-0.1350	1.4357	4.4542
32	1.8050	2.1342	1.6276	0.5066	0.1124	3.1192
33	3.8774	3.3742	3.9706	-0.5965	2.4880	5.5631
34	1.3995	1.6715	1.1692	0.5023	-0.3648	2.6535
35	1.0942	0.8198	0.8240	-0.0042	-0.7269	2.3054
36	0.6098	0.5188	0.2763	0.2425	-1.3059	1.7579
37	1.0886	1.2296	0.8176	0.4120	-0.7336	2.2990
38	1.1663	1.4839	0.9055	0.5784	-0.6412	2.3874
39	1.0784	0.2700	0.8061	-0.5361	-0.7456	2.2875
40	0.4187	1.9573	0.0603	1.8970	-1.5357	1.5434
41	0.3293	0.0862	-0.0408	0.1269	-1.6436	1.4434
42	1.3678	-0.0305	1.1333	-1.1638	-0.4024	2.6172
43	0.2443	0.1044	-0.1369	0.2413	-1.7464	1.3484
44	0.2700	0.0677	-0.1078	0.1754	-1.7152	1.3771
45	0.4383	-0.7985	0.0824	-0.8809	-1.5122	1.5653
46	3.4045	3.0204	3.4360	-0.4156	1.9551	4.9962
47	4.6240	3.3776	4.8147	-1.4371	3.3187	6.4685
48	3.9973	2.9232	4.1061	-1.1830	2.6222	5.7076
49	3.1739	3.3214	3.1752	0.1462	1.6933	4.7217
50	2.6810	2.6101	2.6180	-0.0079	1.1294	4.1394
51	3.6019	3.4012	3.6591	-0.2579	2.1781	5.2321

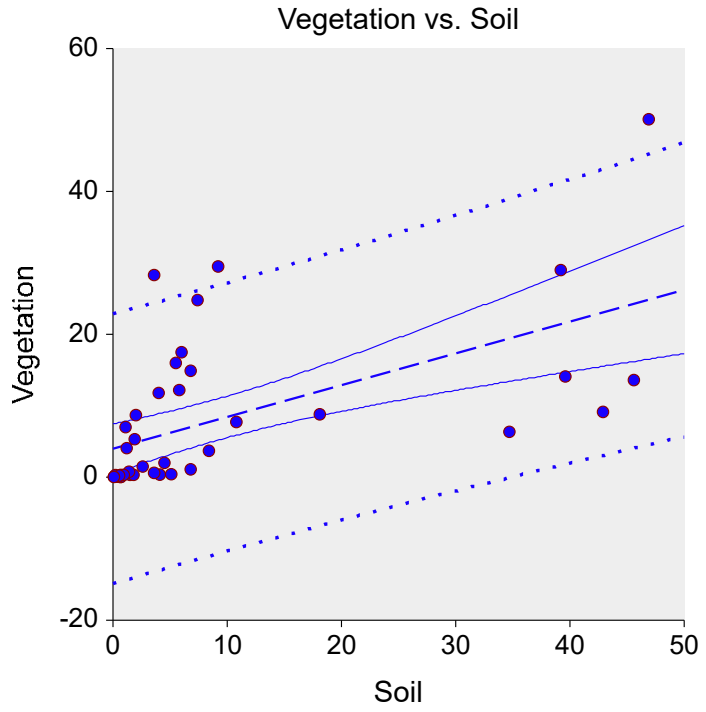
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
No Transformation – APL10 Excluded

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Vegetation	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	3.9966	Rows Prediction Only	0
Slope	0.4457	Sum of Frequencies	41
R-Squared	0.3245	Sum of Weights	41.0000
Correlation	0.5697	Coefficient of Variation	1.1336
Mean Square Error	84.20187	Square Root of MSE	9.176158

Linear Regression Report

Y = Vegetation X = Soil

Summary Statement

The equation of the straight line relating Vegetation and Soil is estimated as: Vegetation = (3.9966) + (0.4457) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Vegetation when Soil is zero, is 3.9966 with a standard error of 1.7176. The slope, the estimated change in Vegetation per unit change in Soil, is 0.4457 with a standard error of 0.1030. The value of R-Squared, the proportion of the variation in Vegetation that can be accounted for by variation in Soil, is 0.3245. The correlation between Vegetation and Soil is 0.5697.

A significance test that the slope is zero resulted in a t-value of 4.3288. The significance level of this t-test is 0.0001. Since 0.0001 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.4457. The lower limit of the 95% confidence interval for the slope is 0.2375 and the upper limit is 0.6540. The estimated intercept is 3.9966. The lower limit of the 95% confidence interval for the intercept is 0.5225 and the upper limit is 7.4707.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Vegetation	Soil
Count	41	41
Mean	8.0949	9.1944
Standard Deviation	11.0246	14.0901
Minimum	0.0300	0.0730
Maximum	50.1000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	3.9966	0.4457
Lower 95% Confidence Limit	0.5225	0.2375
Upper 95% Confidence Limit	7.4707	0.6540
Standard Error	1.7176	0.1030
Standardized Coefficient	0.0000	0.5697
T Value	2.3269	4.3288
Prob Level (T Test)	0.0253	0.0001
Prob Level (Randomization Test N =1000)		0.0030
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.6215	0.9881
Regression of Y on X	3.9966	0.4457
Inverse Regression from X on Y	-4.5332	1.3735
Orthogonal Regression of Y and X	2.0678	0.6555

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(3.99657676301078) + (0.44573932333225) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Section

---------- Estimation Results	----------	Bootstrap Confidence Limits	----------	
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	3.9966	0.9000	1.4657	6.1541
Bootstrap Mean	4.0460	0.9500	0.9851	6.4960
Bias (BM - OV)	0.0494	0.9900	-0.0970	7.1531
Bias Corrected	3.9471			
Standard Error	1.4214			
Slope				
Original Value	0.4457	0.9000	0.1592	0.6881
Bootstrap Mean	0.4446	0.9500	0.1000	0.7107
Bias (BM - OV)	-0.0011	0.9900	-0.0933	0.7573
Bias Corrected	0.4469			
Standard Error	0.1638			
Correlation				
Original Value	0.5697	0.9000	0.3788	0.8323
Bootstrap Mean	0.5548	0.9500	0.3471	0.8837
Bias (BM - OV)	-0.0149	0.9900	0.2867	0.9467
Bias Corrected	0.5846			
Standard Error	0.1380			
R-Squared				
Original Value	0.3245	0.9000	0.0706	0.5548
Bootstrap Mean	0.3268	0.9500	0.0214	0.5837
Bias (BM - OV)	0.0023	0.9900	0.0000	0.6119
Bias Corrected	0.3222			
Standard Error	0.1483			
Standard Error of Estimate				
Original Value	9.1762	0.9000	7.5295	12.0055
Bootstrap Mean	8.6805	0.9500	7.2085	12.5424
Bias (BM - OV)	-0.4957	0.9900	6.5290	13.7257
Bias Corrected	9.6718			
Standard Error	1.3613			
Orthogonal Intercept				
Original Value	2.0678	0.9000	-0.5738	4.0871
Bootstrap Mean	2.1724	0.9500	-1.0539	4.4571
Bias (BM - OV)	0.1046	0.9900	-2.1255	6.0485
Bias Corrected	1.9632			
Standard Error	1.4859			
Orthogonal Slope				
Original Value	0.6555	0.9000	0.2223	1.0115
Bootstrap Mean	0.6679	0.9500	0.0939	1.0588
Bias (BM - OV)	0.0124	0.9900	-0.6052	1.1233
Bias Corrected	0.6432			
Standard Error	0.2886			

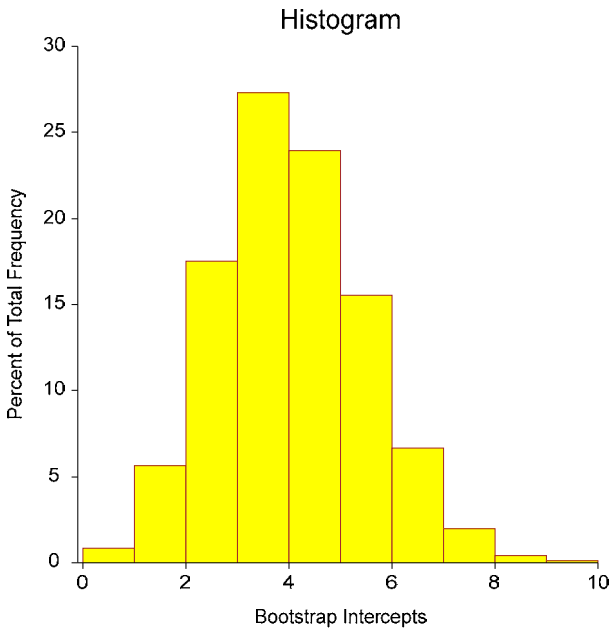
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

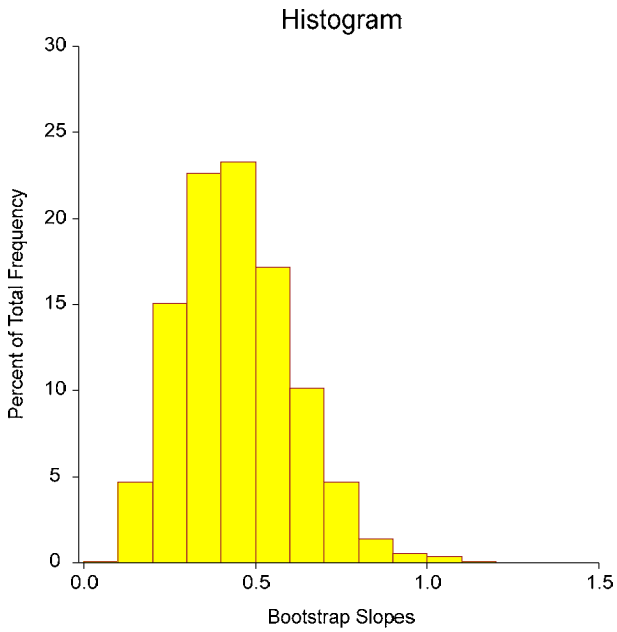
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

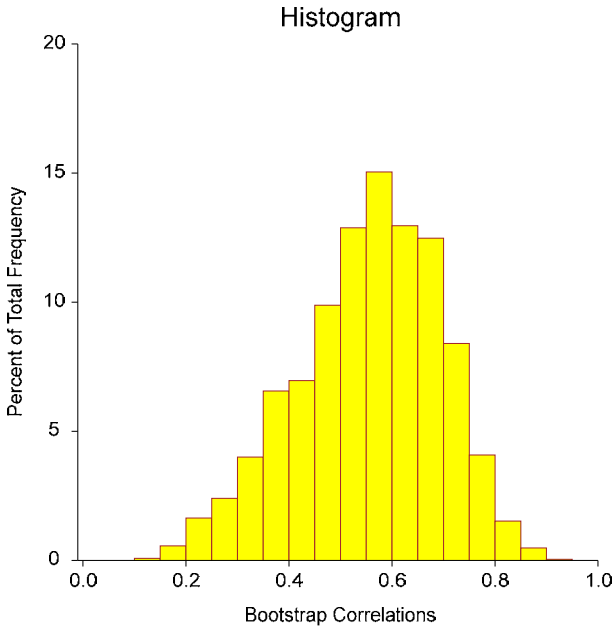
Linear Regression Report

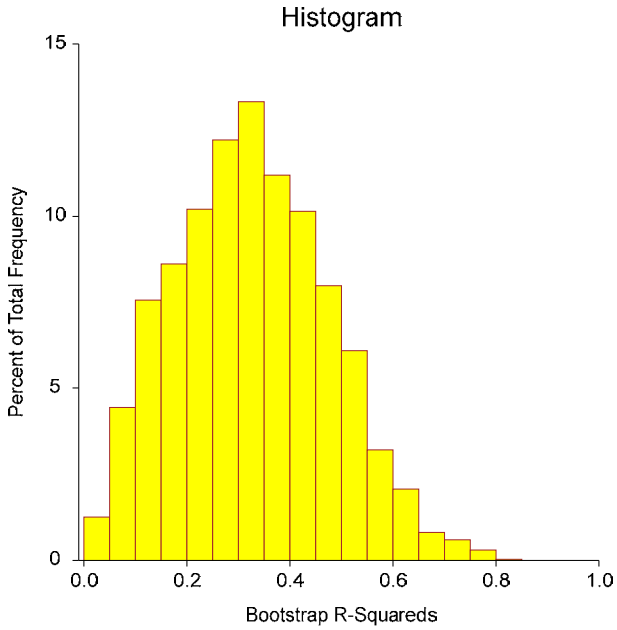
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Bootstrap Histograms Section



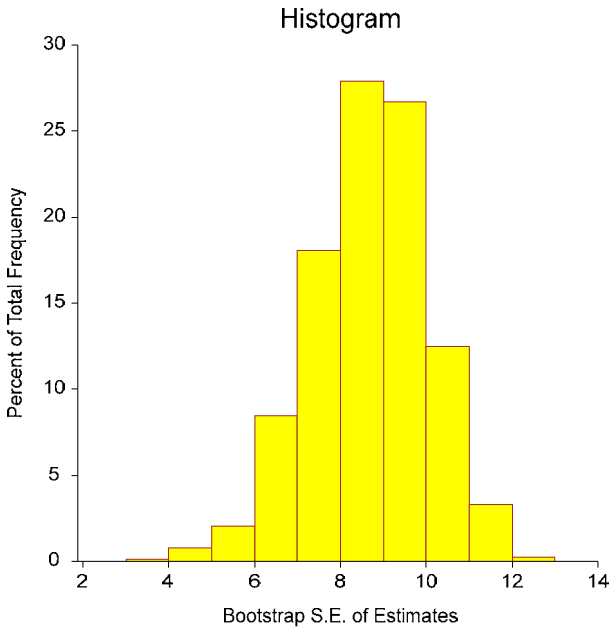


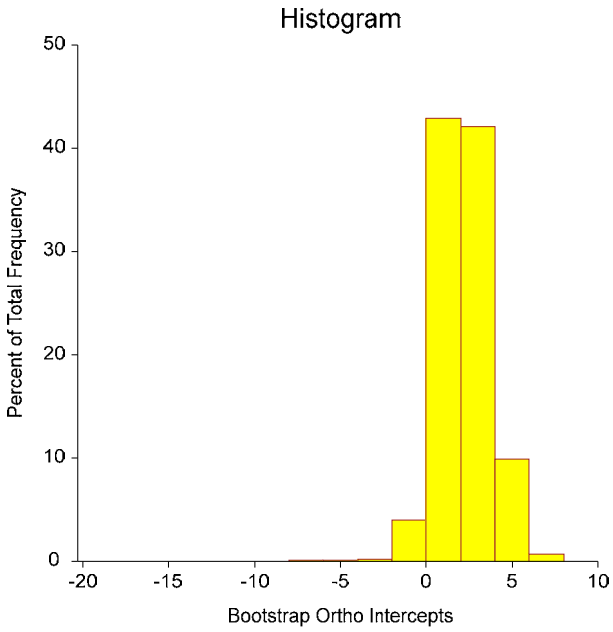


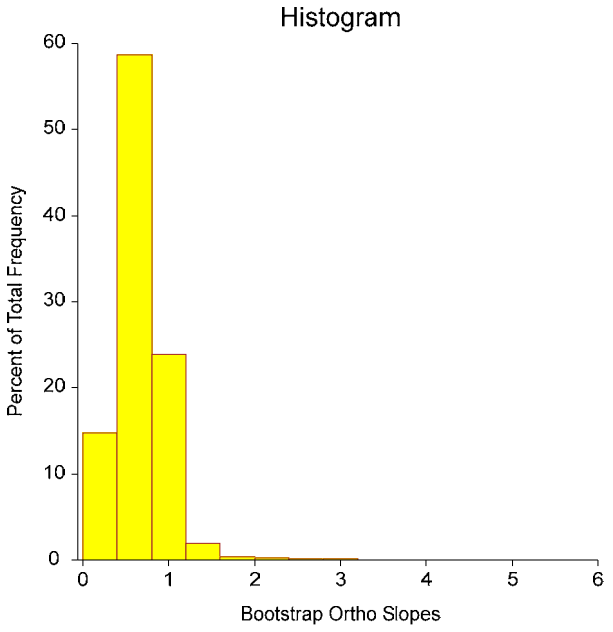


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.5697	0.3245	0.8200
Lower 95% Conf. Limit (r dist'n)	0.3138		
Upper 95% Conf. Limit (r dist'n)	0.7419		
Lower 95% Conf. Limit (Fisher's z)	0.3177		0.6852
Upper 95% Conf. Limit (Fisher's z)	0.7465		0.9005
Adjusted (Rbar)		0.3072	
T-Value for H0: Rho = 0	4.3288	4.3288	8.9470
Prob Level for H0: Rho = 0	0.0001	0.0001	0.0000
Prob Level (Randomization Test N =1000)	0.0030		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	2686.609	2686.609			
Slope	1	1577.803	1577.803	18.7383	0.0001	0.9881
Error	39	3283.873	84.20187			
Lack of Fit	37	2805.7	75.82972	0.3172	0.9456	
Pure Error	2	478.1732	239.0866			
Adj. Total	40	4861.676	121.5419			
Total	41	7548.285				

s = Square Root(84.20187) = 9.176158

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	331.89	0.03503547	-0.001157796
1	376.97	11407.3	6591.27	-0.001157796	0.0001259242
2 (Y'Y)			7548.285		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	2.950052	-0.0974886
1	-0.0974886	0.01060305

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.8300	0.000025	No
Anderson Darling	3.1227	0.000000	No
D'Agostino Skewness	3.2081	0.001336	No
D'Agostino Kurtosis	1.7450	0.080984	No
D'Agostino Omnibus	13.3367	0.001270	No
Constant Residual Variance?			
Modified Levene Test	10.3146	0.002645	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.3172	0.945598	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

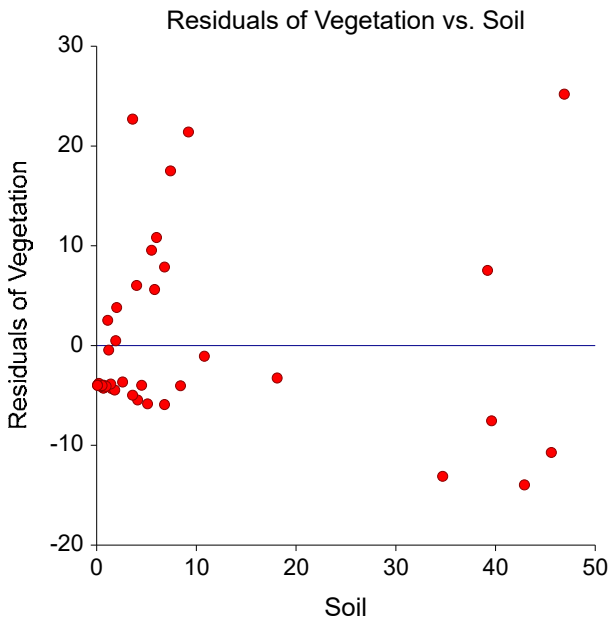
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

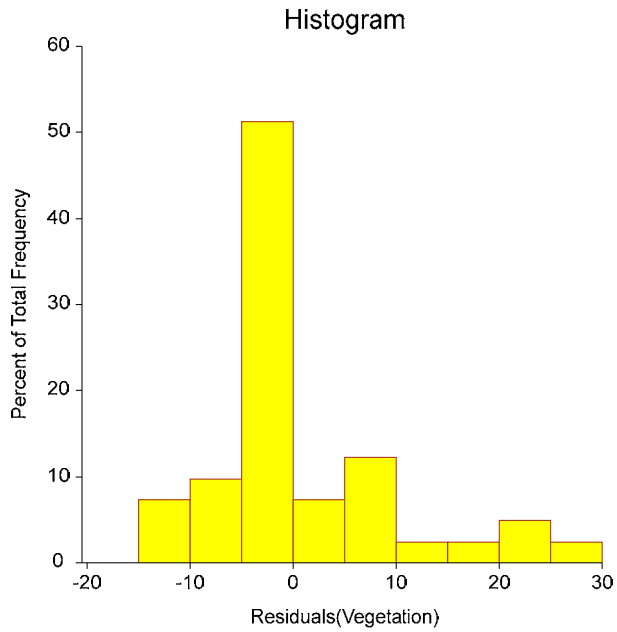
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

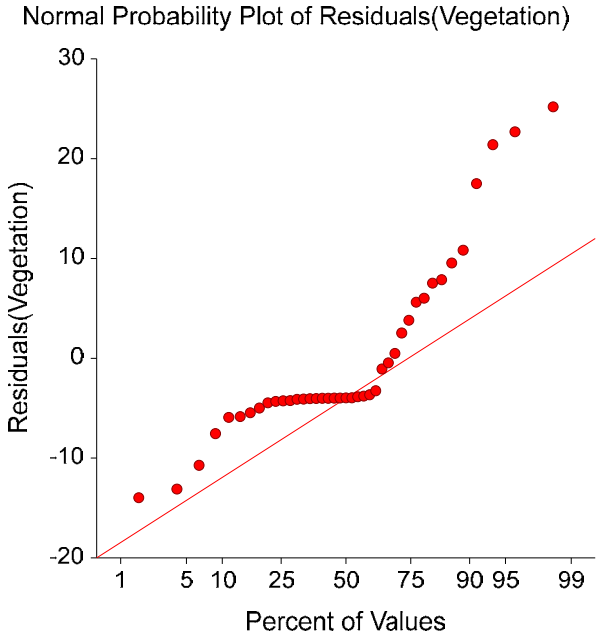
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Original Data Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual
11	6.0000	17.5000	6.6710	10.8290
12	46.9000	50.1000	24.9018	25.1982
13	1.2000	4.0800	4.5315	-0.4515
14	39.6000	14.1000	21.6479	-7.5479
15	4.1000	0.3700	5.8241	-5.4541
16	0.7100	0.0800	4.3131	-4.2331
17	5.1000	0.4300	6.2698	-5.8398
18	0.3500	0.1100	4.1526	-4.0426
19	3.6000	0.6200	5.6012	-4.9812
20	2.6000	1.5000	5.1555	-3.6555
21	0.6600	0.0300	4.2908	-4.2608
22	45.6000	13.6000	24.3223	-10.7223
23	4.5000	2.0200	6.0024	-3.9824
24	5.8000	12.2000	6.5819	5.6181
25	6.8000	14.9000	7.0276	7.8724
26	9.2000	29.5000	8.0974	21.4026
27	7.4000	24.8000	7.2950	17.5050
28	10.8000	7.7400	8.8106	-1.0706
29	3.6000	28.3000	5.6012	22.6988
30	18.1000	8.8100	12.0645	-3.2545
31	42.9000	9.1500	23.1188	-13.9688
32	1.9000	5.3300	4.8435	0.4865
33	4.0000	11.8000	5.7795	6.0205
34	0.4600	0.0900	4.2016	-4.1116
35	1.5000	0.3500	4.6652	-4.3152
36	1.8000	0.3400	4.7989	-4.4589
37	6.8000	1.1100	7.0276	-5.9176
38	1.4000	0.7700	4.6206	-3.8506
39	0.6700	0.3300	4.2952	-3.9652
40	0.9400	0.3300	4.4156	-4.0856
41	0.1800	0.0700	4.0768	-4.0068
42	0.2100	0.3000	4.0902	-3.7902
43	0.5400	0.2300	4.2373	-4.0073
44	0.0730	0.0700	4.0291	-3.9591
45	0.0770	0.0400	4.0309	-3.9909
46	8.4000	3.7100	7.7408	-4.0308
47	2.0000	8.7000	4.8881	3.8119
48	1.1000	7.0200	4.4869	2.5331
49	39.2000	29.0000	21.4696	7.5304
50	34.7000	6.3600	19.4637	-13.1037
51	5.5000	16.0000	6.4481	9.5519

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	17.5000	6.6710	1.4703	3.6970	9.6451
12	46.9000	50.1000	24.9018	4.1386	16.5306	33.2729
13	1.2000	4.0800	4.5315	1.6527	1.1886	7.8743
14	39.6000	14.1000	21.6479	3.4433	14.6831	28.6126
15	4.1000	0.3700	5.8241	1.5261	2.7373	8.9109
16	0.7100	0.0800	4.3131	1.6784	0.9182	7.7079
17	5.1000	0.4300	6.2698	1.4938	3.2483	9.2914
18	0.3500	0.1100	4.1526	1.6980	0.7181	7.5871
19	3.6000	0.6200	5.6012	1.5445	2.4771	8.7253
20	2.6000	1.5000	5.1555	1.5858	1.9479	8.3631
21	0.6600	0.0300	4.2908	1.6811	0.8905	7.6910
22	45.6000	13.6000	24.3223	4.0133	16.2046	32.4400
23	4.5000	2.0200	6.0024	1.5124	2.9433	9.0615
24	5.8000	12.2000	6.5819	1.4751	3.5982	9.5655
25	6.8000	14.9000	7.0276	1.4541	4.0863	9.9689
26	9.2000	29.5000	8.0974	1.4331	5.1987	10.9960
27	7.4000	24.8000	7.2950	1.4449	4.3724	10.2177
28	10.8000	7.7400	8.8106	1.4426	5.8927	11.7285
29	3.6000	28.3000	5.6012	1.5445	2.4771	8.7253
30	18.1000	8.8100	12.0645	1.7014	8.6231	15.5058
31	42.9000	9.1500	23.1188	3.7549	15.5237	30.7139
32	1.9000	5.3300	4.8435	1.6180	1.5708	8.1162
33	4.0000	11.8000	5.7795	1.5296	2.6855	8.8735
34	0.4600	0.0900	4.2016	1.6919	0.7794	7.6239
35	1.5000	0.3500	4.6652	1.6375	1.3530	7.9774
36	1.8000	0.3400	4.7989	1.6228	1.5165	8.0813
37	6.8000	1.1100	7.0276	1.4541	4.0863	9.9689
38	1.4000	0.7700	4.6206	1.6425	1.2983	7.9429
39	0.6700	0.3300	4.2952	1.6805	0.8960	7.6944
40	0.9400	0.3300	4.4156	1.6662	1.0454	7.7857
41	0.1800	0.0700	4.0768	1.7074	0.6232	7.5304
42	0.2100	0.3000	4.0902	1.7057	0.6400	7.5404
43	0.5400	0.2300	4.2373	1.6876	0.8239	7.6507
44	0.0730	0.0700	4.0291	1.7134	0.5634	7.4949
45	0.0770	0.0400	4.0309	1.7132	0.5656	7.4962
46	8.4000	3.7100	7.7408	1.4354	4.8374	10.6442
47	2.0000	8.7000	4.8881	1.6132	1.6250	8.1511
48	1.1000	7.0200	4.4869	1.6578	1.1336	7.8402
49	39.2000	29.0000	21.4696	3.4059	14.5805	28.3586
50	34.7000	6.3600	19.4637	2.9919	13.4121	25.5154
51	5.5000	16.0000	6.4481	1.4827	3.4491	9.4472

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	17.5000	6.6710	9.2932	-12.1263	25.4683
12	46.9000	50.1000	24.9018	10.0663	4.5408	45.2627
13	1.2000	4.0800	4.5315	9.3238	-14.3277	23.3906
14	39.6000	14.1000	21.6479	9.8009	1.8236	41.4721
15	4.1000	0.3700	5.8241	9.3022	-12.9913	24.6396
16	0.7100	0.0800	4.3131	9.3284	-14.5554	23.1815
17	5.1000	0.4300	6.2698	9.2970	-12.5350	25.0747
18	0.3500	0.1100	4.1526	9.3319	-14.7230	23.0282
19	3.6000	0.6200	5.6012	9.3052	-13.2204	24.4229
20	2.6000	1.5000	5.1555	9.3122	-13.6802	23.9912
21	0.6600	0.0300	4.2908	9.3289	-14.5787	23.1602
22	45.6000	13.6000	24.3223	10.0154	4.0642	44.5804
23	4.5000	2.0200	6.0024	9.3000	-12.8085	24.8133
24	5.8000	12.2000	6.5819	9.2940	-12.2169	25.3807
25	6.8000	14.9000	7.0276	9.2907	-11.7645	25.8197
26	9.2000	29.5000	8.0974	9.2874	-10.6881	26.8829
27	7.4000	24.8000	7.2950	9.2892	-11.4942	26.0843
28	10.8000	7.7400	8.8106	9.2889	-9.9779	27.5991
29	3.6000	28.3000	5.6012	9.3052	-13.2204	24.4229
30	18.1000	8.8100	12.0645	9.3326	-6.8124	30.9413
31	42.9000	9.1500	23.1188	9.9147	3.0644	43.1732
32	1.9000	5.3300	4.8435	9.3177	-14.0034	23.6903
33	4.0000	11.8000	5.7795	9.3028	-13.0371	24.5962
34	0.4600	0.0900	4.2016	9.3308	-14.6718	23.0750
35	1.5000	0.3500	4.6652	9.3211	-14.1886	23.5189
36	1.8000	0.3400	4.7989	9.3185	-14.0496	23.6474
37	6.8000	1.1100	7.0276	9.2907	-11.7645	25.8197
38	1.4000	0.7700	4.6206	9.3220	-14.2349	23.4761
39	0.6700	0.3300	4.2952	9.3288	-14.5740	23.1645
40	0.9400	0.3300	4.4156	9.3262	-14.4484	23.2796
41	0.1800	0.0700	4.0768	9.3337	-14.8023	22.9559
42	0.2100	0.3000	4.0902	9.3334	-14.7883	22.9687
43	0.5400	0.2300	4.2373	9.3300	-14.6345	23.1091
44	0.0730	0.0700	4.0291	9.3348	-14.8522	22.9105
45	0.0770	0.0400	4.0309	9.3347	-14.8504	22.9121
46	8.4000	3.7100	7.7408	9.2877	-11.0455	26.5270
47	2.0000	8.7000	4.8881	9.3169	-13.9571	23.7332
48	1.1000	7.0200	4.4869	9.3247	-14.3741	23.3479
49	39.2000	29.0000	21.4696	9.7878	1.6718	41.2673
50	34.7000	6.3600	19.4637	9.6516	-0.0585	38.9859
51	5.5000	16.0000	6.4481	9.2952	-12.3531	25.2494

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	17.5000	6.6710	1.4703	2.4807	10.8613
12	46.9000	50.1000	24.9018	4.1386	13.1072	36.6963
13	1.2000	4.0800	4.5315	1.6527	-0.1785	9.2414
14	39.6000	14.1000	21.6479	3.4433	11.8349	31.4608
15	4.1000	0.3700	5.8241	1.5261	1.4750	10.1732
16	0.7100	0.0800	4.3131	1.6784	-0.4701	9.0962
17	5.1000	0.4300	6.2698	1.4938	2.0127	10.5270
18	0.3500	0.1100	4.1526	1.6980	-0.6864	8.9916
19	3.6000	0.6200	5.6012	1.5445	1.1995	10.0029
20	2.6000	1.5000	5.1555	1.5858	0.6362	9.6748
21	0.6600	0.0300	4.2908	1.6811	-0.5001	9.0816
22	45.6000	13.6000	24.3223	4.0133	12.8849	35.7597
23	4.5000	2.0200	6.0024	1.5124	1.6922	10.3126
24	5.8000	12.2000	6.5819	1.4751	2.3781	10.7857
25	6.8000	14.9000	7.0276	1.4541	2.8835	11.1717
26	9.2000	29.5000	8.0974	1.4331	4.0133	12.1815
27	7.4000	24.8000	7.2950	1.4449	3.1772	11.4129
28	10.8000	7.7400	8.8106	1.4426	4.6994	12.9217
29	3.6000	28.3000	5.6012	1.5445	1.1995	10.0029
30	18.1000	8.8100	12.0645	1.7014	7.2158	16.9131
31	42.9000	9.1500	23.1188	3.7549	12.4177	33.8199
32	1.9000	5.3300	4.8435	1.6180	0.2324	9.4545
33	4.0000	11.8000	5.7795	1.5296	1.4203	10.1388
34	0.4600	0.0900	4.2016	1.6919	-0.6201	9.0234
35	1.5000	0.3500	4.6652	1.6375	-0.0015	9.3319
36	1.8000	0.3400	4.7989	1.6228	0.1742	9.4236
37	6.8000	1.1100	7.0276	1.4541	2.8835	11.1717
38	1.4000	0.7700	4.6206	1.6425	-0.0604	9.3016
39	0.6700	0.3300	4.2952	1.6805	-0.4941	9.0845
40	0.9400	0.3300	4.4156	1.6662	-0.3328	9.1640
41	0.1800	0.0700	4.0768	1.7074	-0.7891	8.9428
42	0.2100	0.3000	4.0902	1.7057	-0.7710	8.9513
43	0.5400	0.2300	4.2373	1.6876	-0.5720	9.0466
44	0.0730	0.0700	4.0291	1.7134	-0.8540	8.9122
45	0.0770	0.0400	4.0309	1.7132	-0.8515	8.9133
46	8.4000	3.7100	7.7408	1.4354	3.6501	11.8315
47	2.0000	8.7000	4.8881	1.6132	0.2906	9.4856
48	1.1000	7.0200	4.4869	1.6578	-0.2377	9.2115
49	39.2000	29.0000	21.4696	3.4059	11.7632	31.1759
50	34.7000	6.3600	19.4637	2.9919	10.9372	27.9902
51	5.5000	16.0000	6.4481	1.4827	2.2226	10.6737

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Section

Row	Soil (X)	Vegetation (Y)	Predicted Vegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	17.5000	6.6710	10.8290	1.1956	61.8799
12	46.9000	50.1000	24.9018	25.1982	3.0768	50.2959
13	1.2000	4.0800	4.5315	-0.4515	-0.0500	11.0653
14	39.6000	14.1000	21.6479	-7.5479	-0.8874	53.5309
15	4.1000	0.3700	5.8241	-5.4541	-0.6028	1474.0832
16	0.7100	0.0800	4.3131	-4.2331	-0.4692	5291.3146
17	5.1000	0.4300	6.2698	-5.8398	-0.6450	1358.1040
18	0.3500	0.1100	4.1526	-4.0426	-0.4483	3675.0778
19	3.6000	0.6200	5.6012	-4.9812	-0.5507	803.4255
20	2.6000	1.5000	5.1555	-3.6555	-0.4045	243.6999
21	0.6600	0.0300	4.2908	-4.2608	-0.4723	14202.5491
22	45.6000	13.6000	24.3223	-10.7223	-1.2994	78.8404
23	4.5000	2.0200	6.0024	-3.9824	-0.4400	197.1487
24	5.8000	12.2000	6.5819	5.6181	0.6203	46.0503
25	6.8000	14.9000	7.0276	7.8724	0.8689	52.8349
26	9.2000	29.5000	8.0974	21.4026	2.3614	72.5513
27	7.4000	24.8000	7.2950	17.5050	1.9318	70.5845
28	10.8000	7.7400	8.8106	-1.0706	-0.1181	13.8315
29	3.6000	28.3000	5.6012	22.6988	2.5095	80.2076
30	18.1000	8.8100	12.0645	-3.2545	-0.3609	36.9405
31	42.9000	9.1500	23.1188	-13.9688	-1.6684	152.6644
32	1.9000	5.3300	4.8435	0.4865	0.0539	9.1279
33	4.0000	11.8000	5.7795	6.0205	0.6654	51.0209
34	0.4600	0.0900	4.2016	-4.1116	-0.4559	4568.4632
35	1.5000	0.3500	4.6652	-4.3152	-0.4779	1232.9102
36	1.8000	0.3400	4.7989	-4.4589	-0.4937	1311.4434
37	6.8000	1.1100	7.0276	-5.9176	-0.6531	533.1175
38	1.4000	0.7700	4.6206	-3.8506	-0.4265	500.0795
39	0.6700	0.3300	4.2952	-3.9652	-0.4396	1201.5825
40	0.9400	0.3300	4.4156	-4.0856	-0.4528	1238.0520
41	0.1800	0.0700	4.0768	-4.0068	-0.4444	5724.0141
42	0.2100	0.3000	4.0902	-3.7902	-0.4204	1263.3940
43	0.5400	0.2300	4.2373	-4.0073	-0.4443	1742.2939
44	0.0730	0.0700	4.0291	-3.9591	-0.4392	5655.8796
45	0.0770	0.0400	4.0309	-3.9909	-0.4427	9977.2467
46	8.4000	3.7100	7.7408	-4.0308	-0.4447	108.6466
47	2.0000	8.7000	4.8881	3.8119	0.4220	43.8155
48	1.1000	7.0200	4.4869	2.5331	0.2807	36.0842
49	39.2000	29.0000	21.4696	7.5304	0.8838	25.9670
50	34.7000	6.3600	19.4637	-13.1037	-1.5106	206.0335
51	5.5000	16.0000	6.4481	9.5519	1.0548	59.6991

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	10.8290	1.2024	0.0257	0.0188	83.2504
12	46.9000	25.1982	**3.4900	0.2034	*1.2087	65.4415
13	1.2000	-0.4515	-0.0494	0.0324	0.0000	86.4122
14	39.6000	-7.5479	*-0.8849	0.1408	0.0645	84.6728
15	4.1000	-5.4541	-0.5978	0.0277	0.0052	85.6126
16	0.7100	-4.2331	-0.4645	0.0335	0.0038	85.9298
17	5.1000	-5.8398	-0.6401	0.0265	0.0057	85.4958
18	0.3500	-4.0426	-0.4437	0.0342	0.0036	85.9724
19	3.6000	-4.9812	-0.5457	0.0283	0.0044	85.7457
20	2.6000	-3.6555	-0.4001	0.0299	0.0025	86.0552
21	0.6600	-4.2608	-0.4676	0.0336	0.0039	85.9234
22	45.6000	-10.7223	*-1.3113	0.1913	0.1997	82.6766
23	4.5000	-3.9824	-0.4354	0.0272	0.0027	85.9887
24	5.8000	5.6181	0.6154	0.0258	0.0051	85.5651
25	6.8000	7.8724	0.8661	0.0251	0.0097	84.7448
26	9.2000	21.4026	*2.5179	0.0244	0.0697	74.0618
27	7.4000	17.5050	*2.0052	0.0248	0.0474	78.1489
28	10.8000	-1.0706	-0.1166	0.0247	0.0002	86.3868
29	3.6000	22.6988	*2.7051	0.0283	0.0918	72.4636
30	18.1000	-3.2545	-0.3569	0.0344	0.0023	86.1291
31	42.9000	-13.9688	*-1.7090	0.1674	0.2799	80.2500
32	1.9000	0.4865	0.0532	0.0311	0.0000	86.4113
33	4.0000	6.0205	0.6606	0.0278	0.0063	85.4366
34	0.4600	-4.1116	-0.4512	0.0340	0.0037	85.9572
35	1.5000	-4.3152	-0.4732	0.0318	0.0038	85.9116
36	1.8000	-4.4589	-0.4889	0.0313	0.0039	85.8776
37	6.8000	-5.9176	-0.6483	0.0251	0.0055	85.4724
38	1.4000	-3.8506	-0.4220	0.0320	0.0030	86.0146
39	0.6700	-3.9652	-0.4350	0.0335	0.0034	85.9896
40	0.9400	-4.0856	-0.4481	0.0330	0.0035	85.9635
41	0.1800	-4.0068	-0.4398	0.0346	0.0035	85.9801
42	0.2100	-3.7902	-0.4159	0.0346	0.0032	86.0261
43	0.5400	-4.0073	-0.4397	0.0338	0.0035	85.9803
44	0.0730	-3.9591	-0.4346	0.0349	0.0035	85.9903
45	0.0770	-3.9909	-0.4381	0.0349	0.0035	85.9834
46	8.4000	-4.0308	-0.4401	0.0245	0.0025	85.9794
47	2.0000	3.8119	0.4175	0.0309	0.0028	86.0231
48	1.1000	2.5331	0.2773	0.0326	0.0013	86.2432
49	39.2000	7.5304	*0.8813	0.1378	0.0624	84.6870
50	34.7000	-13.1037	*-1.5367	0.1063	0.1357	81.3616
51	5.5000	9.5519	1.0564	0.0261	0.0149	83.9523

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	1.2024	0.1952	0.0188	1.0033	0.1828	-0.0437
12	* 3.4900	1.7636	** 1.2087	0.7583	-0.4025	1.6545
13	-0.0494	-0.0090	0.0000	1.0885	-0.0090	0.0045
14	-0.8849	-0.3582	0.0645	* 1.1769	0.0552	-0.3257
15	-0.5978	-0.1008	0.0052	1.0632	-0.0981	0.0347
16	-0.4645	-0.0864	0.0038	1.0775	-0.0864	0.0450
17	-0.6401	-0.1056	0.0057	1.0590	-0.1010	0.0298
18	-0.4437	-0.0835	0.0036	1.0795	-0.0835	0.0448
19	-0.5457	-0.0932	0.0044	1.0672	-0.0913	0.0348
20	-0.4001	-0.0702	0.0025	1.0767	-0.0695	0.0301
21	-0.4676	-0.0871	0.0039	1.0775	-0.0871	0.0455
22	-1.3113	-0.6377	0.1997	* 1.1921	0.1384	-0.5957
23	-0.4354	-0.0728	0.0027	1.0720	-0.0703	0.0233
24	0.6154	0.1002	0.0051	1.0600	0.0943	-0.0237
25	0.8661	0.1390	0.0097	1.0390	0.1273	-0.0236
26	* 2.5179	0.3981	0.0697	0.7930	0.3321	0.0002
27	* 2.0052	0.3197	0.0474	0.8833	0.2871	-0.0409
28	-0.1166	-0.0186	0.0002	1.0792	-0.0142	-0.0021
29	* 2.7051	0.4619	0.0918	0.7622	0.4526	-0.1723
30	-0.3569	-0.0673	0.0023	1.0835	-0.0273	-0.0363
31	-1.7090	-0.7664	0.2799	1.0910	0.1464	-0.7084
32	0.0532	0.0095	0.0000	1.0870	0.0095	-0.0044
33	0.6606	0.1117	0.0063	1.0590	0.1088	-0.0391
34	-0.4512	-0.0846	0.0037	1.0788	-0.0846	0.0450
35	-0.4732	-0.0858	0.0038	1.0753	-0.0855	0.0415
36	-0.4889	-0.0878	0.0039	1.0738	-0.0874	0.0412
37	-0.6483	-0.1040	0.0055	1.0569	-0.0953	0.0176
38	-0.4220	-0.0768	0.0030	1.0781	-0.0766	0.0375
39	-0.4350	-0.0810	0.0034	1.0791	-0.0810	0.0423
40	-0.4481	-0.0827	0.0035	1.0778	-0.0826	0.0422
41	-0.4398	-0.0833	0.0035	1.0801	-0.0833	0.0453
42	-0.4159	-0.0787	0.0032	1.0812	-0.0787	0.0427
43	-0.4397	-0.0823	0.0035	1.0792	-0.0822	0.0434
44	-0.4346	-0.0826	0.0035	1.0806	-0.0826	0.0453
45	-0.4381	-0.0833	0.0035	1.0804	-0.0833	0.0456
46	-0.4401	-0.0697	0.0025	1.0688	-0.0603	0.0040
47	0.4175	0.0746	0.0028	1.0770	0.0741	-0.0342
48	0.2773	0.0509	0.0013	1.0845	0.0509	-0.0256
49	0.8813	0.3523	0.0624	* 1.1732	-0.0525	0.3196
50	-1.5367	-0.5300	0.1357	1.0447	0.0446	-0.4653
51	1.0564	0.1730	0.0149	1.0207	0.1639	-0.0444

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	10.8290	||||||.....	1.1956	|||||.....	1.2024	|||||.....
12	46.9000	25.1982	||||||||||||||	3.0768	||||||||||||||	* 3.4900	||||||||||||||
13	1.2000	-0.4515	|.....	-0.0500	|.....	-0.0494	|.....
14	39.6000	-7.5479	||||.....	-0.8874	||||.....	-0.8849	|||.....
15	4.1000	-5.4541	|||.....	-0.6028	||.....	-0.5978	||.....
16	0.7100	-4.2331	||.....	-0.4692	||.....	-0.4645	|.....
17	5.1000	-5.8398	|||.....	-0.6450	||.....	-0.6401	||.....
18	0.3500	-4.0426	||.....	-0.4483	|.....	-0.4437	|.....
19	3.6000	-4.9812	||.....	-0.5507	||.....	-0.5457	||.....
20	2.6000	-3.6555	|.....	-0.4045	|.....	-0.4001	|.....
21	0.6600	-4.2608	||.....	-0.4723	||.....	-0.4676	|.....
22	45.6000	-10.7223	||||||.....	-1.2994	||||||.....	-1.3113	|||||.....
23	4.5000	-3.9824	||.....	-0.4400	|.....	-0.4354	|.....
24	5.8000	5.6181	|||.....	0.6203	||.....	0.6154	||.....
25	6.8000	7.8724	||||.....	0.8689	||||.....	0.8661	|||.....
26	9.2000	21.4026	|||||||||||...	2.3614	||||||||||....	* 2.5179	|||||||||.....
27	7.4000	17.5050	|||||||||.....	1.9318	||||||||.....	* 2.0052	|||||||.....
28	10.8000	-1.0706	|.....	-0.1181	|.....	-0.1166	|.....
29	3.6000	22.6988	||||||||||||..	2.5095	|||||||||||...	* 2.7051	||||||||||....
30	18.1000	-3.2545	|.....	-0.3609	|.....	-0.3569	|.....
31	42.9000	-13.9688	|||||||.....	-1.6684	|||||||.....	-1.7090	||||||.....
32	1.9000	0.4865	|.....	0.0539	|.....	0.0532	|.....
33	4.0000	6.0205	|||.....	0.6654	|||.....	0.6606	||.....
34	0.4600	-4.1116	||.....	-0.4559	||.....	-0.4512	|.....
35	1.5000	-4.3152	||.....	-0.4779	||.....	-0.4732	|.....
36	1.8000	-4.4589	||.....	-0.4937	||.....	-0.4889	|.....
37	6.8000	-5.9176	|||.....	-0.6531	||.....	-0.6483	||.....
38	1.4000	-3.8506	||.....	-0.4265	|.....	-0.4220	|.....
39	0.6700	-3.9652	||.....	-0.4396	|.....	-0.4350	|.....
40	0.9400	-4.0856	||.....	-0.4528	|.....	-0.4481	|.....
41	0.1800	-4.0068	||.....	-0.4444	|.....	-0.4398	|.....
42	0.2100	-3.7902	||.....	-0.4204	|.....	-0.4159	|.....
43	0.5400	-4.0073	||.....	-0.4443	|.....	-0.4397	|.....
44	0.0730	-3.9591	||.....	-0.4392	|.....	-0.4346	|.....
45	0.0770	-3.9909	||.....	-0.4427	|.....	-0.4381	|.....
46	8.4000	-4.0308	||.....	-0.4447	|.....	-0.4401	|.....
47	2.0000	3.8119	||.....	0.4220	|.....	0.4175	|.....
48	1.1000	2.5331	|.....	0.2807	|.....	0.2773	|.....
49	39.2000	7.5304	||||.....	0.8838	||||.....	0.8813	|||.....
50	34.7000	-13.1037	|||||||.....	-1.5106	|||||||.....	-1.5367	||||||.....
51	5.5000	9.5519	|||||.....	1.0548	||||.....	1.0564	||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.1952	|.....	0.0188	|.....	-0.0437	|.....
12	46.9000	1.7636	|||||||||||||||	** 1.2087	||||||||||||||	1.6545	||||||||||||||
13	1.2000	-0.0090	|.....	0.0000	|.....	0.0045	|.....
14	39.6000	-0.3582	||.....	0.0645	|.....	-0.3257	||.....
15	4.1000	-0.1008	|.....	0.0052	|.....	0.0347	|.....
16	0.7100	-0.0864	|.....	0.0038	|.....	0.0450	|.....
17	5.1000	-0.1056	|.....	0.0057	|.....	0.0298	|.....
18	0.3500	-0.0835	|.....	0.0036	|.....	0.0448	|.....
19	3.6000	-0.0932	|.....	0.0044	|.....	0.0348	|.....
20	2.6000	-0.0702	|.....	0.0025	|.....	0.0301	|.....
21	0.6600	-0.0871	|.....	0.0039	|.....	0.0455	|.....
22	45.6000	-0.6377	|||||.....	0.1997	||.....	-0.5957	|||||.....
23	4.5000	-0.0728	|.....	0.0027	|.....	0.0233	|.....
24	5.8000	0.1002	|.....	0.0051	|.....	-0.0237	|.....
25	6.8000	0.1390	|.....	0.0097	|.....	-0.0236	|.....
26	9.2000	0.3981	|||.....	0.0697	|.....	0.0002	|.....
27	7.4000	0.3197	||.....	0.0474	|.....	-0.0409	|.....
28	10.8000	-0.0186	|.....	0.0002	|.....	-0.0021	|.....
29	3.6000	0.4619	|||.....	0.0918	|.....	-0.1723	|.....
30	18.1000	-0.0673	|.....	0.0023	|.....	-0.0363	|.....
31	42.9000	-0.7664	||||||.....	0.2799	|||.....	-0.7084	||||||.....
32	1.9000	0.0095	|.....	0.0000	|.....	-0.0044	|.....
33	4.0000	0.1117	|.....	0.0063	|.....	-0.0391	|.....
34	0.4600	-0.0846	|.....	0.0037	|.....	0.0450	|.....
35	1.5000	-0.0858	|.....	0.0038	|.....	0.0415	|.....
36	1.8000	-0.0878	|.....	0.0039	|.....	0.0412	|.....
37	6.8000	-0.1040	|.....	0.0055	|.....	0.0176	|.....
38	1.4000	-0.0768	|.....	0.0030	|.....	0.0375	|.....
39	0.6700	-0.0810	|.....	0.0034	|.....	0.0423	|.....
40	0.9400	-0.0827	|.....	0.0035	|.....	0.0422	|.....
41	0.1800	-0.0833	|.....	0.0035	|.....	0.0453	|.....
42	0.2100	-0.0787	|.....	0.0032	|.....	0.0427	|.....
43	0.5400	-0.0823	|.....	0.0035	|.....	0.0434	|.....
44	0.0730	-0.0826	|.....	0.0035	|.....	0.0453	|.....
45	0.0770	-0.0833	|.....	0.0035	|.....	0.0456	|.....
46	8.4000	-0.0697	|.....	0.0025	|.....	0.0040	|.....
47	2.0000	0.0746	|.....	0.0028	|.....	-0.0342	|.....
48	1.1000	0.0509	|.....	0.0013	|.....	-0.0256	|.....
49	39.2000	0.3523	||.....	0.0624	|.....	0.3196	||.....
50	34.7000	-0.5300	||||.....	0.1357	|.....	-0.4653	||||.....
51	5.5000	0.1730	|.....	0.0149	|.....	-0.0444	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	1.2024	|||||.....	0.0188	|.....	0.0257	|.....
12	46.9000	* 3.4900	||||||||||||||	** 1.2087	||||||||||||||	0.2034	||||||||||||||
13	1.2000	-0.0494	|.....	0.0000	|.....	0.0324	|.....
14	39.6000	-0.8849	|||.....	0.0645	|.....	0.1408	||||||||.....
15	4.1000	-0.5978	||.....	0.0052	|.....	0.0277	|.....
16	0.7100	-0.4645	|.....	0.0038	|.....	0.0335	|.....
17	5.1000	-0.6401	||.....	0.0057	|.....	0.0265	|.....
18	0.3500	-0.4437	|.....	0.0036	|.....	0.0342	|.....
19	3.6000	-0.5457	||.....	0.0044	|.....	0.0283	|.....
20	2.6000	-0.4001	|.....	0.0025	|.....	0.0299	|.....
21	0.6600	-0.4676	|.....	0.0039	|.....	0.0336	|.....
22	45.6000	-1.3113	|||||.....	0.1997	||.....	0.1913	||||||||||||..
23	4.5000	-0.4354	|.....	0.0027	|.....	0.0272	|.....
24	5.8000	0.6154	||.....	0.0051	|.....	0.0258	|.....
25	6.8000	0.8661	|||.....	0.0097	|.....	0.0251	|.....
26	9.2000	* 2.5179	|||||||||.....	0.0697	|.....	0.0244	|.....
27	7.4000	* 2.0052	|||||||.....	0.0474	|.....	0.0248	|.....
28	10.8000	-0.1166	|.....	0.0002	|.....	0.0247	|.....
29	3.6000	* 2.7051	||||||||||....	0.0918	|.....	0.0283	|.....
30	18.1000	-0.3569	|.....	0.0023	|.....	0.0344	|.....
31	42.9000	-1.7090	||||||.....	0.2799	|||.....	0.1674	||||||||||....
32	1.9000	0.0532	|.....	0.0000	|.....	0.0311	|.....
33	4.0000	0.6606	||.....	0.0063	|.....	0.0278	|.....
34	0.4600	-0.4512	|.....	0.0037	|.....	0.0340	|.....
35	1.5000	-0.4732	|.....	0.0038	|.....	0.0318	|.....
36	1.8000	-0.4889	|.....	0.0039	|.....	0.0313	|.....
37	6.8000	-0.6483	||.....	0.0055	|.....	0.0251	|.....
38	1.4000	-0.4220	|.....	0.0030	|.....	0.0320	|.....
39	0.6700	-0.4350	|.....	0.0034	|.....	0.0335	|.....
40	0.9400	-0.4481	|.....	0.0035	|.....	0.0330	|.....
41	0.1800	-0.4398	|.....	0.0035	|.....	0.0346	|.....
42	0.2100	-0.4159	|.....	0.0032	|.....	0.0346	|.....
43	0.5400	-0.4397	|.....	0.0035	|.....	0.0338	|.....
44	0.0730	-0.4346	|.....	0.0035	|.....	0.0349	|.....
45	0.0770	-0.4381	|.....	0.0035	|.....	0.0349	|.....
46	8.4000	-0.4401	|.....	0.0025	|.....	0.0245	|.....
47	2.0000	0.4175	|.....	0.0028	|.....	0.0309	|.....
48	1.1000	0.2773	|.....	0.0013	|.....	0.0326	|.....
49	39.2000	0.8813	|||.....	0.0624	|.....	0.1378	||||||||.....
50	34.7000	-1.5367	||||||.....	0.1357	|.....	0.1063	||||||.....
51	5.5000	1.0564	||||.....	0.0149	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Means

Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	17.5000	6.0000	30.2944	-24.2944	21.5869	50.7895
12	50.1000	46.9000	103.4314	-56.5314	72.9425	186.5656
13	4.0800	1.2000	0.1872	1.0128	-11.4444	6.7868
14	14.1000	39.6000	22.6667	16.9333	15.5229	37.3367
15	0.3700	4.1000	-8.1361	12.2361	-25.6824	-0.2714
16	0.0800	0.7100	-8.7867	9.4967	-26.8338	-0.7847
17	0.4300	5.1000	-8.0015	13.1015	-25.4447	-0.1647
18	0.1100	0.3500	-8.7194	9.0694	-26.7145	-0.7318
19	0.6200	3.6000	-7.5752	11.1752	-24.6930	0.1742
20	1.5000	2.6000	-5.6010	8.2010	-21.2370	1.7696
21	0.0300	0.6600	-8.8989	9.5589	-27.0327	-0.8728
22	13.6000	45.6000	21.5449	24.0551	14.5731	35.4164
23	2.0200	4.5000	-4.4344	8.9344	-19.2174	2.7350
24	12.2000	5.8000	18.4041	-12.6041	11.7890	30.1642
25	14.9000	6.8000	24.4614	-17.6614	17.0044	40.4474
26	29.5000	9.2000	57.2160	-48.0160	40.9957	100.2635
27	24.8000	7.4000	46.6717	-39.2717	33.5601	80.7200
28	7.7400	10.8000	8.3982	2.4018	0.8050	15.5467
29	28.3000	3.6000	54.5238	-50.9238	39.1077	95.2633
30	8.8100	18.1000	10.7987	7.3013	3.8292	18.6646
31	9.1500	42.9000	11.5615	31.3385	4.7324	19.7130
32	5.3300	1.9000	2.9915	-1.0915	-6.9783	9.4961
33	11.8000	4.0000	17.5067	-13.5067	10.9520	28.7051
34	0.0900	0.4600	-8.7643	9.2243	-26.7941	-0.7670
35	0.3500	1.5000	-8.1810	9.6810	-25.7617	-0.3069
36	0.3400	1.8000	-8.2034	10.0034	-25.8013	-0.3247
37	1.1100	6.8000	-6.4759	13.2759	-22.7632	1.0571
38	0.7700	1.4000	-7.2387	8.6387	-24.1009	0.4431
39	0.3300	0.6700	-8.2258	8.8958	-25.8410	-0.3424
40	0.3300	0.9400	-8.2258	9.1658	-25.8410	-0.3424
41	0.0700	0.1800	-8.8091	8.9891	-26.8736	-0.8023
42	0.3000	0.2100	-8.2931	8.5031	-25.9600	-0.3957
43	0.2300	0.5400	-8.4502	8.9902	-26.2378	-0.5197
44	0.0700	0.0730	-8.8091	8.8821	-26.8736	-0.8023
45	0.0400	0.0770	-8.8764	8.9534	-26.9929	-0.8552
46	3.7100	8.4000	-0.6429	9.0429	-12.8079	6.0265
47	8.7000	2.0000	10.5520	-8.5520	3.5311	18.3312
48	7.0200	1.1000	6.7829	-5.6829	-1.3860	13.6047
49	29.0000	39.2000	56.0943	-16.8943	40.2097	98.1794
50	6.3600	34.7000	5.3023	29.3977	-3.4996	11.9297
51	16.0000	5.5000	26.9292	-21.4292	18.9797	44.7864

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Vegetation X = Soil

Inverse Prediction of X Individuals

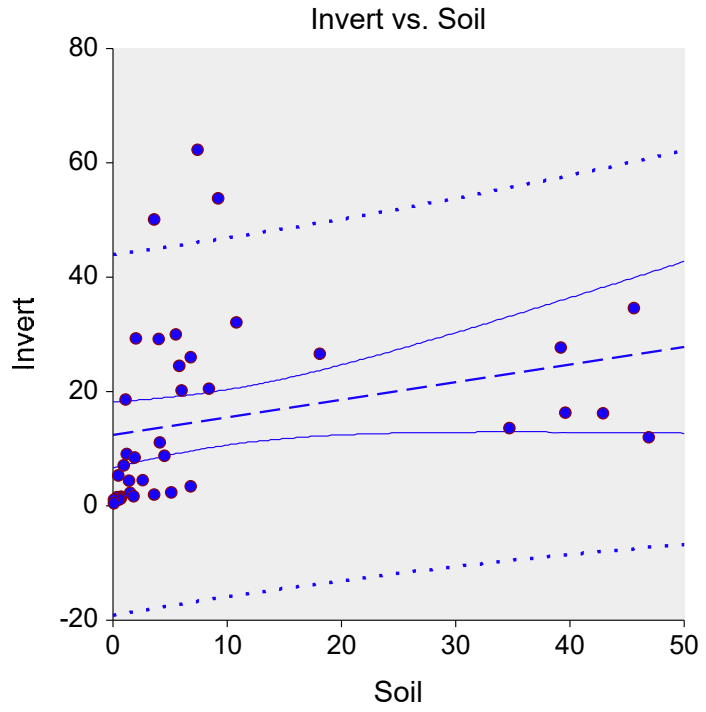
Row	Vegetation (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	17.5000	6.0000	30.2944	-24.2944	-13.1209	85.4973
12	50.1000	46.9000	103.4314	-56.5314	55.9587	203.5493
13	4.0800	1.2000	0.1872	1.0128	-50.3005	45.6430
14	14.1000	39.6000	22.6667	16.9333	-21.9143	74.7739
15	0.3700	4.1000	-8.1361	12.2361	-61.7583	35.8045
16	0.0800	0.7100	-8.7867	9.4967	-62.6747	35.0562
17	0.4300	5.1000	-8.0015	13.1015	-61.5691	35.9597
18	0.1100	0.3500	-8.7194	9.0694	-62.5798	35.1335
19	0.6200	3.6000	-7.5752	11.1752	-60.9707	36.4519
20	1.5000	2.6000	-5.6010	8.2010	-58.2159	38.7485
21	0.0300	0.6600	-8.8989	9.5589	-62.8330	34.9275
22	13.6000	45.6000	21.5449	24.0551	-23.2422	73.2317
23	2.0200	4.5000	-4.4344	8.9344	-56.6010	40.1186
24	12.2000	5.8000	18.4041	-12.6041	-27.0089	68.9620
25	14.9000	6.8000	24.4614	-17.6614	-19.8085	77.2603
26	29.5000	9.2000	57.2160	-48.0160	14.9846	126.2746
27	24.8000	7.4000	46.6717	-39.2717	4.4693	109.8108
28	7.7400	10.8000	8.3982	2.4018	-39.4951	55.8468
29	28.3000	3.6000	54.5238	-50.9238	12.3534	122.0175
30	8.8100	18.1000	10.7987	7.3013	-36.4314	58.9251
31	9.1500	42.9000	11.5615	31.3385	-35.4669	59.9123
32	5.3300	1.9000	2.9915	-1.0915	-46.5537	49.0715
33	11.8000	4.0000	17.5067	-13.5067	-28.0984	67.7554
34	0.0900	0.4600	-8.7643	9.2243	-62.6431	35.0820
35	0.3500	1.5000	-8.1810	9.6810	-61.8214	35.7528
36	0.3400	1.8000	-8.2034	10.0034	-61.8530	35.7269
37	1.1100	6.8000	-6.4759	13.2759	-59.4333	37.7273
38	0.7700	1.4000	-7.2387	8.6387	-60.4992	36.8414
39	0.3300	0.6700	-8.2258	8.8958	-61.8845	35.7011
40	0.3300	0.9400	-8.2258	9.1658	-61.8845	35.7011
41	0.0700	0.1800	-8.8091	8.9891	-62.7064	35.0305
42	0.3000	0.2100	-8.2931	8.5031	-61.9792	35.6236
43	0.2300	0.5400	-8.4502	8.9902	-62.2003	35.4429
44	0.0700	0.0730	-8.8091	8.8821	-62.7064	35.0305
45	0.0400	0.0770	-8.8764	8.9534	-62.8013	34.9532
46	3.7100	8.4000	-0.6429	9.0429	-51.4207	44.6392
47	8.7000	2.0000	10.5520	-8.5520	-36.7444	58.6067
48	7.0200	1.1000	6.7829	-5.6829	-41.5810	53.7998
49	29.0000	39.2000	56.0943	-16.8943	13.8925	124.4966
50	6.3600	34.7000	5.3023	29.3977	-43.5103	51.9404
51	16.0000	5.5000	26.9292	-21.4292	-16.9503	80.7163

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Invert	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	12.4203	Rows Prediction Only	0
Slope	0.3056	Sum of Frequencies	41
R-Squared	0.0749	Sum of Weights	41.0000
Correlation	0.2736	Coefficient of Variation	1.0067
Mean Square Error	235.0882	Square Root of MSE	15.33259

Linear Regression Report

Y = Invert X = Soil

Summary Statement

The equation of the straight line relating Invert and Soil is estimated as: Invert = (12.4203) + (0.3056) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Invert when Soil is zero, is 12.4203 with a standard error of 2.8699. The slope, the estimated change in Invert per unit change in Soil, is 0.3056 with a standard error of 0.1721. The value of R-Squared, the proportion of the variation in Invert that can be accounted for by variation in Soil, is 0.0749. The correlation between Invert and Soil is 0.2736.

A significance test that the slope is zero resulted in a t-value of 1.7764. The significance level of this t-test is 0.0835. Since 0.0835 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.3056. The lower limit of the 95% confidence interval for the slope is -0.0424 and the upper limit is 0.6537. The estimated intercept is 12.4203. The lower limit of the 95% confidence interval for the intercept is 6.6153 and the upper limit is 18.2252.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Invert	Soil
Count	41	41
Mean	15.2305	9.1944
Standard Deviation	15.7403	14.0901
Minimum	0.4500	0.0730
Maximum	62.3000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	12.4203	0.3056
Lower 95% Confidence Limit	6.6153	-0.0424
Upper 95% Confidence Limit	18.2252	0.6537
Standard Error	2.8699	0.1721
Standardized Coefficient	0.0000	0.2736
T Value	4.3277	1.7764
Prob Level (T Test)	0.0001	0.0835
Prob Level (Randomization Test N =1000)		0.0940
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9881	0.4102
Regression of Y on X	12.4203	0.3056
Inverse Regression from X on Y	-22.3101	4.0830
Orthogonal Regression of Y and X	1.5792	1.4847

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(12.4202591360387) + (0.305646007434053) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	12.4203	0.9000	7.6982	16.6992
Bootstrap Mean	12.3514	0.9500	6.7076	17.4345
Bias (BM - OV)	-0.0688	0.9900	4.0755	18.8331
Bias Corrected	12.4891			
Standard Error	2.7563			
Slope				
Original Value	0.3056	0.9000	0.0455	0.4783
Bootstrap Mean	0.3305	0.9500	-0.0469	0.5105
Bias (BM - OV)	0.0248	0.9900	-0.3809	0.5830
Bias Corrected	0.2808			
Standard Error	0.1560			
Correlation				
Original Value	0.2736	0.9000	0.0737	0.4283
Bootstrap Mean	0.2903	0.9500	0.0298	0.4603
Bias (BM - OV)	0.0167	0.9900	-0.0696	0.5232
Bias Corrected	0.2569			
Standard Error	0.1110			
R-Squared				
Original Value	0.0749	0.9000	0.0000	0.1356
Bootstrap Mean	0.0966	0.9500	0.0000	0.1421
Bias (BM - OV)	0.0218	0.9900	0.0000	0.1489
Bias Corrected	0.0531			
Standard Error	0.0695			
Standard Error of Estimate				
Original Value	15.3326	0.9000	12.0649	19.8926
Bootstrap Mean	14.8293	0.9500	11.3461	20.5997
Bias (BM - OV)	-0.5033	0.9900	10.4025	22.1638
Bias Corrected	15.8359			
Standard Error	2.3837			
Orthogonal Intercept				
Original Value	1.5792	0.9000	-5.5938	25.8911
Bootstrap Mean	-1.9135	0.9500	-6.9482	38.6138
Bias (BM - OV)	-3.4927	0.9900	-10.1249	89.5612
Bias Corrected	5.0719			
Standard Error	24.0286			
Orthogonal Slope				
Original Value	1.4847	0.9000	-2.4982	2.4942
Bootstrap Mean	2.0588	0.9500	-4.2029	2.5769
Bias (BM - OV)	0.5740	0.9900	-9.3481	2.7352
Bias Corrected	0.9107			
Standard Error	2.6862			

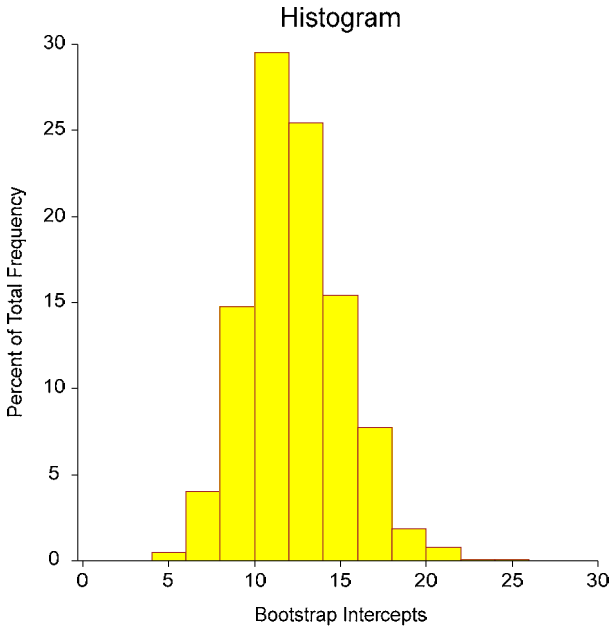
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

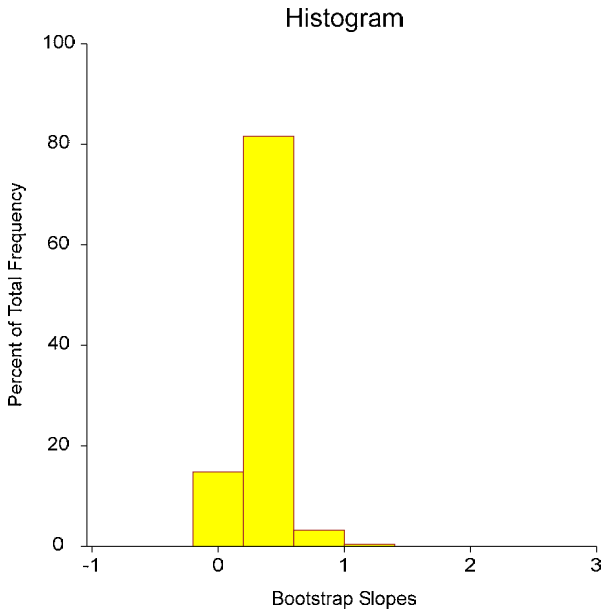
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

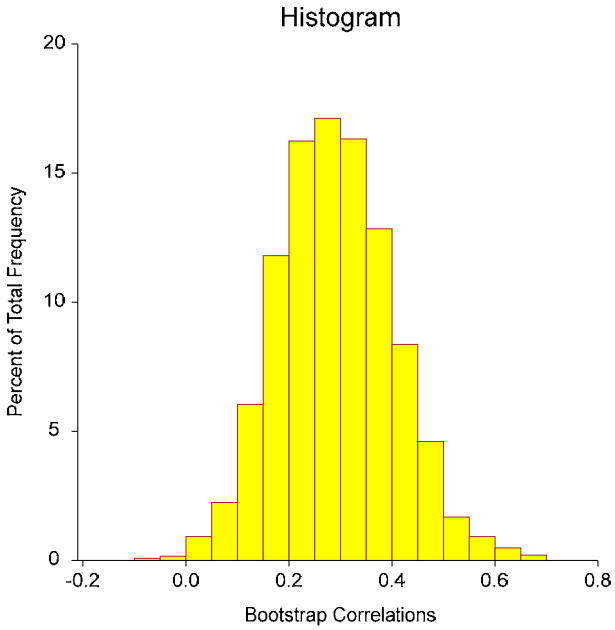
Linear Regression Report

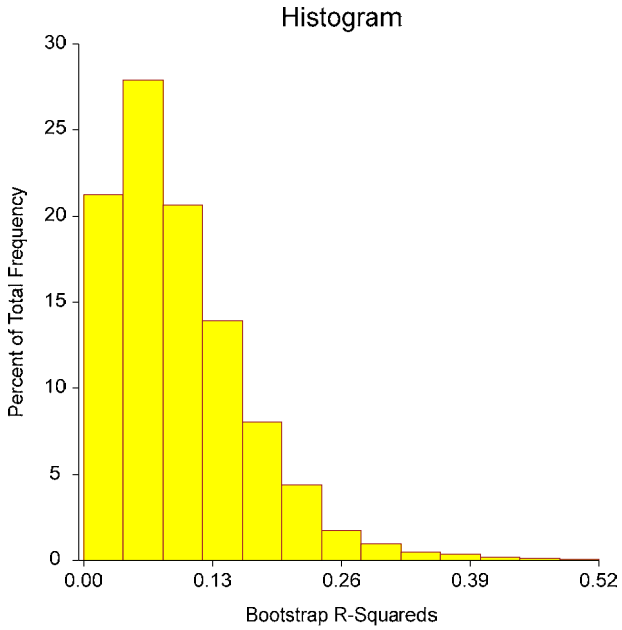
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Bootstrap Histograms Section



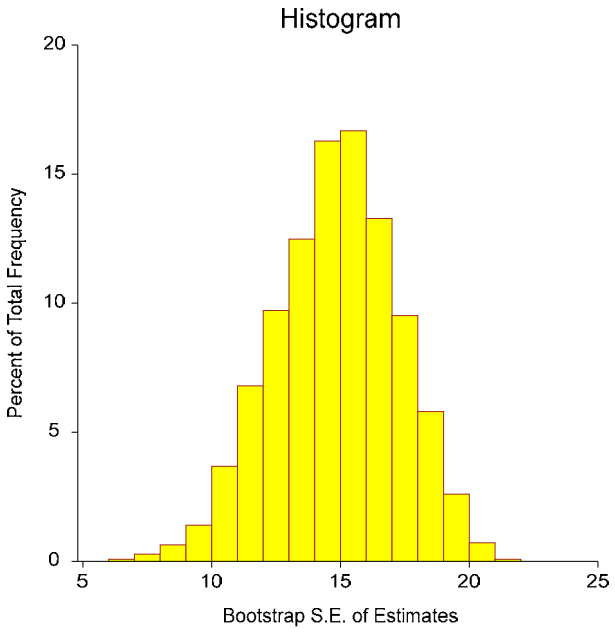


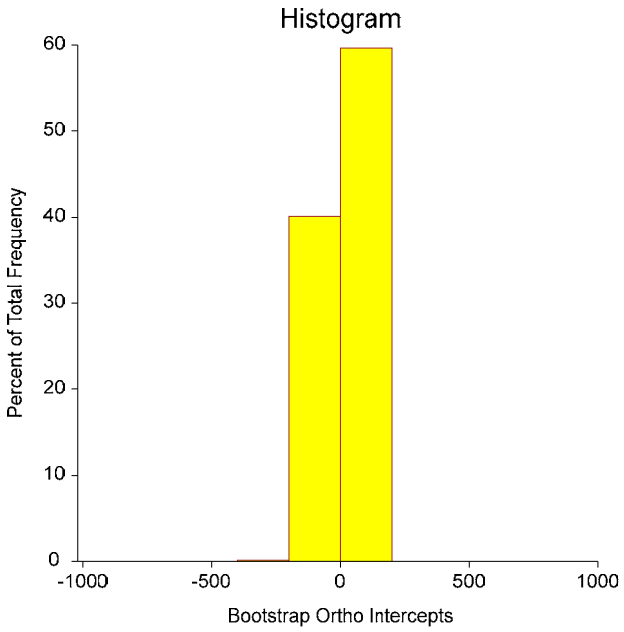


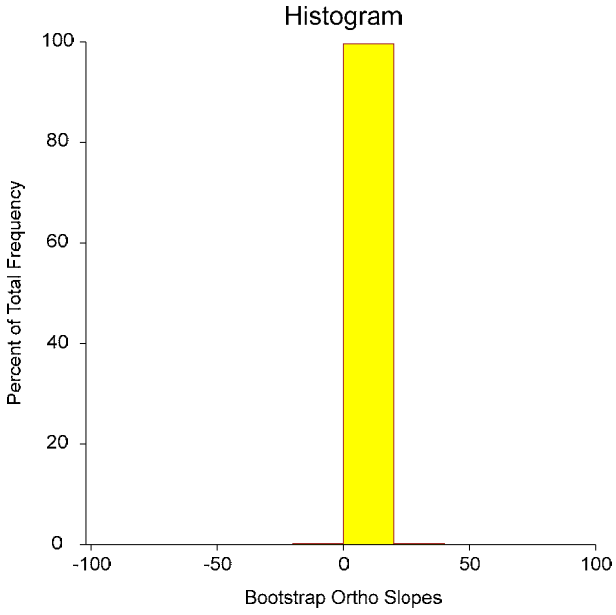


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.2736	0.0749	0.7444
Lower 95% Conf. Limit (r dist'n)	-0.0372		
Upper 95% Conf. Limit (r dist'n)	0.5312		
Lower 95% Conf. Limit (Fisher's z)	-0.0372		0.5665
Upper 95% Conf. Limit (Fisher's z)	0.5361		0.8560
Adjusted (Rbar)		0.0511	
T-Value for H0: Rho = 0	1.7764	1.7764	6.9621
Prob Level for H0: Rho = 0	0.0835	0.0835	0.0000
Prob Level (Randomization Test N =1000)	0.0940		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	9510.678	9510.678			
Slope	1	741.8708	741.8708	3.1557	0.0835	0.4102
Error	39	9168.439	235.0882			
Lack of Fit	37	7755.263	209.6017	0.2966	0.9548	
Pure Error	2	1413.177	706.5883			
Adj. Total	40	9910.311	247.7578			
Total	41	19420.99				

s = Square Root(235.0882) = 15.33259

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	624.45	0.03503547	-0.001157796
1	376.97	11407.3	8168.66	-0.001157796	0.0001259242
2 (Y'Y)			19420.99		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	8.236426	-0.2721842
1	-0.2721842	0.02960329

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7907	0.000004	No
Anderson Darling	3.0181	0.000000	No
D'Agostino Skewness	3.6012	0.000317	No
D'Agostino Kurtosis	2.1723	0.029836	No
D'Agostino Omnibus	17.6876	0.000144	No
Constant Residual Variance?			
Modified Levene Test	3.1567	0.083416	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2966	0.954807	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

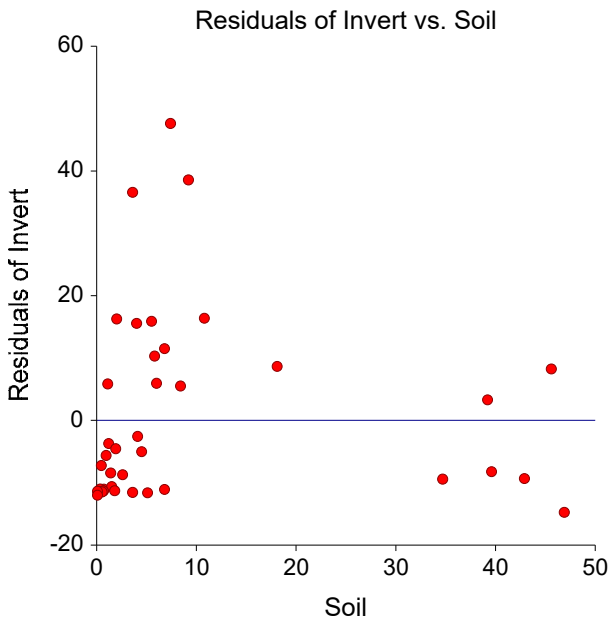
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

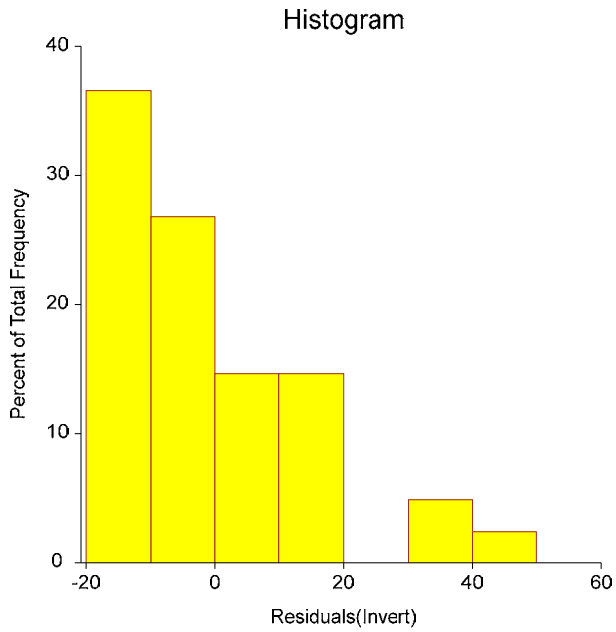
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

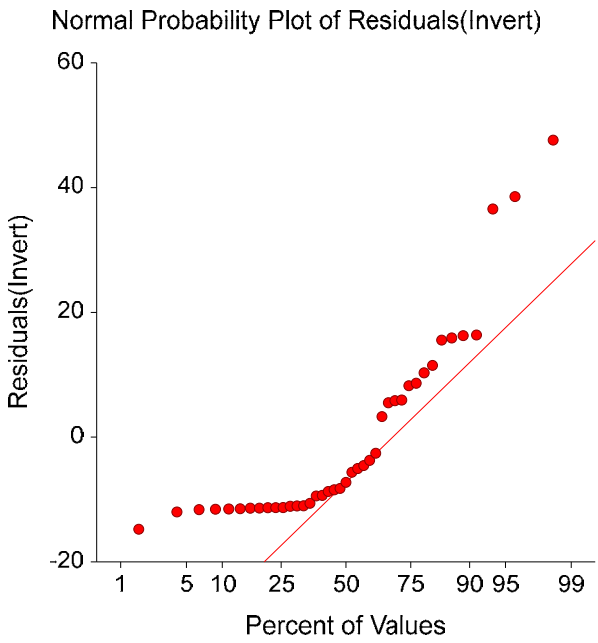
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Original Data Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual
11	6.0000	20.2000	14.2541	5.9459
12	46.9000	12.0000	26.7551	-14.7551
13	1.2000	9.0700	12.7870	-3.7170
14	39.6000	16.3000	24.5238	-8.2238
15	4.1000	11.1000	13.6734	-2.5734
16	0.7100	1.6100	12.6373	-11.0273
17	5.1000	2.3600	13.9791	-11.6191
18	0.3500	1.5200	12.5272	-11.0072
19	3.6000	1.9700	13.5206	-11.5506
20	2.6000	4.5000	13.2149	-8.7149
21	0.6600	1.3200	12.6220	-11.3020
22	45.6000	34.6000	26.3577	8.2423
23	4.5000	8.7700	13.7957	-5.0257
24	5.8000	24.5000	14.1930	10.3070
25	6.8000	26.0000	14.4987	11.5013
26	9.2000	53.8000	15.2322	38.5678
27	7.4000	62.3000	14.6820	47.6180
28	10.8000	32.1000	15.7212	16.3788
29	3.6000	50.1000	13.5206	36.5794
30	18.1000	26.6000	17.9525	8.6475
31	42.9000	16.2000	25.5325	-9.3325
32	1.9000	8.4500	13.0010	-4.5510
33	4.0000	29.2000	13.6428	15.5572
34	0.4600	5.3200	12.5609	-7.2409
35	1.5000	2.2700	12.8787	-10.6087
36	1.8000	1.6800	12.9704	-11.2904
37	6.8000	3.4200	14.4987	-11.0787
38	1.4000	4.4100	12.8482	-8.4382
39	0.6700	1.3100	12.6250	-11.3150
40	0.9400	7.0800	12.7076	-5.6276
41	0.1800	1.0900	12.4753	-11.3853
42	0.2100	0.9700	12.4844	-11.5144
43	0.5400	1.1100	12.5853	-11.4753
44	0.0730	1.0700	12.4426	-11.3726
45	0.0770	0.4500	12.4438	-11.9938
46	8.4000	20.5000	14.9877	5.5123
47	2.0000	29.3000	13.0316	16.2684
48	1.1000	18.6000	12.7565	5.8435
49	39.2000	27.7000	24.4016	3.2984
50	34.7000	13.6000	23.0262	-9.4262
51	5.5000	30.0000	14.1013	15.8987

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	20.2000	14.2541	2.4568	9.2848	19.2235
12	46.9000	12.0000	26.7551	6.9153	12.7676	40.7426
13	1.2000	9.0700	12.7870	2.7615	7.2014	18.3727
14	39.6000	16.3000	24.5238	5.7534	12.8864	36.1613
15	4.1000	11.1000	13.6734	2.5499	8.5157	18.8311
16	0.7100	1.6100	12.6373	2.8044	6.9648	18.3098
17	5.1000	2.3600	13.9791	2.4960	8.9304	19.0277
18	0.3500	1.5200	12.5272	2.8372	6.7885	18.2659
19	3.6000	1.9700	13.5206	2.5808	8.3005	18.7407
20	2.6000	4.5000	13.2149	2.6498	7.8553	18.5746
21	0.6600	1.3200	12.6220	2.8089	6.9404	18.3036
22	45.6000	34.6000	26.3577	6.7059	12.7937	39.9217
23	4.5000	8.7700	13.7957	2.5271	8.6841	18.9072
24	5.8000	24.5000	14.1930	2.4647	9.2076	19.1784
25	6.8000	26.0000	14.4987	2.4297	9.5841	19.4132
26	9.2000	53.8000	15.2322	2.3945	10.3888	20.0756
27	7.4000	62.3000	14.6820	2.4144	9.7985	19.5656
28	10.8000	32.1000	15.7212	2.4104	10.8457	20.5968
29	3.6000	50.1000	13.5206	2.5808	8.3005	18.7407
30	18.1000	26.6000	17.9525	2.8428	12.2023	23.7026
31	42.9000	16.2000	25.5325	6.2742	12.8418	38.2232
32	1.9000	8.4500	13.0010	2.7035	7.5326	18.4694
33	4.0000	29.2000	13.6428	2.5559	8.4731	18.8126
34	0.4600	5.3200	12.5609	2.8271	6.8426	18.2791
35	1.5000	2.2700	12.8787	2.7361	7.3444	18.4131
36	1.8000	1.6800	12.9704	2.7115	7.4858	18.4550
37	6.8000	3.4200	14.4987	2.4297	9.5841	19.4132
38	1.4000	4.4100	12.8482	2.7445	7.2969	18.3995
39	0.6700	1.3100	12.6250	2.8080	6.9453	18.3048
40	0.9400	7.0800	12.7076	2.7840	7.0763	18.3388
41	0.1800	1.0900	12.4753	2.8530	6.7046	18.2459
42	0.2100	0.9700	12.4844	2.8502	6.7195	18.2494
43	0.5400	1.1100	12.5853	2.8198	6.8818	18.2888
44	0.0730	1.0700	12.4426	2.8630	6.6516	18.2336
45	0.0770	0.4500	12.4438	2.8626	6.6536	18.2340
46	8.4000	20.5000	14.9877	2.3984	10.1364	19.8390
47	2.0000	29.3000	13.0316	2.6956	7.5792	18.4839
48	1.1000	18.6000	12.7565	2.7701	7.1534	18.3595
49	39.2000	27.7000	24.4016	5.6909	12.8906	35.9126
50	34.7000	13.6000	23.0262	4.9992	12.9144	33.1380
51	5.5000	30.0000	14.1013	2.4775	9.0901	19.1125

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	20.2000	14.2541	15.5282	-17.1546	45.6628
12	46.9000	12.0000	26.7551	16.8199	-7.2664	60.7765
13	1.2000	9.0700	12.7870	15.5793	-18.7250	44.2991
14	39.6000	16.3000	24.5238	16.3765	-8.6008	57.6485
15	4.1000	11.1000	13.6734	15.5432	-17.7656	45.1125
16	0.7100	1.6100	12.6373	15.5870	-18.8903	44.1649
17	5.1000	2.3600	13.9791	15.5344	-17.4423	45.4004
18	0.3500	1.5200	12.5272	15.5929	-19.0123	44.0668
19	3.6000	1.9700	13.5206	15.5483	-17.9288	44.9699
20	2.6000	4.5000	13.2149	15.5599	-18.2579	44.6877
21	0.6600	1.3200	12.6220	15.5878	-18.9072	44.1512
22	45.6000	34.6000	26.3577	16.7349	-7.4918	60.2073
23	4.5000	8.7700	13.7957	15.5394	-17.6358	45.2272
24	5.8000	24.5000	14.1930	15.5294	-17.2182	45.6042
25	6.8000	26.0000	14.4987	15.5239	-16.9014	45.8987
26	9.2000	53.8000	15.2322	15.5184	-16.1568	46.6212
27	7.4000	62.3000	14.6820	15.5215	-16.7132	46.0773
28	10.8000	32.1000	15.7212	15.5209	-15.6728	47.1152
29	3.6000	50.1000	13.5206	15.5483	-17.9288	44.9699
30	18.1000	26.6000	17.9525	15.5939	-13.5892	49.4941
31	42.9000	16.2000	25.5325	16.5666	-7.9767	59.0417
32	1.9000	8.4500	13.0010	15.5691	-18.4905	44.4925
33	4.0000	29.2000	13.6428	15.5442	-17.7982	45.0839
34	0.4600	5.3200	12.5609	15.5910	-18.9750	44.0967
35	1.5000	2.2700	12.8787	15.5748	-18.6243	44.3818
36	1.8000	1.6800	12.9704	15.5705	-18.5239	44.4647
37	6.8000	3.4200	14.4987	15.5239	-16.9014	45.8987
38	1.4000	4.4100	12.8482	15.5763	-18.6578	44.3542
39	0.6700	1.3100	12.6250	15.5876	-18.9038	44.1539
40	0.9400	7.0800	12.7076	15.5833	-18.8126	44.2278
41	0.1800	1.0900	12.4753	15.5958	-19.0701	44.0207
42	0.2100	0.9700	12.4844	15.5952	-19.0599	44.0288
43	0.5400	1.1100	12.5853	15.5897	-18.9479	44.1185
44	0.0730	1.0700	12.4426	15.5976	-19.1065	43.9917
45	0.0770	0.4500	12.4438	15.5975	-19.1052	43.9928
46	8.4000	20.5000	14.9877	15.5190	-16.4025	46.3779
47	2.0000	29.3000	13.0316	15.5677	-18.4572	44.5203
48	1.1000	18.6000	12.7565	15.5808	-18.7587	44.2716
49	39.2000	27.7000	24.4016	16.3547	-8.6788	57.4820
50	34.7000	13.6000	23.0262	16.1270	-9.5938	55.6461
51	5.5000	30.0000	14.1013	15.5315	-17.3140	45.5166

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	20.2000	14.2541	2.4568	7.2525	21.2557
12	46.9000	12.0000	26.7551	6.9153	7.0474	46.4627
13	1.2000	9.0700	12.7870	2.7615	4.9172	20.6569
14	39.6000	16.3000	24.5238	5.7534	8.1273	40.9204
15	4.1000	11.1000	13.6734	2.5499	6.4064	20.9404
16	0.7100	1.6100	12.6373	2.8044	4.6450	20.6295
17	5.1000	2.3600	13.9791	2.4960	6.8657	21.0924
18	0.3500	1.5200	12.5272	2.8372	4.4417	20.6128
19	3.6000	1.9700	13.5206	2.5808	6.1657	20.8754
20	2.6000	4.5000	13.2149	2.6498	5.6635	20.7664
21	0.6600	1.3200	12.6220	2.8089	4.6169	20.6270
22	45.6000	34.6000	26.3577	6.7059	7.2468	45.4687
23	4.5000	8.7700	13.7957	2.5271	6.5938	20.9976
24	5.8000	24.5000	14.1930	2.4647	7.1688	21.2172
25	6.8000	26.0000	14.4987	2.4297	7.5742	21.4231
26	9.2000	53.8000	15.2322	2.3945	8.4081	22.0564
27	7.4000	62.3000	14.6820	2.4144	7.8014	21.5627
28	10.8000	32.1000	15.7212	2.4104	8.8518	22.5907
29	3.6000	50.1000	13.5206	2.5808	6.1657	20.8754
30	18.1000	26.6000	17.9525	2.8428	9.8507	26.0542
31	42.9000	16.2000	25.5325	6.2742	7.6519	43.4130
32	1.9000	8.4500	13.0010	2.7035	5.2963	20.7057
33	4.0000	29.2000	13.6428	2.5559	6.3589	20.9268
34	0.4600	5.3200	12.5609	2.8271	4.5041	20.6176
35	1.5000	2.2700	12.8787	2.7361	5.0811	20.6764
36	1.8000	1.6800	12.9704	2.7115	5.2429	20.6980
37	6.8000	3.4200	14.4987	2.4297	7.5742	21.4231
38	1.4000	4.4100	12.8482	2.7445	5.0267	20.6697
39	0.6700	1.3100	12.6250	2.8080	4.6225	20.6275
40	0.9400	7.0800	12.7076	2.7840	4.7734	20.6417
41	0.1800	1.0900	12.4753	2.8530	4.3447	20.6059
42	0.2100	0.9700	12.4844	2.8502	4.3619	20.6070
43	0.5400	1.1100	12.5853	2.8198	4.5493	20.6213
44	0.0730	1.0700	12.4426	2.8630	4.2834	20.6018
45	0.0770	0.4500	12.4438	2.8626	4.2857	20.6019
46	8.4000	20.5000	14.9877	2.3984	8.1524	21.8229
47	2.0000	29.3000	13.0316	2.6956	5.3495	20.7136
48	1.1000	18.6000	12.7565	2.7701	4.8620	20.6509
49	39.2000	27.7000	24.4016	5.6909	8.1831	40.6200
50	34.7000	13.6000	23.0262	4.9992	8.7791	37.2732
51	5.5000	30.0000	14.1013	2.4775	7.0408	21.1618

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Section

Row	Soil (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	20.2000	14.2541	5.9459	0.3929	29.4350
12	46.9000	12.0000	26.7551	-14.7551	-1.0782	122.9588
13	1.2000	9.0700	12.7870	-3.7170	-0.2465	40.9816
14	39.6000	16.3000	24.5238	-8.2238	-0.5786	50.4530
15	4.1000	11.1000	13.6734	-2.5734	-0.1702	23.1839
16	0.7100	1.6100	12.6373	-11.0273	-0.7315	684.9235
17	5.1000	2.3600	13.9791	-11.6191	-0.7680	492.3328
18	0.3500	1.5200	12.5272	-11.0072	-0.7305	724.1602
19	3.6000	1.9700	13.5206	-11.5506	-0.7642	586.3241
20	2.6000	4.5000	13.2149	-8.7149	-0.5771	193.6653
21	0.6600	1.3200	12.6220	-11.3020	-0.7498	856.2110
22	45.6000	34.6000	26.3577	8.2423	0.5978	23.8216
23	4.5000	8.7700	13.7957	-5.0257	-0.3323	57.3052
24	5.8000	24.5000	14.1930	10.3070	0.6811	42.0694
25	6.8000	26.0000	14.4987	11.5013	0.7597	44.2360
26	9.2000	53.8000	15.2322	38.5678	2.5467	71.6874
27	7.4000	62.3000	14.6820	47.6180	3.1449	76.4333
28	10.8000	32.1000	15.7212	16.3788	1.0817	51.0242
29	3.6000	50.1000	13.5206	36.5794	2.4203	73.0128
30	18.1000	26.6000	17.9525	8.6475	0.5739	32.5096
31	42.9000	16.2000	25.5325	-9.3325	-0.6671	57.6079
32	1.9000	8.4500	13.0010	-4.5510	-0.3015	53.8578
33	4.0000	29.2000	13.6428	15.5572	1.0290	53.2779
34	0.4600	5.3200	12.5609	-7.2409	-0.4805	136.1063
35	1.5000	2.2700	12.8787	-10.6087	-0.7032	467.3449
36	1.8000	1.6800	12.9704	-11.2904	-0.7482	672.0489
37	6.8000	3.4200	14.4987	-11.0787	-0.7318	323.9372
38	1.4000	4.4100	12.8482	-8.4382	-0.5594	191.3416
39	0.6700	1.3100	12.6250	-11.3150	-0.7507	863.7437
40	0.9400	7.0800	12.7076	-5.6276	-0.3732	79.4854
41	0.1800	1.0900	12.4753	-11.3853	-0.7558	1044.5207
42	0.2100	0.9700	12.4844	-11.5144	-0.7643	1187.0562
43	0.5400	1.1100	12.5853	-11.4753	-0.7614	1033.8115
44	0.0730	1.0700	12.4426	-11.3726	-0.7550	1062.8571
45	0.0770	0.4500	12.4438	-11.9938	-0.7962	2665.2875
46	8.4000	20.5000	14.9877	5.5123	0.3640	26.8893
47	2.0000	29.3000	13.0316	16.2684	1.0778	55.5237
48	1.1000	18.6000	12.7565	5.8435	0.3875	31.4168
49	39.2000	27.7000	24.4016	3.2984	0.2317	11.9076
50	34.7000	13.6000	23.0262	-9.4262	-0.6503	69.3101
51	5.5000	30.0000	14.1013	15.8987	1.0507	52.9956

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	5.9459	0.3886	0.0257	0.0020	240.3199
12	46.9000	-14.7551	*-1.0805	0.2034	0.1484	234.0824
13	1.2000	-3.7170	-0.2435	0.0324	0.0010	240.8990
14	39.6000	-8.2238	*-0.5736	0.1408	0.0274	239.2033
15	4.1000	-2.5734	-0.1681	0.0277	0.0004	241.0955
16	0.7100	-11.0273	-0.7271	0.0335	0.0093	237.9640
17	5.1000	-11.6191	-0.7639	0.0265	0.0080	237.6253
18	0.3500	-11.0072	-0.7261	0.0342	0.0095	237.9733
19	3.6000	-11.5506	-0.7601	0.0283	0.0085	237.6614
20	2.6000	-8.7149	-0.5721	0.0299	0.0051	239.2145
21	0.6600	-11.3020	-0.7455	0.0336	0.0098	237.7966
22	45.6000	8.2423	*0.5928	0.1913	0.0423	239.0641
23	4.5000	-5.0257	-0.3285	0.0272	0.0015	240.5915
24	5.8000	10.3070	0.6763	0.0258	0.0062	238.4049
25	6.8000	11.5013	0.7555	0.0251	0.0074	237.7040
26	9.2000	38.5678	*2.7531	0.0244	0.0811	201.1521
27	7.4000	47.6180	*3.5932	0.0248	0.1257	180.0873
28	10.8000	16.3788	1.0841	0.0247	0.0148	234.0363
29	3.6000	36.5794	*2.5916	0.0283	0.0854	205.0361
30	18.1000	8.6475	0.5690	0.0344	0.0059	239.2368
31	42.9000	-9.3325	*-0.6623	0.1674	0.0447	238.5218
32	1.9000	-4.5510	-0.2980	0.0311	0.0015	240.7122
33	4.0000	15.5572	1.0298	0.0278	0.0151	234.7236
34	0.4600	-7.2409	-0.4757	0.0340	0.0041	239.8464
35	1.5000	-10.6087	-0.6986	0.0318	0.0081	238.2156
36	1.8000	-11.2904	-0.7439	0.0313	0.0090	237.8119
37	6.8000	-11.0787	-0.7274	0.0251	0.0069	237.9616
38	1.4000	-8.4382	-0.5544	0.0320	0.0052	239.3390
39	0.6700	-11.3150	-0.7464	0.0335	0.0098	237.7886
40	0.9400	-5.6276	-0.3691	0.0330	0.0024	240.4129
41	0.1800	-11.3853	-0.7515	0.0346	0.0102	237.7412
42	0.2100	-11.5144	-0.7602	0.0346	0.0105	237.6608
43	0.5400	-11.4753	-0.7572	0.0338	0.0101	237.6881
44	0.0730	-11.3726	-0.7508	0.0349	0.0103	237.7482
45	0.0770	-11.9938	-0.7924	0.0349	0.0114	237.3525
46	8.4000	5.5123	0.3599	0.0245	0.0017	240.4551
47	2.0000	16.2684	1.0801	0.0309	0.0185	234.0878
48	1.1000	5.8435	0.3832	0.0326	0.0025	240.3458
49	39.2000	3.2984	*0.2288	0.1378	0.0043	240.9427
50	34.7000	-9.4262	*-0.6454	0.1063	0.0252	238.6584
51	5.5000	15.8987	1.0522	0.0261	0.0148	234.4446

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.3886	0.0631	0.0020	1.0725	0.0591	-0.0141
12	-1.0805	-0.5460	0.1484	* 1.2446	0.1246	-0.5123
13	-0.2435	-0.0446	0.0010	1.0852	-0.0445	0.0222
14	-0.5736	-0.2322	0.0274	* 1.2050	0.0358	-0.2112
15	-0.1681	-0.0283	0.0004	1.0817	-0.0276	0.0097
16	-0.7271	-0.1353	0.0093	1.0601	-0.1352	0.0704
17	-0.7639	-0.1260	0.0080	1.0495	-0.1205	0.0356
18	-0.7261	-0.1367	0.0095	1.0610	-0.1367	0.0733
19	-0.7601	-0.1298	0.0085	1.0518	-0.1272	0.0484
20	-0.5721	-0.1004	0.0051	1.0673	-0.0994	0.0430
21	-0.7455	-0.1389	0.0098	1.0587	-0.1389	0.0726
22	0.5928	0.2883	0.0423	* 1.2787	-0.0625	0.2693
23	-0.3285	-0.0549	0.0015	1.0766	-0.0531	0.0175
24	0.6763	0.1102	0.0062	1.0557	0.1037	-0.0261
25	0.7555	0.1213	0.0074	1.0487	0.1110	-0.0206
26	* 2.7531	0.4353	0.0811	0.7504	0.3631	0.0002
27	* 3.5932	0.5730	0.1257	0.6017	0.5145	-0.0733
28	1.0841	0.1726	0.0148	1.0162	0.1321	0.0198
29	* 2.5916	0.4425	0.0854	0.7829	0.4336	-0.1650
30	0.5690	0.1074	0.0059	1.0725	0.0436	0.0579
31	-0.6623	-0.2970	0.0447	* 1.2365	0.0567	-0.2745
32	-0.2980	-0.0534	0.0015	1.0821	-0.0531	0.0248
33	1.0298	0.1741	0.0151	1.0254	0.1697	-0.0609
34	-0.4757	-0.0892	0.0041	1.0775	-0.0892	0.0474
35	-0.6986	-0.1267	0.0081	1.0606	-0.1263	0.0613
36	-0.7439	-0.1337	0.0090	1.0563	-0.1330	0.0627
37	-0.7274	-0.1167	0.0069	1.0510	-0.1069	0.0198
38	-0.5544	-0.1009	0.0052	1.0708	-0.1006	0.0493
39	-0.7464	-0.1390	0.0098	1.0586	-0.1390	0.0726
40	-0.3691	-0.0681	0.0024	1.0815	-0.0681	0.0348
41	-0.7515	-0.1423	0.0102	1.0594	-0.1423	0.0774
42	-0.7602	-0.1438	0.0105	1.0586	-0.1438	0.0780
43	-0.7572	-0.1417	0.0101	1.0580	-0.1416	0.0748
44	-0.7508	-0.1427	0.0103	1.0597	-0.1427	0.0782
45	-0.7924	-0.1506	0.0114	1.0562	-0.1506	0.0825
46	0.3599	0.0570	0.0017	1.0724	0.0493	-0.0032
47	1.0801	0.1929	0.0185	1.0231	0.1918	-0.0886
48	0.3832	0.0704	0.0025	1.0805	0.0703	-0.0354
49	0.2288	0.0915	0.0043	* 1.2183	-0.0136	0.0830
50	-0.6454	-0.2226	0.0252	* 1.1532	0.0187	-0.1954
51	1.0522	0.1723	0.0148	1.0212	0.1633	-0.0442

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	5.9459	|.....	0.3929	|.....	0.3886	|.....
12	46.9000	-14.7551	||||.....	-1.0782	||||.....	-1.0805	|||.....
13	1.2000	-3.7170	|.....	-0.2465	|.....	-0.2435	|.....
14	39.6000	-8.2238	|.....	-0.5786	||.....	-0.5736	|.....
15	4.1000	-2.5734	|.....	-0.1702	|.....	-0.1681	|.....
16	0.7100	-11.0273	||.....	-0.7315	||.....	-0.7271	||.....
17	5.1000	-11.6191	|||.....	-0.7680	|||.....	-0.7639	||.....
18	0.3500	-11.0072	||.....	-0.7305	||.....	-0.7261	||.....
19	3.6000	-11.5506	||.....	-0.7642	||.....	-0.7601	||.....
20	2.6000	-8.7149	||.....	-0.5771	||.....	-0.5721	|.....
21	0.6600	-11.3020	||.....	-0.7498	||.....	-0.7455	||.....
22	45.6000	8.2423	|.....	0.5978	||.....	0.5928	|.....
23	4.5000	-5.0257	|.....	-0.3323	|.....	-0.3285	|.....
24	5.8000	10.3070	||.....	0.6811	||.....	0.6763	||.....
25	6.8000	11.5013	||.....	0.7597	||.....	0.7555	||.....
26	9.2000	38.5678	||||||||||....	2.5467	||||||||||....	* 2.7531	||||||||||....
27	7.4000	47.6180	||||||||||||||	3.1449	||||||||||||||	* 3.5932	||||||||||||||
28	10.8000	16.3788	||||.....	1.0817	||||.....	1.0841	||||.....
29	3.6000	36.5794	||||||||||....	2.4203	||||||||||....	* 2.5916	|||||||||.....
30	18.1000	8.6475	||.....	0.5739	||.....	0.5690	|.....
31	42.9000	-9.3325	||.....	-0.6671	||.....	-0.6623	||.....
32	1.9000	-4.5510	|.....	-0.3015	|.....	-0.2980	|.....
33	4.0000	15.5572	||||.....	1.0290	||||.....	1.0298	|||.....
34	0.4600	-7.2409	|.....	-0.4805	|.....	-0.4757	|.....
35	1.5000	-10.6087	||.....	-0.7032	||.....	-0.6986	||.....
36	1.8000	-11.2904	||.....	-0.7482	||.....	-0.7439	||.....
37	6.8000	-11.0787	||.....	-0.7318	||.....	-0.7274	||.....
38	1.4000	-8.4382	|.....	-0.5594	|.....	-0.5544	|.....
39	0.6700	-11.3150	||.....	-0.7507	||.....	-0.7464	||.....
40	0.9400	-5.6276	|.....	-0.3732	|.....	-0.3691	|.....
41	0.1800	-11.3853	||.....	-0.7558	||.....	-0.7515	||.....
42	0.2100	-11.5144	||.....	-0.7643	||.....	-0.7602	||.....
43	0.5400	-11.4753	||.....	-0.7614	||.....	-0.7572	||.....
44	0.0730	-11.3726	||.....	-0.7550	||.....	-0.7508	||.....
45	0.0770	-11.9938	|||.....	-0.7962	|||.....	-0.7924	||.....
46	8.4000	5.5123	|.....	0.3640	|.....	0.3599	|.....
47	2.0000	16.2684	||||.....	1.0778	||||.....	1.0801	|||.....
48	1.1000	5.8435	|.....	0.3875	|.....	0.3832	|.....
49	39.2000	3.2984	|.....	0.2317	|.....	0.2288	|.....
50	34.7000	-9.4262	||.....	-0.6503	||.....	-0.6454	||.....
51	5.5000	15.8987	||||.....	1.0507	||||.....	1.0522	|||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.0631	|.....	0.0020	|.....	-0.0141	|.....
12	46.9000	-0.5460	|||||||||||||.	0.1484	|||||||||||||	-0.5123	|||||||||||||
13	1.2000	-0.0446	|.....	0.0010	|.....	0.0222	|.....
14	39.6000	-0.2322	|||||.....	0.0274	||.....	-0.2112	|||||.....
15	4.1000	-0.0283	|.....	0.0004	|.....	0.0097	|.....
16	0.7100	-0.1353	||.....	0.0093	|.....	0.0704	||.....
17	5.1000	-0.1260	||.....	0.0080	|.....	0.0356	|.....
18	0.3500	-0.1367	||.....	0.0095	|.....	0.0733	||.....
19	3.6000	-0.1298	||.....	0.0085	|.....	0.0484	|.....
20	2.6000	-0.1004	|.....	0.0051	|.....	0.0430	|.....
21	0.6600	-0.1389	|||.....	0.0098	|.....	0.0726	||.....
22	45.6000	0.2883	|||||||.....	0.0423	||||.....	0.2693	|||||||.....
23	4.5000	-0.0549	|.....	0.0015	|.....	0.0175	|.....
24	5.8000	0.1102	||.....	0.0062	|.....	-0.0261	|.....
25	6.8000	0.1213	||.....	0.0074	|.....	-0.0206	|.....
26	9.2000	0.4353	||||||||||....	0.0811	|||||||.....	0.0002	|.....
27	7.4000	0.5730	||||||||||||||	0.1257	||||||||||...	-0.0733	||.....
28	10.8000	0.1726	|||.....	0.0148	|.....	0.0198	|.....
29	3.6000	0.4425	||||||||||....	0.0854	|||||||.....	-0.1650	||||.....
30	18.1000	0.1074	||.....	0.0059	|.....	0.0579	|.....
31	42.9000	-0.2970	|||||||.....	0.0447	||||.....	-0.2745	|||||||.....
32	1.9000	-0.0534	|.....	0.0015	|.....	0.0248	|.....
33	4.0000	0.1741	||||.....	0.0151	|.....	-0.0609	|.....
34	0.4600	-0.0892	|.....	0.0041	|.....	0.0474	|.....
35	1.5000	-0.1267	||.....	0.0081	|.....	0.0613	|.....
36	1.8000	-0.1337	||.....	0.0090	|.....	0.0627	|.....
37	6.8000	-0.1167	||.....	0.0069	|.....	0.0198	|.....
38	1.4000	-0.1009	|.....	0.0052	|.....	0.0493	|.....
39	0.6700	-0.1390	|||.....	0.0098	|.....	0.0726	||.....
40	0.9400	-0.0681	|.....	0.0024	|.....	0.0348	|.....
41	0.1800	-0.1423	|||.....	0.0102	|.....	0.0774	||.....
42	0.2100	-0.1438	|||.....	0.0105	|.....	0.0780	||.....
43	0.5400	-0.1417	|||.....	0.0101	|.....	0.0748	||.....
44	0.0730	-0.1427	|||.....	0.0103	|.....	0.0782	||.....
45	0.0770	-0.1506	|||.....	0.0114	|.....	0.0825	||.....
46	8.4000	0.0570	|.....	0.0017	|.....	-0.0032	|.....
47	2.0000	0.1929	||||.....	0.0185	|.....	-0.0886	||.....
48	1.1000	0.0704	|.....	0.0025	|.....	-0.0354	|.....
49	39.2000	0.0915	|.....	0.0043	|.....	0.0830	||.....
50	34.7000	-0.2226	|||||.....	0.0252	||.....	-0.1954	|||||.....
51	5.5000	0.1723	|||.....	0.0148	|.....	-0.0442	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	0.3886	|.....	0.0020	|.....	0.0257	|.....
12	46.9000	-1.0805	|||.....	0.1484	||||||||||||||	0.2034	||||||||||||||
13	1.2000	-0.2435	|.....	0.0010	|.....	0.0324	|.....
14	39.6000	-0.5736	|.....	0.0274	||.....	0.1408	||||||||.....
15	4.1000	-0.1681	|.....	0.0004	|.....	0.0277	|.....
16	0.7100	-0.7271	||.....	0.0093	|.....	0.0335	|.....
17	5.1000	-0.7639	||.....	0.0080	|.....	0.0265	|.....
18	0.3500	-0.7261	||.....	0.0095	|.....	0.0342	|.....
19	3.6000	-0.7601	||.....	0.0085	|.....	0.0283	|.....
20	2.6000	-0.5721	|.....	0.0051	|.....	0.0299	|.....
21	0.6600	-0.7455	||.....	0.0098	|.....	0.0336	|.....
22	45.6000	0.5928	|.....	0.0423	||||.....	0.1913	||||||||||||..
23	4.5000	-0.3285	|.....	0.0015	|.....	0.0272	|.....
24	5.8000	0.6763	||.....	0.0062	|.....	0.0258	|.....
25	6.8000	0.7555	||.....	0.0074	|.....	0.0251	|.....
26	9.2000	* 2.7531	|||||||||||....	0.0811	|||||||.....	0.0244	|.....
27	7.4000	* 3.5932	||||||||||||||	0.1257	|||||||||||...	0.0248	|.....
28	10.8000	1.0841	||||.....	0.0148	|.....	0.0247	|.....
29	3.6000	* 2.5916	||||||||||.....	0.0854	|||||||.....	0.0283	|.....
30	18.1000	0.5690	|.....	0.0059	|.....	0.0344	|.....
31	42.9000	-0.6623	||.....	0.0447	||||.....	0.1674	||||||||||....
32	1.9000	-0.2980	|.....	0.0015	|.....	0.0311	|.....
33	4.0000	1.0298	|||.....	0.0151	|.....	0.0278	|.....
34	0.4600	-0.4757	|.....	0.0041	|.....	0.0340	|.....
35	1.5000	-0.6986	||.....	0.0081	|.....	0.0318	|.....
36	1.8000	-0.7439	||.....	0.0090	|.....	0.0313	|.....
37	6.8000	-0.7274	||.....	0.0069	|.....	0.0251	|.....
38	1.4000	-0.5544	|.....	0.0052	|.....	0.0320	|.....
39	0.6700	-0.7464	||.....	0.0098	|.....	0.0335	|.....
40	0.9400	-0.3691	|.....	0.0024	|.....	0.0330	|.....
41	0.1800	-0.7515	||.....	0.0102	|.....	0.0346	|.....
42	0.2100	-0.7602	||.....	0.0105	|.....	0.0346	|.....
43	0.5400	-0.7572	||.....	0.0101	|.....	0.0338	|.....
44	0.0730	-0.7508	||.....	0.0103	|.....	0.0349	|.....
45	0.0770	-0.7924	||.....	0.0114	|.....	0.0349	|.....
46	8.4000	0.3599	|.....	0.0017	|.....	0.0245	|.....
47	2.0000	1.0801	|||.....	0.0185	|.....	0.0309	|.....
48	1.1000	0.3832	|.....	0.0025	|.....	0.0326	|.....
49	39.2000	0.2288	|.....	0.0043	|.....	0.1378	||||||||.....
50	34.7000	-0.6454	||.....	0.0252	||.....	0.1063	|||||.....
51	5.5000	1.0522	|||.....	0.0148	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Means

Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	20.2000	6.0000	25.4534	-19.4534	-100.8966	9.6002
12	12.0000	46.9000	-1.3750	48.2750	16.5472	73.1437
13	9.0700	1.2000	-10.9612	12.1612	5.4491	148.9117
14	16.3000	39.6000	12.6936	26.9064	-28.4234	23.2063
15	11.1000	4.1000	-4.3196	8.4196	11.8029	97.7525
16	1.6100	0.7100	-35.3686	36.0786	-9.1502	328.1653
17	2.3600	5.1000	-32.9147	38.0147	-7.8552	310.3166
18	1.5200	0.3500	-35.6630	36.0130	-9.3045	330.3061
19	1.9700	3.6000	-34.1907	37.7907	-8.5307	319.6001
20	4.5000	2.6000	-25.9132	28.5132	-4.0432	259.2713
21	1.3200	0.6600	-36.3174	36.9774	-9.6465	335.0625
22	34.6000	45.6000	72.5668	-26.9668	-446.2083	37.0804
23	8.7700	4.5000	-11.9428	16.4428	4.7071	156.2752
24	24.5000	5.8000	39.5220	-33.7220	-205.8852	19.6807
25	26.0000	6.8000	44.4296	-37.6296	-241.8154	22.5035
26	53.8000	9.2000	135.3845	-126.1845	-900.2283	67.3250
27	62.3000	7.4000	163.1945	-155.7945	-1100.9990	80.4868
28	32.1000	10.8000	64.3874	-53.5874	-386.9435	32.9947
29	50.1000	3.6000	123.2790	-119.6790	-812.8098	61.5716
30	26.6000	18.1000	46.3927	-28.2927	-256.1471	23.5922
31	16.2000	42.9000	12.3664	30.5336	-27.9360	24.9261
32	8.4500	1.9000	-12.9897	14.8897	3.9461	164.0991
33	29.2000	4.0000	54.8993	-50.8993	-318.0772	28.1361
34	5.3200	0.4600	-23.2303	23.6903	-2.5185	239.6480
35	2.2700	1.5000	-33.2092	34.7092	-8.0115	312.4594
36	1.6800	1.8000	-35.1395	36.9395	-9.0300	326.5002
37	3.4200	6.8000	-29.4467	36.2467	-5.9921	285.0576
38	4.4100	1.4000	-26.2076	27.6076	-4.2079	261.4225
39	1.3100	0.6700	-36.3501	37.0201	-9.6636	335.3003
40	7.0800	0.9400	-17.4720	18.4120	0.9476	197.3357
41	1.0900	0.1800	-37.0699	37.2499	-10.0386	340.5311
42	0.9700	0.2100	-37.4625	37.6725	-10.2427	343.3837
43	1.1100	0.5400	-37.0044	37.5444	-10.0046	340.0556
44	1.0700	0.0730	-37.1353	37.2083	-10.0727	341.0065
45	0.4500	0.0770	-39.1638	39.2408	-11.1230	355.7412
46	20.5000	8.4000	26.4350	-18.0350	-108.4350	10.5170
47	29.3000	2.0000	55.2264	-53.2264	-320.4549	28.3066
48	18.6000	1.1000	20.2186	-19.1186	-58.7427	2.7608
49	27.7000	39.2000	49.9916	-10.7916	-282.3779	25.5442
50	13.6000	34.7000	3.8598	30.8402	6.5181	47.8582
51	30.0000	5.5000	57.5167	-52.0167	-337.0917	29.4932

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Soil

Inverse Prediction of X Individuals

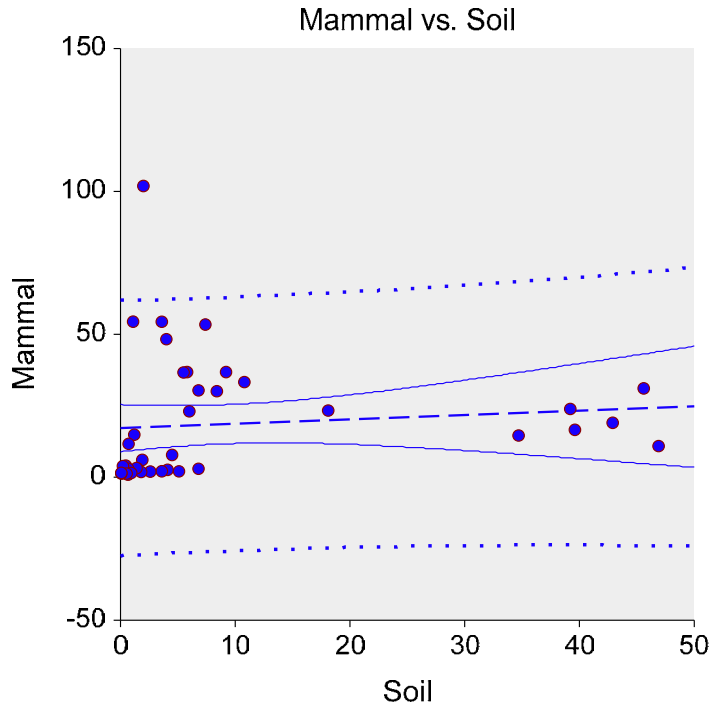
Row	Invert (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	20.2000	6.0000	25.4534	-19.4534	-223.6237	132.3273
12	12.0000	46.9000	-1.3750	48.2750	-139.3470	229.0380
13	9.0700	1.2000	-10.9612	12.1612	-94.8146	249.1754
14	16.3000	39.6000	12.6936	26.9064	-190.7417	185.5246
15	11.1000	4.1000	-4.3196	8.4196	-126.5530	236.1084
16	1.6100	0.7100	-35.3686	36.0786	80.2471	238.7681
17	2.3600	5.1000	-32.9147	38.0147	54.1775	248.2840
18	1.5200	0.3500	-35.6630	36.0130	83.7295	237.2721
19	1.9700	3.6000	-34.1907	37.7907	67.1593	243.9101
20	4.5000	2.6000	-25.9132	28.5132	-4.2724	259.5005
21	1.3200	0.6600	-36.3174	36.9774	91.8448	233.5711
22	34.6000	45.6000	72.5668	-26.9668	-358.3961	-50.7318
23	8.7700	4.5000	-11.9428	16.4428	-89.7570	250.7393
24	24.5000	5.8000	39.5220	-33.7220	-241.4521	55.2476
25	26.0000	6.8000	44.4296	-37.6296	-241.0392	21.7273
26	53.8000	9.2000	135.3845	-126.1845	-862.8956	29.9923
27	62.3000	7.4000	163.1945	-155.7945	-1070.8357	50.3236
28	32.1000	10.8000	64.3874	-53.5874	-273.7182	-80.2306
29	50.1000	3.6000	123.2790	-119.6790	-771.1037	19.8655
30	26.6000	18.1000	46.3927	-28.2927	-239.4203	6.8654
31	16.2000	42.9000	12.3664	30.5336	-189.7236	186.7137
32	8.4500	1.9000	-12.9897	14.8897	-84.2493	252.2945
33	29.2000	4.0000	54.8993	-50.8993	-213.9761	-75.9651
34	5.3200	0.4600	-23.2303	23.6903	-23.0916	260.2210
35	2.2700	1.5000	-33.2092	34.7092	57.0806	247.3673
36	1.6800	1.8000	-35.1395	36.9395	77.6022	239.8679
37	3.4200	6.8000	-29.4467	36.2467	23.1275	255.9380
38	4.4100	1.4000	-26.2076	27.6076	-2.1129	259.3275
39	1.3100	0.6700	-36.3501	37.0201	92.2659	233.3708
40	7.0800	0.9400	-17.4720	18.4120	-59.2427	257.5260
41	1.0900	0.1800	-37.0699	37.2499	101.9778	228.5146
42	0.9700	0.2100	-37.4625	37.6725	107.7083	225.4327
43	1.1100	0.5400	-37.0044	37.5444	101.0557	228.9953
44	1.0700	0.0730	-37.1353	37.2083	102.9088	228.0250
45	0.4500	0.0770	-39.1638	39.2408	139.4407	205.1775
46	20.5000	8.4000	26.4350	-18.0350	-225.5667	127.6487
47	29.3000	2.0000	55.2264	-53.2264	-211.7935	-80.3548
48	18.6000	1.1000	20.2186	-19.1186	-211.7897	155.8079
49	27.7000	39.2000	49.9916	-10.7916	-233.4105	-23.4232
50	13.6000	34.7000	3.8598	30.8402	-160.3083	214.6846
51	30.0000	5.5000	57.5167	-52.0167	-187.4376	-120.1608

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Soil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	17.1934	Rows Prediction Only	0
Slope	0.1488	Sum of Frequencies	41
R-Squared	0.0095	Sum of Weights	41.0000
Correlation	0.0974	Coefficient of Variation	1.1683
Mean Square Error	470.2239	Square Root of MSE	21.68465

Linear Regression Report

Y = Mammal X = Soil

Summary Statement
The equation of the straight line relating Mammal and Soil is estimated as: Mammal = (17.1934) + (0.1488) Soil using the 41 observations in this dataset. The y-intercept, the estimated value of Mammal when Soil is zero, is 17.1934 with a standard error of 4.0589. The slope, the estimated change in Mammal per unit change in Soil, is 0.1488 with a standard error of 0.2433. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Soil, is 0.0095. The correlation between Mammal and Soil is 0.0974.

A significance test that the slope is zero resulted in a t-value of 0.6114. The significance level of this t-test is 0.5445. Since 0.5445 > 0.0500, the hypothesis that the slope is zero is not rejected.

The estimated slope is 0.1488. The lower limit of the 95% confidence interval for the slope is -0.3434 and the upper limit is 0.6410. The estimated intercept is 17.1934. The lower limit of the 95% confidence interval for the intercept is 8.9836 and the upper limit is 25.4033.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Soil
Count	41	41
Mean	18.5613	9.1944
Standard Deviation	21.5142	14.0901
Minimum	0.8900	0.0730
Maximum	101.9000	46.9000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	17.1934	0.1488
Lower 95% Confidence Limit	8.9836	-0.3434
Upper 95% Confidence Limit	25.4033	0.6410
Standard Error	4.0589	0.2433
Standardized Coefficient	0.0000	0.0974
T Value	4.2360	0.6114
Prob Level (T Test)	0.0001	0.5445
Prob Level (Randomization Test N =1000)		0.5390
Reject H0 (Alpha = 0.0500)	Yes	No
Power (Alpha = 0.0500)	0.9850	0.0916
Regression of Y on X	17.1934	0.1488
Inverse Regression from X on Y	-125.5308	15.6717
Orthogonal Regression of Y and X	-64.7412	9.0601

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(17.1934476825897) + (0.148765980530249) * (Soil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	17.1934	0.9000	9.5978	23.9403
Bootstrap Mean	17.1540	0.9500	7.7286	24.7563
Bias (BM - OV)	-0.0395	0.9900	4.3809	26.3971
Bias Corrected	17.2329			
Standard Error	4.3642			
Slope				
Original Value	0.1488	0.9000	-0.1161	0.3870
Bootstrap Mean	0.1703	0.9500	-0.1878	0.4364
Bias (BM - OV)	0.0215	0.9900	-0.4918	0.5397
Bias Corrected	0.1273			
Standard Error	0.1839			
Correlation				
Original Value	0.0974	0.9000	-0.1236	0.2480
Bootstrap Mean	0.1184	0.9500	-0.1733	0.2756
Bias (BM - OV)	0.0210	0.9900	-0.2530	0.3315
Bias Corrected	0.0764			
Standard Error	0.1116			
R-Squared				
Original Value	0.0095	0.9000	0.0000	0.0189
Bootstrap Mean	0.0265	0.9500	0.0000	0.0190
Bias (BM - OV)	0.0170	0.9900	0.0000	0.0190
Bias Corrected	-0.0075			
Standard Error	0.0366			
Standard Error of Estimate				
Original Value	21.6846	0.9000	15.3243	29.0661
Bootstrap Mean	20.8787	0.9500	14.3411	29.8388
Bias (BM - OV)	-0.8060	0.9900	12.4884	31.3913
Bias Corrected	22.4906			
Standard Error	4.1650			
Orthogonal Intercept				
Original Value	-64.7412	0.9000	-553.6402	372.7975
Bootstrap Mean	-119.2628	0.9500	-937.4990	952.3407
Bias (BM - OV)	-54.5216	0.9900	-9149.6189	8081.2406
Bias Corrected	-10.2196			
Standard Error	9895.8517			
Orthogonal Slope				
Original Value	9.0601	0.9000	-47.2086	62.1134
Bootstrap Mean	14.7059	0.9500	-106.1062	108.9818
Bias (BM - OV)	5.6458	0.9900	-945.9856	928.5713
Bias Corrected	3.4144			
Standard Error	987.9544			

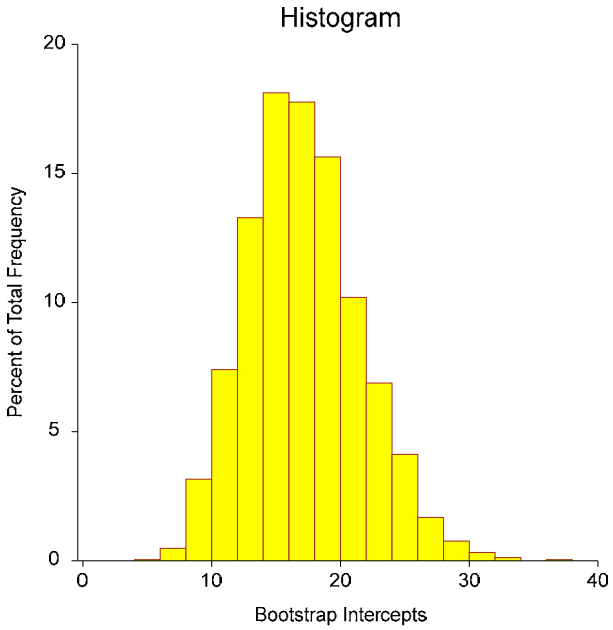
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

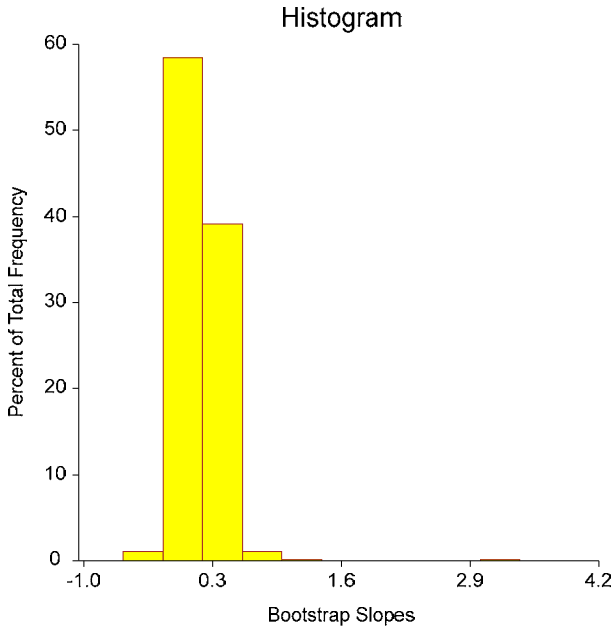
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

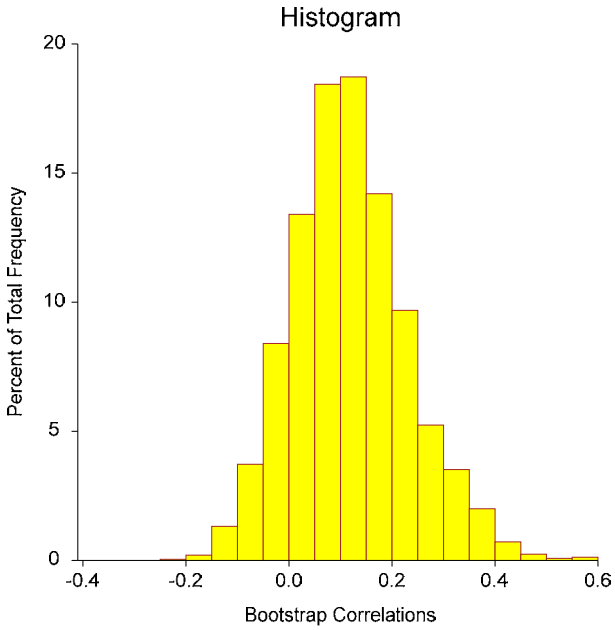
Linear Regression Report

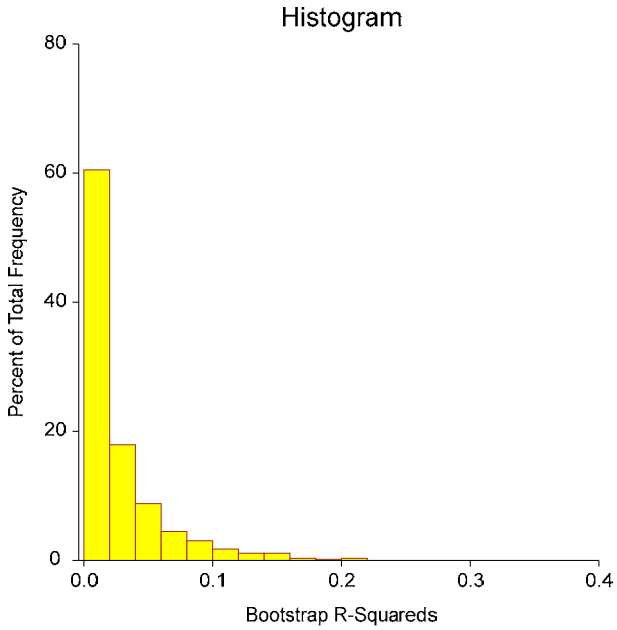
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Bootstrap Histograms Section



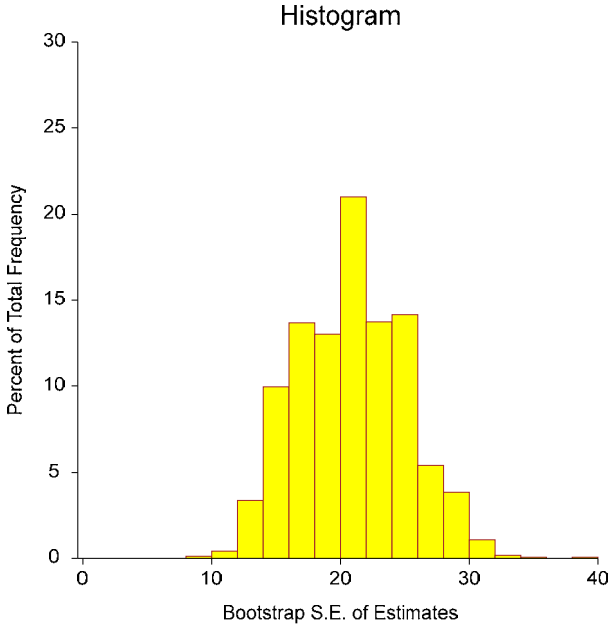


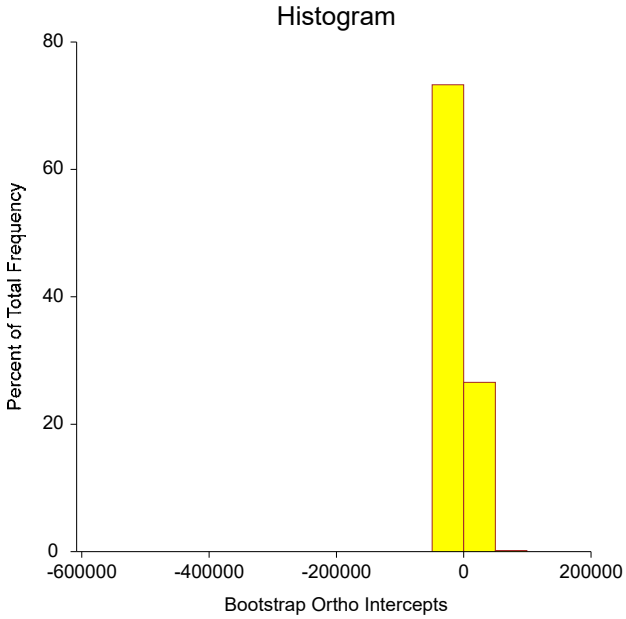


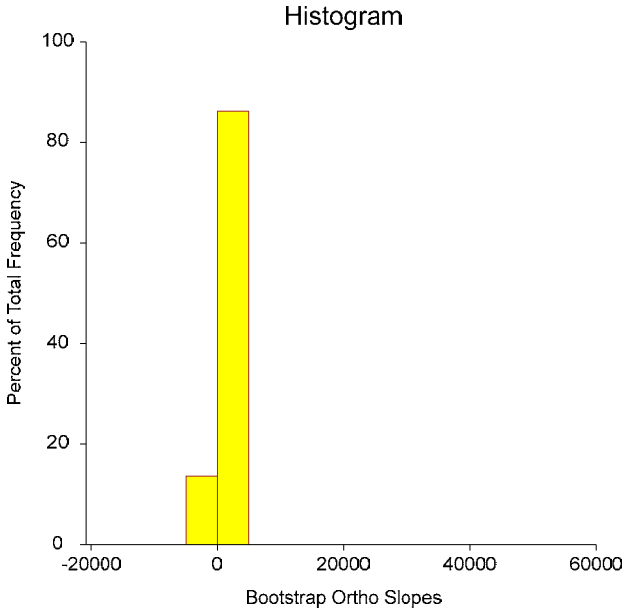


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.0974	0.0095	0.5719
Lower 95% Conf. Limit (r dist'n)	-0.2145		
Upper 95% Conf. Limit (r dist'n)	0.3892		
Lower 95% Conf. Limit (Fisher's z)	-0.2167		0.3206
Upper 95% Conf. Limit (Fisher's z)	0.3933		0.7479
Adjusted (Rbar)		0.0159	
T-Value for H0: Rho = 0	0.6114	0.6114	4.3532
Prob Level for H0: Rho = 0	0.5445	0.5445	0.0001
Prob Level (Randomization Test N =1000)	0.5390		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14125.34	14125.34			
Slope	1	175.7511	175.7511	0.3738	0.5445	0.0916
Error	39	18338.73	470.2239			
Lack of Fit	37	16595.41	448.5245	0.5146	0.8424	
Pure Error	2	1743.324	871.6622			
Adj. Total	40	18514.48	462.8621			
Total	41	32639.82				

s = Square Root(470.2239) = 21.68465

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	376.97	761.0117	0.03503547	-0.001157796
1	376.97	11407.3	8178.432	-0.001157796	0.0001259242
2 (Y'Y)			32639.82		
Determinant		325592.8			3.071322E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	16.47452	-0.5444234
1	-0.5444234	0.05921256

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7572	0.000001	No
Anderson Darling	3.1758	0.000000	No
D'Agostino Skewness	4.1762	0.000030	No
D'Agostino Kurtosis	3.2455	0.001172	No
D'Agostino Omnibus	27.9744	0.000001	No
Constant Residual Variance?			
Modified Levene Test	0.0518	0.821223	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.5146	0.842441	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

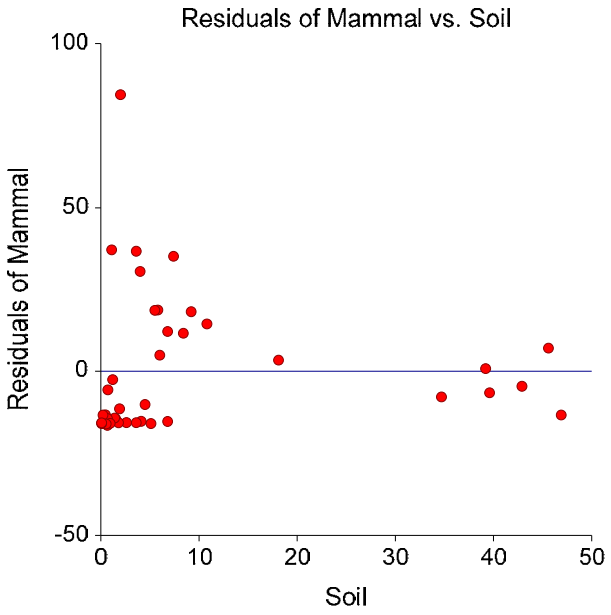
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

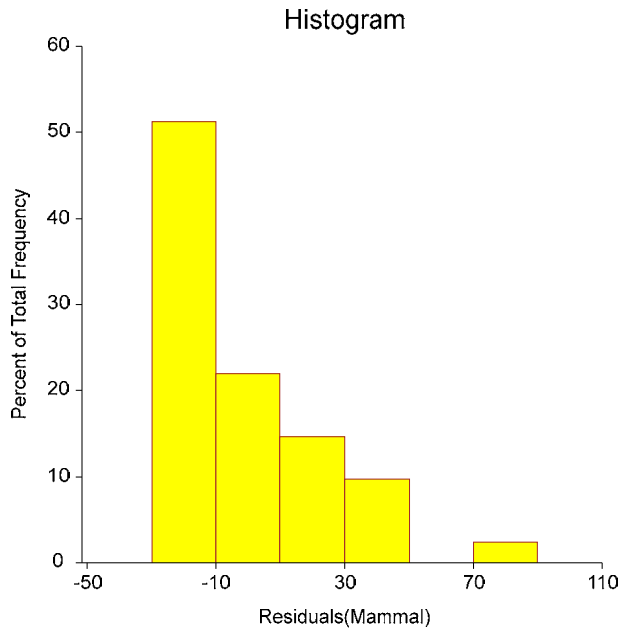
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

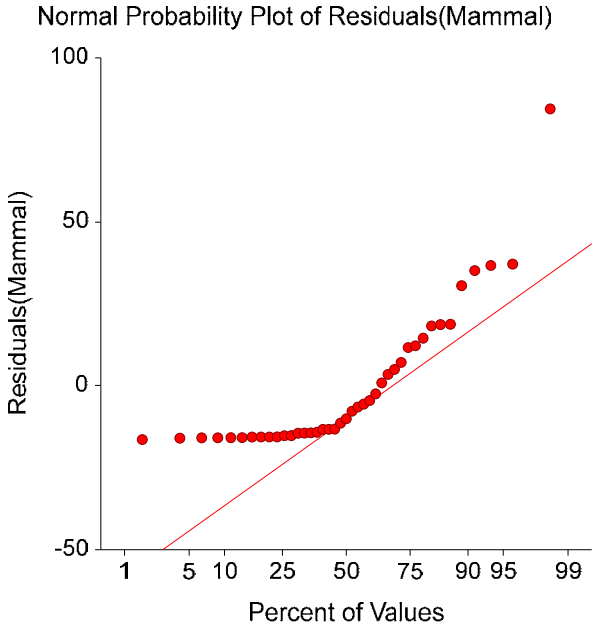
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Original Data Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
11	6.0000	23.0667	18.0860	4.9806
12	46.9000	10.9000	24.1706	-13.2706
13	1.2000	14.8900	17.3720	-2.4820
14	39.6000	16.6000	23.0846	-6.4846
15	4.1000	2.6000	17.8034	-15.2034
16	0.7100	11.6950	17.2991	-5.6041
17	5.1000	2.0767	17.9522	-15.8755
18	0.3500	2.7800	17.2455	-14.4655
19	3.6000	2.1100	17.7290	-15.6190
20	2.6000	1.9900	17.5802	-15.5902
21	0.6600	0.8900	17.2916	-16.4016
22	45.6000	31.1000	23.9772	7.1228
23	4.5000	7.8000	17.8629	-10.0629
24	5.8000	36.8000	18.0563	18.7437
25	6.8000	30.4000	18.2051	12.1949
26	9.2000	36.8000	18.5621	18.2379
27	7.4000	53.4233	18.2943	35.1290
28	10.8000	33.3000	18.8001	14.4999
29	3.6000	54.4000	17.7290	36.6710
30	18.1000	23.3500	19.8861	3.4639
31	42.9000	19.0700	23.5755	-4.5055
32	1.9000	6.0800	17.4761	-11.3961
33	4.0000	48.3000	17.7885	30.5115
34	0.4600	4.0533	17.2619	-13.2085
35	1.5000	2.9867	17.4166	-14.4299
36	1.8000	1.8400	17.4612	-15.6212
37	6.8000	2.9700	18.2051	-15.2351
38	1.4000	3.2100	17.4017	-14.1917
39	0.6700	2.9400	17.2931	-14.3531
40	0.9400	1.5200	17.3333	-15.8133
41	0.1800	1.3900	17.2202	-15.8302
42	0.2100	3.9267	17.2247	-13.2980
43	0.5400	1.2767	17.2738	-15.9971
44	0.0730	1.3100	17.2043	-15.8943
45	0.0770	1.5500	17.2049	-15.6549
46	8.4000	30.1000	18.4431	11.6569
47	2.0000	101.9000	17.4910	84.4090
48	1.1000	54.4500	17.3571	37.0929
49	39.2000	23.9000	23.0251	0.8749
50	34.7000	14.6000	22.3556	-7.7556
51	5.5000	36.6667	18.0117	18.6550

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Confidence Limits of Means

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	6.0000	23.0667	18.0860	3.4746	11.0579	25.1142
12	46.9000	10.9000	24.1706	9.7802	4.3883	43.9529
13	1.2000	14.8900	17.3720	3.9055	9.4723	25.2716
14	39.6000	16.6000	23.0846	8.1370	6.6259	39.5432
15	4.1000	2.6000	17.8034	3.6063	10.5089	25.0979
16	0.7100	11.6950	17.2991	3.9663	9.2765	25.3216
17	5.1000	2.0767	17.9522	3.5301	10.8119	25.0924
18	0.3500	2.7800	17.2455	4.0126	9.1293	25.3617
19	3.6000	2.1100	17.7290	3.6499	10.3463	25.1117
20	2.6000	1.9900	17.5802	3.7475	10.0002	25.1603
21	0.6600	0.8900	17.2916	3.9726	9.2563	25.3270
22	45.6000	31.1000	23.9772	9.4841	4.7939	43.1605
23	4.5000	7.8000	17.8629	3.5740	10.6337	25.0921
24	5.8000	36.8000	18.0563	3.4858	11.0055	25.1071
25	6.8000	30.4000	18.2051	3.4363	11.2544	25.1557
26	9.2000	36.8000	18.5621	3.3866	11.7121	25.4121
27	7.4000	53.4233	18.2943	3.4146	11.3876	25.2010
28	10.8000	33.3000	18.8001	3.4090	11.9047	25.6955
29	3.6000	54.4000	17.7290	3.6499	10.3463	25.1117
30	18.1000	23.3500	19.8861	4.0206	11.7537	28.0185
31	42.9000	19.0700	23.5755	8.8735	5.6272	41.5238
32	1.9000	6.0800	17.4761	3.8235	9.7423	25.2099
33	4.0000	48.3000	17.7885	3.6148	10.4770	25.1001
34	0.4600	4.0533	17.2619	3.9983	9.1746	25.3491
35	1.5000	2.9867	17.4166	3.8697	9.5894	25.2438
36	1.8000	1.8400	17.4612	3.8349	9.7044	25.2180
37	6.8000	2.9700	18.2051	3.4363	11.2544	25.1557
38	1.4000	3.2100	17.4017	3.8815	9.5506	25.2528
39	0.6700	2.9400	17.2931	3.9713	9.2603	25.3259
40	0.9400	1.5200	17.3333	3.9374	9.3691	25.2975
41	0.1800	1.3900	17.2202	4.0349	9.0589	25.3816
42	0.2100	3.9267	17.2247	4.0309	9.0713	25.3780
43	0.5400	1.2767	17.2738	3.9880	9.2074	25.3402
44	0.0730	1.3100	17.2043	4.0491	9.0142	25.3944
45	0.0770	1.5500	17.2049	4.0486	9.0159	25.3939
46	8.4000	30.1000	18.4431	3.3921	11.5819	25.3042
47	2.0000	101.9000	17.4910	3.8123	9.7799	25.2021
48	1.1000	54.4500	17.3571	3.9177	9.4328	25.2814
49	39.2000	23.9000	23.0251	8.0486	6.7452	39.3049
50	34.7000	14.6000	22.3556	7.0703	8.0546	36.6566
51	5.5000	36.6667	18.0117	3.5039	10.9244	25.0989

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Predicted Values and Prediction Limits

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	6.0000	23.0667	18.0860	21.9613	-26.3348	62.5069
12	46.9000	10.9000	24.1706	23.7881	-23.9455	72.2866
13	1.2000	14.8900	17.3720	22.0335	-27.1951	61.9390
14	39.6000	16.6000	23.0846	23.1611	-23.7631	69.9323
15	4.1000	2.6000	17.8034	21.9825	-26.6604	62.2672
16	0.7100	11.6950	17.2991	22.0444	-27.2899	61.8881
17	5.1000	2.0767	17.9522	21.9701	-26.4866	62.3909
18	0.3500	2.7800	17.2455	22.0528	-27.3604	61.8514
19	3.6000	2.1100	17.7290	21.9897	-26.7493	62.2073
20	2.6000	1.9900	17.5802	22.0061	-26.9313	62.0917
21	0.6600	0.8900	17.2916	22.0455	-27.2997	61.8829
22	45.6000	31.1000	23.9772	23.6679	-23.8957	71.8501
23	4.5000	7.8000	17.8629	21.9772	-26.5902	62.3160
24	5.8000	36.8000	18.0563	21.9630	-26.3681	62.4807
25	6.8000	30.4000	18.2051	21.9552	-26.2036	62.6137
26	9.2000	36.8000	18.5621	21.9475	-25.8309	62.9551
27	7.4000	53.4233	18.2943	21.9518	-26.1075	62.6961
28	10.8000	33.3000	18.8001	21.9510	-25.5999	63.2002
29	3.6000	54.4000	17.7290	21.9897	-26.7493	62.2073
30	18.1000	23.3500	19.8861	22.0542	-24.7228	64.4950
31	42.9000	19.0700	23.5755	23.4299	-23.8160	70.9670
32	1.9000	6.0800	17.4761	22.0192	-27.0618	62.0141
33	4.0000	48.3000	17.7885	21.9839	-26.6781	62.2551
34	0.4600	4.0533	17.2619	22.0502	-27.3388	61.8626
35	1.5000	2.9867	17.4166	22.0272	-27.1377	61.9709
36	1.8000	1.8400	17.4612	22.0211	-27.0807	62.0032
37	6.8000	2.9700	18.2051	21.9552	-26.2036	62.6137
38	1.4000	3.2100	17.4017	22.0293	-27.1567	61.9602
39	0.6700	2.9400	17.2931	22.0453	-27.2977	61.8840
40	0.9400	1.5200	17.3333	22.0392	-27.2452	61.9118
41	0.1800	1.3900	17.2202	22.0568	-27.3940	61.8344
42	0.2100	3.9267	17.2247	22.0561	-27.3880	61.8374
43	0.5400	1.2767	17.2738	22.0483	-27.3231	61.8707
44	0.0730	1.3100	17.2043	22.0594	-27.4151	61.8238
45	0.0770	1.5500	17.2049	22.0593	-27.4143	61.8241
46	8.4000	30.1000	18.4431	21.9484	-25.9516	62.8378
47	2.0000	101.9000	17.4910	22.0172	-27.0430	62.0250
48	1.1000	54.4500	17.3571	22.0357	-27.2143	61.9285
49	39.2000	23.9000	23.0251	23.1302	-23.7601	69.8102
50	34.7000	14.6000	22.3556	22.8082	-23.7783	68.4895
51	5.5000	36.6667	18.0117	21.9659	-26.4186	62.4419

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Working-Hotelling Simultaneous Confidence Band

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	6.0000	23.0667	18.0860	3.4746	8.1838	27.9883
12	46.9000	10.9000	24.1706	9.7802	-3.7017	52.0429
13	1.2000	14.8900	17.3720	3.9055	6.2417	28.5022
14	39.6000	16.6000	23.0846	8.1370	-0.1048	46.2740
15	4.1000	2.6000	17.8034	3.6063	7.5258	28.0810
16	0.7100	11.6950	17.2991	3.9663	5.9957	28.6024
17	5.1000	2.0767	17.9522	3.5301	7.8919	28.0124
18	0.3500	2.7800	17.2455	4.0126	5.8102	28.6808
19	3.6000	2.1100	17.7290	3.6499	7.3271	28.1309
20	2.6000	1.9900	17.5802	3.7475	6.9003	28.2601
21	0.6600	0.8900	17.2916	3.9726	5.9702	28.6131
22	45.6000	31.1000	23.9772	9.4841	-3.0512	51.0055
23	4.5000	7.8000	17.8629	3.5740	7.6773	28.0484
24	5.8000	36.8000	18.0563	3.4858	8.1221	27.9905
25	6.8000	30.4000	18.2051	3.4363	8.4120	27.9981
26	9.2000	36.8000	18.5621	3.3866	8.9108	28.2134
27	7.4000	53.4233	18.2943	3.4146	8.5631	28.0255
28	10.8000	33.3000	18.8001	3.4090	9.0848	28.5154
29	3.6000	54.4000	17.7290	3.6499	7.3271	28.1309
30	18.1000	23.3500	19.8861	4.0206	8.4280	31.3442
31	42.9000	19.0700	23.5755	8.8735	-1.7127	48.8637
32	1.9000	6.0800	17.4761	3.8235	6.5795	28.3727
33	4.0000	48.3000	17.7885	3.6148	7.4869	28.0901
34	0.4600	4.0533	17.2619	3.9983	5.8673	28.6564
35	1.5000	2.9867	17.4166	3.8697	6.3885	28.4447
36	1.8000	1.8400	17.4612	3.8349	6.5323	28.3902
37	6.8000	2.9700	18.2051	3.4363	8.4120	27.9981
38	1.4000	3.2100	17.4017	3.8815	6.3399	28.4635
39	0.6700	2.9400	17.2931	3.9713	5.9753	28.6109
40	0.9400	1.5200	17.3333	3.9374	6.1121	28.5544
41	0.1800	1.3900	17.2202	4.0349	5.7213	28.7192
42	0.2100	3.9267	17.2247	4.0309	5.7370	28.7123
43	0.5400	1.2767	17.2738	3.9880	5.9086	28.6389
44	0.0730	1.3100	17.2043	4.0491	5.6648	28.7438
45	0.0770	1.5500	17.2049	4.0486	5.6670	28.7428
46	8.4000	30.1000	18.4431	3.3921	8.7761	28.1101
47	2.0000	101.9000	17.4910	3.8123	6.6264	28.3556
48	1.1000	54.4500	17.3571	3.9177	6.1921	28.5221
49	39.2000	23.9000	23.0251	8.0486	0.0876	45.9626
50	34.7000	14.6000	22.3556	7.0703	2.2063	42.5050
51	5.5000	36.6667	18.0117	3.5039	8.0261	27.9972

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Section

Row	Soil (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	6.0000	23.0667	18.0860	4.9806	0.2327	21.5923
12	46.9000	10.9000	24.1706	-13.2706	-0.6857	121.7484
13	1.2000	14.8900	17.3720	-2.4820	-0.1164	16.6687
14	39.6000	16.6000	23.0846	-6.4846	-0.3226	39.0637
15	4.1000	2.6000	17.8034	-15.2034	-0.7110	584.7457
16	0.7100	11.6950	17.2991	-5.6041	-0.2629	47.9185
17	5.1000	2.0767	17.9522	-15.8755	-0.7420	764.4697
18	0.3500	2.7800	17.2455	-14.4655	-0.6788	520.3423
19	3.6000	2.1100	17.7290	-15.6190	-0.7307	740.2372
20	2.6000	1.9900	17.5802	-15.5902	-0.7299	783.4291
21	0.6600	0.8900	17.2916	-16.4016	-0.7694	1842.8801
22	45.6000	31.1000	23.9772	7.1228	0.3653	22.9030
23	4.5000	7.8000	17.8629	-10.0629	-0.4705	129.0115
24	5.8000	36.8000	18.0563	18.7437	0.8758	50.9340
25	6.8000	30.4000	18.2051	12.1949	0.5696	40.1149
26	9.2000	36.8000	18.5621	18.2379	0.8515	49.5595
27	7.4000	53.4233	18.2943	35.1290	1.6405	65.7559
28	10.8000	33.3000	18.8001	14.4999	0.6771	43.5432
29	3.6000	54.4000	17.7290	36.6710	1.7156	67.4099
30	18.1000	23.3500	19.8861	3.4639	0.1626	14.8346
31	42.9000	19.0700	23.5755	-4.5055	-0.2277	23.6262
32	1.9000	6.0800	17.4761	-11.3961	-0.5339	187.4359
33	4.0000	48.3000	17.7885	30.5115	1.4270	63.1708
34	0.4600	4.0533	17.2619	-13.2085	-0.6197	325.8688
35	1.5000	2.9867	17.4166	-14.4299	-0.6763	483.1450
36	1.8000	1.8400	17.4612	-15.6212	-0.7319	848.9797
37	6.8000	2.9700	18.2051	-15.2351	-0.7116	512.9649
38	1.4000	3.2100	17.4017	-14.1917	-0.6652	442.1097
39	0.6700	2.9400	17.2931	-14.3531	-0.6733	488.2014
40	0.9400	1.5200	17.3333	-15.8133	-0.7416	1040.3479
41	0.1800	1.3900	17.2202	-15.8302	-0.7430	1138.8651
42	0.2100	3.9267	17.2247	-13.2980	-0.6241	338.6593
43	0.5400	1.2767	17.2738	-15.9971	-0.7505	1253.0377
44	0.0730	1.3100	17.2043	-15.8943	-0.7461	1213.3059
45	0.0770	1.5500	17.2049	-15.6549	-0.7349	1009.9937
46	8.4000	30.1000	18.4431	11.6569	0.5443	38.7273
47	2.0000	101.9000	17.4910	84.4090	3.9542	82.8352
48	1.1000	54.4500	17.3571	37.0929	1.7392	68.1229
49	39.2000	23.9000	23.0251	0.8749	0.0435	3.6608
50	34.7000	14.6000	22.3556	-7.7556	-0.3783	53.1207
51	5.5000	36.6667	18.0117	18.6550	0.8717	50.8773

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Residual Diagnostics Section

Row	Soil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	6.0000	4.9806	0.2298	0.0257	0.0007	481.9282
12	46.9000	-13.2706	*-0.6810	0.2034	0.0600	476.7803
13	1.2000	-2.4820	-0.1149	0.0324	0.0002	482.4307
14	39.6000	-6.4846	*-0.3189	0.1408	0.0085	481.3103
15	4.1000	-15.2034	-0.7064	0.0277	0.0072	476.3425
16	0.7100	-5.6041	-0.2597	0.0335	0.0012	481.7431
17	5.1000	-15.8755	-0.7377	0.0265	0.0075	475.7853
18	0.3500	-14.4655	-0.6740	0.0342	0.0082	476.8964
19	3.6000	-15.6190	-0.7263	0.0283	0.0078	475.9912
20	2.6000	-15.5902	-0.7255	0.0299	0.0082	476.0051
21	0.6600	-16.4016	-0.7653	0.0336	0.0103	475.2731
22	45.6000	7.1228	*0.3612	0.1913	0.0158	480.9473
23	4.5000	-10.0629	-0.4657	0.0272	0.0031	479.8590
24	5.8000	18.7437	0.8731	0.0258	0.0102	473.1075
25	6.8000	12.1949	0.5646	0.0251	0.0042	478.5838
26	9.2000	18.2379	0.8484	0.0244	0.0091	473.6262
27	7.4000	35.1290	1.6782	0.0248	0.0342	449.2975
28	10.8000	14.4999	0.6723	0.0247	0.0058	476.9252
29	3.6000	36.6710	1.7612	0.0283	0.0429	446.1779
30	18.1000	3.4639	0.1605	0.0344	0.0005	482.2712
31	42.9000	-4.5055	*-0.2249	0.1674	0.0052	481.9566
32	1.9000	-11.3961	-0.5290	0.0311	0.0046	479.0709
33	4.0000	30.5115	1.4469	0.0278	0.0291	457.3993
34	0.4600	-13.2085	-0.6148	0.0340	0.0068	477.8454
35	1.5000	-14.4299	-0.6715	0.0318	0.0075	476.9384
36	1.8000	-15.6212	-0.7275	0.0313	0.0086	475.9692
37	6.8000	-15.2351	-0.7070	0.0251	0.0065	476.3328
38	1.4000	-14.1917	-0.6604	0.0320	0.0073	477.1226
39	0.6700	-14.3531	-0.6685	0.0335	0.0079	476.9887
40	0.9400	-15.8133	-0.7372	0.0330	0.0094	475.7933
41	0.1800	-15.8302	-0.7387	0.0346	0.0099	475.7671
42	0.2100	-13.2980	-0.6192	0.0346	0.0070	477.7780
43	0.5400	-15.9971	-0.7462	0.0338	0.0099	475.6280
44	0.0730	-15.8943	-0.7418	0.0349	0.0101	475.7099
45	0.0770	-15.6549	-0.7304	0.0349	0.0098	475.9159
46	8.4000	11.6569	0.5393	0.0245	0.0037	478.9326
47	2.0000	84.4090	*5.0427	0.0309	0.2493	289.1213
48	1.1000	37.0929	1.7875	0.0326	0.0510	445.1690
49	39.2000	0.8749	*0.0429	0.1378	0.0002	482.5748
50	34.7000	-7.7556	*-0.3741	0.1063	0.0085	480.8270
51	5.5000	18.6550	0.8690	0.0261	0.0102	473.1945

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.2298	0.0373	0.0007	1.0781	0.0349	-0.0083
12	-0.6810	-0.3441	0.0600	* 1.2906	0.0785	-0.3228
13	-0.1149	-0.0210	0.0002	1.0879	-0.0210	0.0105
14	-0.3189	-0.1291	0.0085	* 1.2194	0.0199	-0.1174
15	-0.7064	-0.1191	0.0072	1.0554	-0.1159	0.0410
16	-0.2597	-0.0483	0.0012	1.0859	-0.0483	0.0252
17	-0.7377	-0.1217	0.0075	1.0517	-0.1164	0.0344
18	-0.6740	-0.1269	0.0082	1.0650	-0.1269	0.0681
19	-0.7263	-0.1240	0.0078	1.0546	-0.1215	0.0463
20	-0.7255	-0.1273	0.0082	1.0563	-0.1260	0.0545
21	-0.7653	-0.1426	0.0103	1.0571	-0.1425	0.0746
22	0.3612	0.1757	0.0158	* 1.2936	-0.0381	0.1641
23	-0.4657	-0.0778	0.0031	1.0705	-0.0752	0.0249
24	0.8731	0.1422	0.0102	1.0392	0.1338	-0.0337
25	0.5646	0.0906	0.0042	1.0626	0.0830	-0.0154
26	0.8484	0.1341	0.0091	1.0399	0.1119	0.0001
27	1.6782	0.2676	0.0342	0.9362	0.2403	-0.0342
28	0.6723	0.1070	0.0058	1.0548	0.0819	0.0123
29	1.7612	0.3007	0.0429	0.9266	0.2946	-0.1122
30	0.1605	0.0303	0.0005	1.0893	0.0123	0.0163
31	-0.2249	-0.1009	0.0052	* 1.2618	0.0193	-0.0932
32	-0.5290	-0.0948	0.0046	1.0713	-0.0943	0.0440
33	1.4469	0.2446	0.0291	0.9732	0.2384	-0.0855
34	-0.6148	-0.1153	0.0068	1.0690	-0.1153	0.0613
35	-0.6715	-0.1218	0.0075	1.0626	-0.1214	0.0589
36	-0.7275	-0.1307	0.0086	1.0577	-0.1301	0.0613
37	-0.7070	-0.1135	0.0065	1.0526	-0.1039	0.0192
38	-0.6604	-0.1201	0.0073	1.0636	-0.1198	0.0587
39	-0.6685	-0.1245	0.0079	1.0647	-0.1245	0.0650
40	-0.7372	-0.1361	0.0094	1.0587	-0.1360	0.0694
41	-0.7387	-0.1399	0.0099	1.0604	-0.1399	0.0760
42	-0.6192	-0.1171	0.0070	1.0693	-0.1171	0.0635
43	-0.7462	-0.1396	0.0099	1.0589	-0.1396	0.0737
44	-0.7418	-0.1410	0.0101	1.0604	-0.1410	0.0773
45	-0.7304	-0.1388	0.0098	1.0614	-0.1388	0.0761
46	0.5393	0.0854	0.0037	1.0634	0.0738	-0.0049
47	* 5.0427	0.9006	0.2493	0.3901	0.8955	-0.4136
48	1.7875	0.3283	0.0510	0.9265	0.3278	-0.1651
49	0.0429	0.0171	0.0002	* 1.2215	-0.0026	0.0156
50	-0.3741	-0.1290	0.0085	* 1.1700	0.0109	-0.1133
51	0.8690	0.1423	0.0102	1.0398	0.1349	-0.0365

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier Detection Chart

Row	Soil (X)	Residual		Standardized Residual		RStudent	
11	6.0000	4.9806	|.....	0.2327	|.....	0.2298	|.....
12	46.9000	-13.2706	||.....	-0.6857	||.....	-0.6810	|.....
13	1.2000	-2.4820	|.....	-0.1164	|.....	-0.1149	|.....
14	39.6000	-6.4846	|.....	-0.3226	|.....	-0.3189	|.....
15	4.1000	-15.2034	||.....	-0.7110	||.....	-0.7064	|.....
16	0.7100	-5.6041	|.....	-0.2629	|.....	-0.2597	|.....
17	5.1000	-15.8755	||.....	-0.7420	||.....	-0.7377	||.....
18	0.3500	-14.4655	||.....	-0.6788	||.....	-0.6740	|.....
19	3.6000	-15.6190	||.....	-0.7307	||.....	-0.7263	||.....
20	2.6000	-15.5902	||.....	-0.7299	||.....	-0.7255	||.....
21	0.6600	-16.4016	||.....	-0.7694	||.....	-0.7653	||.....
22	45.6000	7.1228	|.....	0.3653	|.....	0.3612	|.....
23	4.5000	-10.0629	|.....	-0.4705	|.....	-0.4657	|.....
24	5.8000	18.7437	|||.....	0.8758	|||.....	0.8731	||.....
25	6.8000	12.1949	||.....	0.5696	||.....	0.5646	|.....
26	9.2000	18.2379	|||.....	0.8515	|||.....	0.8484	||.....
27	7.4000	35.1290	||||||.....	1.6405	||||||.....	1.6782	||||.....
28	10.8000	14.4999	||.....	0.6771	||.....	0.6723	|.....
29	3.6000	36.6710	||||||.....	1.7156	||||||.....	1.7612	|||||.....
30	18.1000	3.4639	|.....	0.1626	|.....	0.1605	|.....
31	42.9000	-4.5055	|.....	-0.2277	|.....	-0.2249	|.....
32	1.9000	-11.3961	|.....	-0.5339	|.....	-0.5290	|.....
33	4.0000	30.5115	|||||.....	1.4270	|||||.....	1.4469	||||.....
34	0.4600	-13.2085	||.....	-0.6197	||.....	-0.6148	|.....
35	1.5000	-14.4299	||.....	-0.6763	||.....	-0.6715	|.....
36	1.8000	-15.6212	||.....	-0.7319	||.....	-0.7275	||.....
37	6.8000	-15.2351	||.....	-0.7116	||.....	-0.7070	|.....
38	1.4000	-14.1917	||.....	-0.6652	||.....	-0.6604	|.....
39	0.6700	-14.3531	||.....	-0.6733	||.....	-0.6685	|.....
40	0.9400	-15.8133	||.....	-0.7416	||.....	-0.7372	||.....
41	0.1800	-15.8302	||.....	-0.7430	||.....	-0.7387	||.....
42	0.2100	-13.2980	||.....	-0.6241	||.....	-0.6192	|.....
43	0.5400	-15.9971	||.....	-0.7505	||.....	-0.7462	||.....
44	0.0730	-15.8943	||.....	-0.7461	||.....	-0.7418	||.....
45	0.0770	-15.6549	||.....	-0.7349	||.....	-0.7304	||.....
46	8.4000	11.6569	|.....	0.5443	|.....	0.5393	|.....
47	2.0000	84.4090	||||||||||||||	3.9542	||||||||||||||	* 5.0427	||||||||||||||
48	1.1000	37.0929	||||||.....	1.7392	||||||.....	1.7875	|||||.....
49	39.2000	0.8749	|.....	0.0435	|.....	0.0429	|.....
50	34.7000	-7.7556	|.....	-0.3783	|.....	-0.3741	|.....
51	5.5000	18.6550	|||.....	0.8717	|||.....	0.8690	||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influence Detection Chart

Row	Soil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	6.0000	0.0373	|.....	0.0007	|.....	-0.0083	|.....
12	46.9000	-0.3441	|||||.....	0.0600	|||.....	-0.3228	|||||||||||....
13	1.2000	-0.0210	|.....	0.0002	|.....	0.0105	|.....
14	39.6000	-0.1291	|.....	0.0085	|.....	-0.1174	||||.....
15	4.1000	-0.1191	|.....	0.0072	|.....	0.0410	|.....
16	0.7100	-0.0483	|.....	0.0012	|.....	0.0252	|.....
17	5.1000	-0.1217	|.....	0.0075	|.....	0.0344	|.....
18	0.3500	-0.1269	|.....	0.0082	|.....	0.0681	||.....
19	3.6000	-0.1240	|.....	0.0078	|.....	0.0463	|.....
20	2.6000	-0.1273	|.....	0.0082	|.....	0.0545	|.....
21	0.6600	-0.1426	||.....	0.0103	|.....	0.0746	||.....
22	45.6000	0.1757	||.....	0.0158	|.....	0.1641	|||||.....
23	4.5000	-0.0778	|.....	0.0031	|.....	0.0249	|.....
24	5.8000	0.1422	||.....	0.0102	|.....	-0.0337	|.....
25	6.8000	0.0906	|.....	0.0042	|.....	-0.0154	|.....
26	9.2000	0.1341	|.....	0.0091	|.....	0.0001	|.....
27	7.4000	0.2676	||||.....	0.0342	||.....	-0.0342	|.....
28	10.8000	0.1070	|.....	0.0058	|.....	0.0123	|.....
29	3.6000	0.3007	||||.....	0.0429	||.....	-0.1122	||||.....
30	18.1000	0.0303	|.....	0.0005	|.....	0.0163	|.....
31	42.9000	-0.1009	|.....	0.0052	|.....	-0.0932	|||.....
32	1.9000	-0.0948	|.....	0.0046	|.....	0.0440	|.....
33	4.0000	0.2446	|||.....	0.0291	|.....	-0.0855	|||.....
34	0.4600	-0.1153	|.....	0.0068	|.....	0.0613	||.....
35	1.5000	-0.1218	|.....	0.0075	|.....	0.0589	||.....
36	1.8000	-0.1307	|.....	0.0086	|.....	0.0613	||.....
37	6.8000	-0.1135	|.....	0.0065	|.....	0.0192	|.....
38	1.4000	-0.1201	|.....	0.0073	|.....	0.0587	||.....
39	0.6700	-0.1245	|.....	0.0079	|.....	0.0650	||.....
40	0.9400	-0.1361	||.....	0.0094	|.....	0.0694	||.....
41	0.1800	-0.1399	||.....	0.0099	|.....	0.0760	||.....
42	0.2100	-0.1171	|.....	0.0070	|.....	0.0635	||.....
43	0.5400	-0.1396	||.....	0.0099	|.....	0.0737	||.....
44	0.0730	-0.1410	||.....	0.0101	|.....	0.0773	||.....
45	0.0770	-0.1388	||.....	0.0098	|.....	0.0761	||.....
46	8.4000	0.0854	|.....	0.0037	|.....	-0.0049	|.....
47	2.0000	0.9006	|||||||||||||||	0.2493	||||||||||||||	-0.4136	||||||||||||||
48	1.1000	0.3283	|||||.....	0.0510	|||.....	-0.1651	|||||.....
49	39.2000	0.0171	|.....	0.0002	|.....	0.0156	|.....
50	34.7000	-0.1290	|.....	0.0085	|.....	-0.1133	||||.....
51	5.5000	0.1423	||.....	0.0102	|.....	-0.0365	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Outlier & Influence Chart

Row	Soil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	6.0000	0.2298	|.....	0.0007	|.....	0.0257	|.....
12	46.9000	-0.6810	|.....	0.0600	|||.....	0.2034	||||||||||||||
13	1.2000	-0.1149	|.....	0.0002	|.....	0.0324	|.....
14	39.6000	-0.3189	|.....	0.0085	|.....	0.1408	||||||||.....
15	4.1000	-0.7064	|.....	0.0072	|.....	0.0277	|.....
16	0.7100	-0.2597	|.....	0.0012	|.....	0.0335	|.....
17	5.1000	-0.7377	||.....	0.0075	|.....	0.0265	|.....
18	0.3500	-0.6740	|.....	0.0082	|.....	0.0342	|.....
19	3.6000	-0.7263	||.....	0.0078	|.....	0.0283	|.....
20	2.6000	-0.7255	||.....	0.0082	|.....	0.0299	|.....
21	0.6600	-0.7653	||.....	0.0103	|.....	0.0336	|.....
22	45.6000	0.3612	|.....	0.0158	|.....	0.1913	||||||||||||..
23	4.5000	-0.4657	|.....	0.0031	|.....	0.0272	|.....
24	5.8000	0.8731	||.....	0.0102	|.....	0.0258	|.....
25	6.8000	0.5646	|.....	0.0042	|.....	0.0251	|.....
26	9.2000	0.8484	||.....	0.0091	|.....	0.0244	|.....
27	7.4000	1.6782	||||.....	0.0342	||.....	0.0248	|.....
28	10.8000	0.6723	|.....	0.0058	|.....	0.0247	|.....
29	3.6000	1.7612	|||||.....	0.0429	||.....	0.0283	|.....
30	18.1000	0.1605	|.....	0.0005	|.....	0.0344	|.....
31	42.9000	-0.2249	|.....	0.0052	|.....	0.1674	||||||||||....
32	1.9000	-0.5290	|.....	0.0046	|.....	0.0311	|.....
33	4.0000	1.4469	||||.....	0.0291	|.....	0.0278	|.....
34	0.4600	-0.6148	|.....	0.0068	|.....	0.0340	|.....
35	1.5000	-0.6715	|.....	0.0075	|.....	0.0318	|.....
36	1.8000	-0.7275	||.....	0.0086	|.....	0.0313	|.....
37	6.8000	-0.7070	|.....	0.0065	|.....	0.0251	|.....
38	1.4000	-0.6604	|.....	0.0073	|.....	0.0320	|.....
39	0.6700	-0.6685	|.....	0.0079	|.....	0.0335	|.....
40	0.9400	-0.7372	||.....	0.0094	|.....	0.0330	|.....
41	0.1800	-0.7387	||.....	0.0099	|.....	0.0346	|.....
42	0.2100	-0.6192	|.....	0.0070	|.....	0.0346	|.....
43	0.5400	-0.7462	||.....	0.0099	|.....	0.0338	|.....
44	0.0730	-0.7418	||.....	0.0101	|.....	0.0349	|.....
45	0.0770	-0.7304	||.....	0.0098	|.....	0.0349	|.....
46	8.4000	0.5393	|.....	0.0037	|.....	0.0245	|.....
47	2.0000	* 5.0427	|||||||||||||||	0.2493	||||||||||||||	0.0309	|.....
48	1.1000	1.7875	|||||.....	0.0510	|||.....	0.0326	|.....
49	39.2000	0.0429	|.....	0.0002	|.....	0.1378	||||||||.....
50	34.7000	-0.3741	|.....	0.0085	|.....	0.1063	|||||.....
51	5.5000	0.8690	||.....	0.0102	|.....	0.0261	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Means

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	23.0667	6.0000	39.4796	-33.4796	-4.4182	16.7173
12	10.9000	46.9000	-42.3043	89.2043	5.4116	23.3326
13	14.8900	1.2000	-15.4837	16.6837	-0.3983	23.7494
14	16.6000	39.6000	-3.9891	43.5891	-3.4061	24.4458
15	2.6000	4.1000	-98.0967	102.1967	-12.5847	52.5476
16	11.6950	0.7100	-36.9604	37.6704	9.0864	18.5832
17	2.0767	5.1000	-101.6145	106.7145	-13.5093	54.1796
18	2.7800	0.3500	-96.8867	97.2367	-12.2648	51.9844
19	2.1100	3.6000	-101.3904	104.9904	-13.4507	54.0759
20	1.9900	2.6000	-102.1971	104.7971	-13.6617	54.4491
21	0.8900	0.6600	-109.5912	110.2512	-15.5792	57.8535
22	31.1000	45.6000	93.4794	-47.8794	-23.2146	24.6553
23	7.8000	4.5000	-63.1424	67.6424	-2.6592	35.5935
24	36.8000	5.8000	131.7946	-125.9946	-41.2104	34.9467
25	30.4000	6.8000	88.7740	-81.9740	-20.8875	23.2743
26	36.8000	9.2000	131.7946	-122.5946	-41.2104	34.9467
27	53.4233	7.4000	243.5361	-236.1361	-90.9381	62.2053
28	33.3000	10.8000	108.2677	-97.4677	-30.3115	28.7786
29	54.4000	3.6000	250.1012	-246.5012	-93.8202	63.7673
30	23.3500	18.1000	41.3841	-23.2841	-3.9673	15.8833
31	19.0700	42.9000	12.6141	30.2859	-5.7052	23.4063
32	6.0800	1.9000	-74.7042	76.6042	-6.1547	41.4138
33	48.3000	4.0000	209.0972	-205.0972	-75.7767	53.9689
34	4.0533	0.4600	-88.3274	88.7874	-9.9690	47.9675
35	2.9867	1.5000	-95.4975	96.9975	-11.8961	51.3364
36	1.8400	1.8000	-103.2054	105.0054	-13.9249	54.9151
37	2.9700	6.8000	-95.6095	102.4095	-11.9259	51.3887
38	3.2100	1.4000	-93.9963	95.3963	-11.4962	50.6346
39	2.9400	0.6700	-95.8112	96.4812	-11.9795	51.4829
40	1.5200	0.9400	-105.3564	106.2964	-14.4846	55.9073
41	1.3900	0.1800	-106.2303	106.4103	-14.7112	56.3097
42	3.9267	0.2100	-89.1789	89.3889	-10.2002	48.3700
43	1.2767	0.5400	-106.9921	107.5321	-14.9085	56.6601
44	1.3100	0.0730	-106.7680	106.8410	-14.8505	56.5571
45	1.5500	0.0770	-105.1547	105.2317	-14.4322	55.8144
46	30.1000	8.4000	86.7574	-78.3574	-19.8759	22.6683
47	101.9000	2.0000	569.3946	-567.3946	-232.8999	138.6433
48	54.4500	1.1000	250.4373	-249.3373	-93.9677	63.8472
49	23.9000	39.2000	45.0812	-5.8812	-2.8198	13.9924
50	14.6000	34.7000	-17.4331	52.1331	0.2650	23.4780
51	36.6667	5.5000	130.8983	-125.3983	-40.8008	34.7173

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Soil

Inverse Prediction of X Individuals

Row	Mammal (Y)	Soil (X)	Predicted Soil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	23.0667	6.0000	39.4796	-33.4796	-87.9323	100.2313
12	10.9000	46.9000	-42.3043	89.2043	-78.6839	107.4281
13	14.8900	1.2000	-15.4837	16.6837	-82.5873	105.9384
14	16.6000	39.6000	-3.9891	43.5891	-83.9981	105.0378
15	2.6000	4.1000	-98.0967	102.1967	-67.6493	107.6122
16	11.6950	0.7100	-36.9604	37.6704	-79.5309	107.2005
17	2.0767	5.1000	-101.6145	106.7145	-66.8099	107.4802
18	2.7800	0.3500	-96.8867	97.2367	-67.9338	107.6534
19	2.1100	3.6000	-101.3904	104.9904	-66.8639	107.4891
20	1.9900	2.6000	-102.1971	104.7971	-66.6691	107.4565
21	0.8900	0.6600	-109.5912	110.2512	-64.8374	107.1116
22	31.1000	45.6000	93.4794	-47.8794	-89.6501	91.0908
23	7.8000	4.5000	-63.1424	67.6424	-75.0418	107.9761
24	36.8000	5.8000	131.7946	-125.9946	-88.5118	82.2480
25	30.4000	6.8000	88.7740	-81.9740	-89.6479	92.0347
26	36.8000	9.2000	131.7946	-122.5946	-88.5118	82.2480
27	53.4233	7.4000	243.5361	-236.1361	-67.9992	39.2664
28	33.3000	10.8000	108.2677	-97.4677	-89.4614	87.9285
29	54.4000	3.6000	250.1012	-246.5012	-65.3380	35.2851
30	23.3500	18.1000	41.3841	-23.2841	-88.0538	99.9698
31	19.0700	42.9000	12.6141	30.2859	-85.7622	103.4633
32	6.0800	1.9000	-74.7042	76.6042	-72.7807	108.0398
33	48.3000	4.0000	209.0972	-205.0972	-78.2183	56.4104
34	4.0533	0.4600	-88.3274	88.7874	-69.8857	107.8843
35	2.9867	1.5000	-95.4975	96.9975	-68.2578	107.6981
36	1.8400	1.8000	-103.2054	105.0054	-66.4242	107.4144
37	2.9700	6.8000	-95.6095	102.4095	-68.2318	107.6946
38	3.2100	1.4000	-93.9963	95.3963	-68.6047	107.7432
39	2.9400	0.6700	-95.8112	96.4812	-68.1849	107.6882
40	1.5200	0.9400	-105.3564	106.2964	-65.8967	107.3194
41	1.3900	0.1800	-106.2303	106.4103	-65.6803	107.2788
42	3.9267	0.2100	-89.1789	89.3889	-69.6963	107.8660
43	1.2767	0.5400	-106.9921	107.5321	-65.4908	107.2424
44	1.3100	0.0730	-106.7680	106.8410	-65.5466	107.2532
45	1.5500	0.0770	-105.1547	105.2317	-65.9464	107.3286
46	30.1000	8.4000	86.7574	-78.3574	-89.6379	92.4303
47	101.9000	2.0000	569.3946	-567.3946	-207.6630	113.4063
48	54.4500	1.1000	250.4373	-249.3373	-65.1933	35.0728
49	23.9000	39.2000	45.0812	-5.8812	-88.2772	99.4499
50	14.6000	34.7000	-17.4331	52.1331	-82.3326	106.0756
51	36.6667	5.5000	130.8983	-125.3983	-88.5634	82.4799

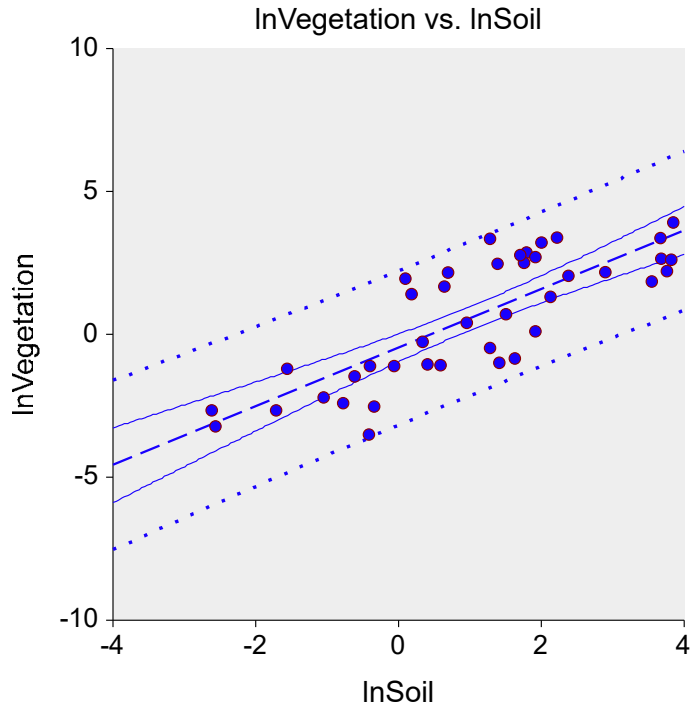
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Soil to Tissue Linear Regressions
ln Transformation – APL 10 Excluded

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnVegetation	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	-0.4733	Rows Prediction Only	0
Slope	1.0254	Sum of Frequencies	41
R-Squared	0.6468	Sum of Weights	41.0000
Correlation	0.8043	Coefficient of Variation	2.1555
Mean Square Error	1.727502	Square Root of MSE	1.314345

Linear Regression Report

Y = lnVegetation X = lnSoil

Summary Statement

The equation of the straight line relating lnVegetation and lnSoil is estimated as: lnVegetation = (-0.4733) + (1.0254) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnVegetation when lnSoil is zero, is -0.4733 with a standard error of 0.2420. The slope, the estimated change in lnVegetation per unit change in lnSoil, is 1.0254 with a standard error of 0.1213. The value of R-Squared, the proportion of the variation in lnVegetation that can be accounted for by variation in lnSoil, is 0.6468. The correlation between lnVegetation and lnSoil is 0.8043.

A significance test that the slope is zero resulted in a t-value of 8.4514. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 1.0254. The lower limit of the 95% confidence interval for the slope is 0.7800 and the upper limit is 1.2708. The estimated intercept is -0.4733. The lower limit of the 95% confidence interval for the intercept is -0.9627 and the upper limit is 0.0162.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnVegetation	lnSoil
Count	41	41
Mean	0.6098	1.0562
Standard Deviation	2.1838	1.7128
Minimum	-3.5066	-2.6173
Maximum	3.9140	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	-0.4733	1.0254
Lower 95% Confidence Limit	-0.9627	0.7800
Upper 95% Confidence Limit	0.0162	1.2708
Standard Error	0.2420	0.1213
Standardized Coefficient	0.0000	0.8043
T Value	-1.9558	8.4514
Prob Level (T Test)	0.0577	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.4792	1.0000
Regression of Y on X	-0.4733	1.0254
Inverse Regression from X on Y	-1.0646	1.5853
Orthogonal Regression of Y and X	-0.8167	1.3505

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(-0.473278702218619) + (1.02542063324731) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	-0.4733	0.9000	-0.8585	-0.1121
Bootstrap Mean	-0.4712	0.9500	-0.9386	-0.0403
Bias (BM - OV)	0.0021	0.9900	-1.0754	0.1058
Bias Corrected	-0.4754			
Standard Error	0.2286			
Slope				
Original Value	1.0254	0.9000	0.8685	1.1571
Bootstrap Mean	1.0323	0.9500	0.8323	1.1915
Bias (BM - OV)	0.0069	0.9900	0.7552	1.2547
Bias Corrected	1.0186			
Standard Error	0.0897			
Correlation				
Original Value	0.8043	0.9000	0.7400	0.8864
Bootstrap Mean	0.8021	0.9500	0.7289	0.9107
Bias (BM - OV)	-0.0021	0.9900	0.7085	0.9564
Bias Corrected	0.8064			
Standard Error	0.0459			
R-Squared				
Original Value	0.6468	0.9000	0.5393	0.7723
Bootstrap Mean	0.6455	0.9500	0.5199	0.8066
Bias (BM - OV)	-0.0013	0.9900	0.4836	0.8684
Bias Corrected	0.6481			
Standard Error	0.0723			
Standard Error of Estimate				
Original Value	1.3143	0.9000	1.1671	1.5273
Bootstrap Mean	1.2869	0.9500	1.1345	1.5652
Bias (BM - OV)	-0.0274	0.9900	1.0814	1.6500
Bias Corrected	1.3417			
Standard Error	0.1087			
Orthogonal Intercept				
Original Value	-0.8167	0.9000	-1.2068	-0.3463
Bootstrap Mean	-0.8354	0.9500	-1.2728	-0.2538
Bias (BM - OV)	-0.0187	0.9900	-1.4214	-0.0244
Bias Corrected	-0.7980			
Standard Error	0.2607			
Orthogonal Slope				
Original Value	1.3505	0.9000	1.0313	1.5466
Bootstrap Mean	1.3752	0.9500	0.9515	1.5793
Bias (BM - OV)	0.0247	0.9900	0.7699	1.6416
Bias Corrected	1.3259			
Standard Error	0.1589			

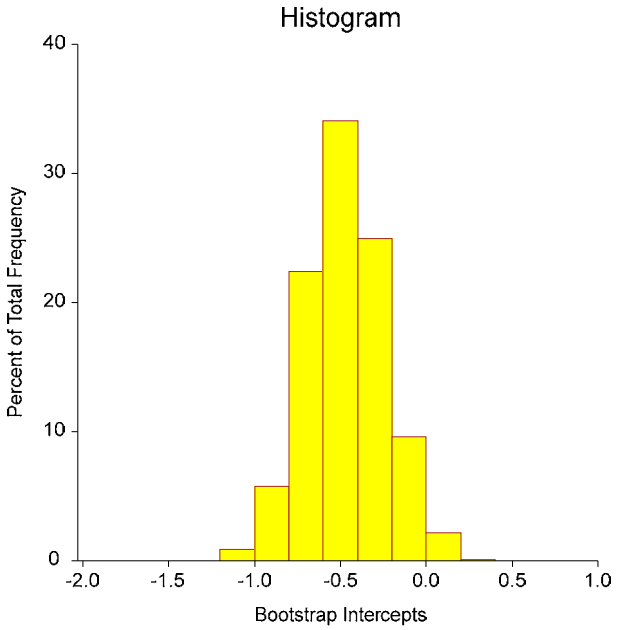
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

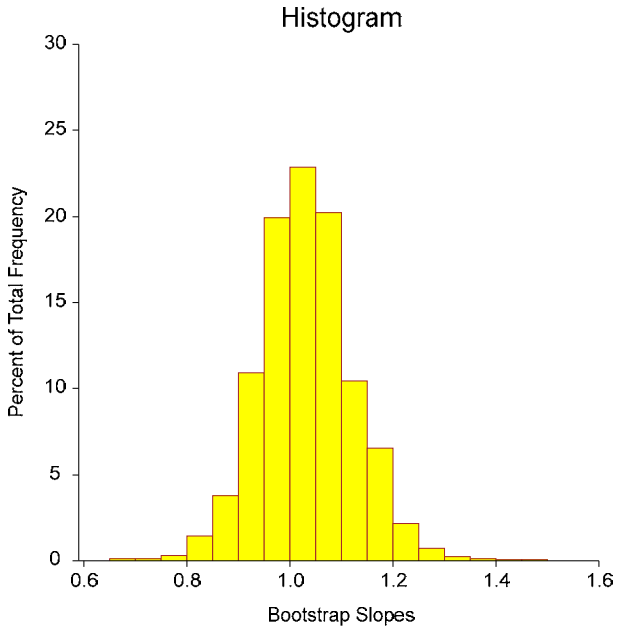
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

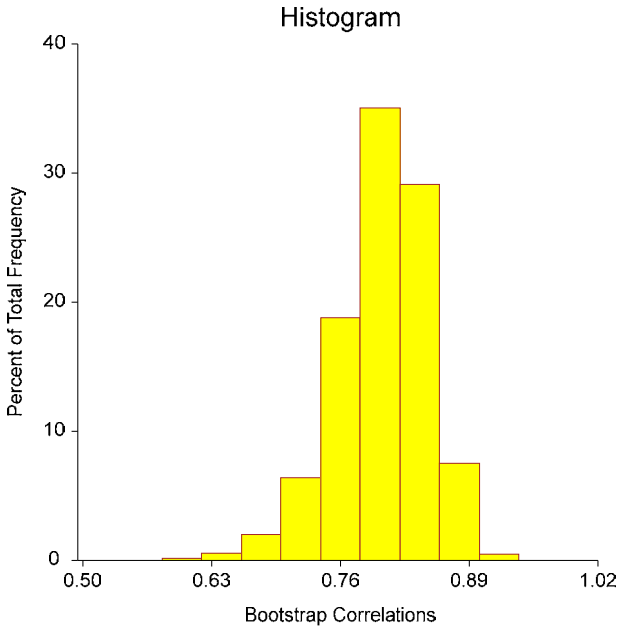
Linear Regression Report

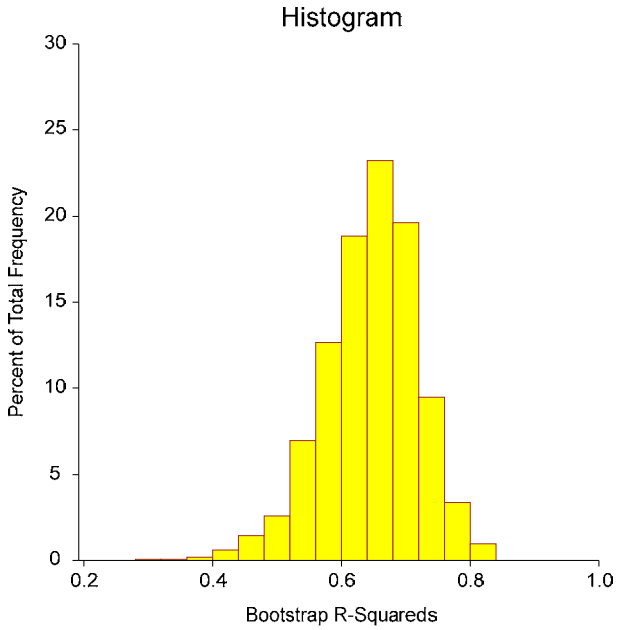
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Bootstrap Histograms Section



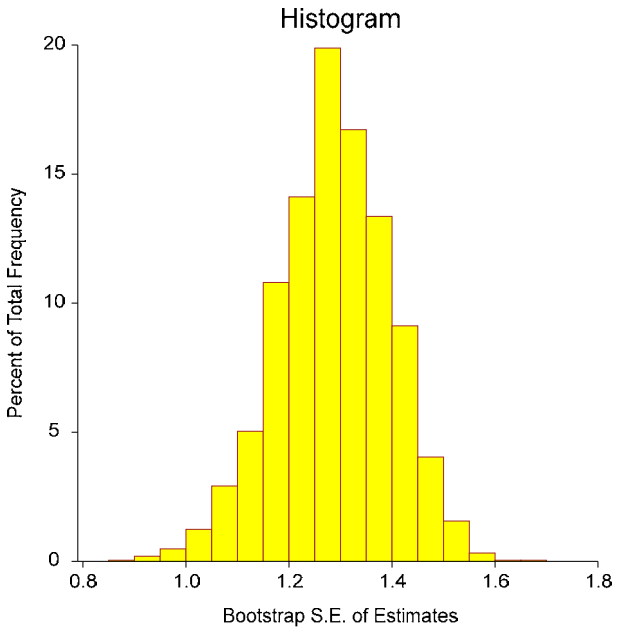


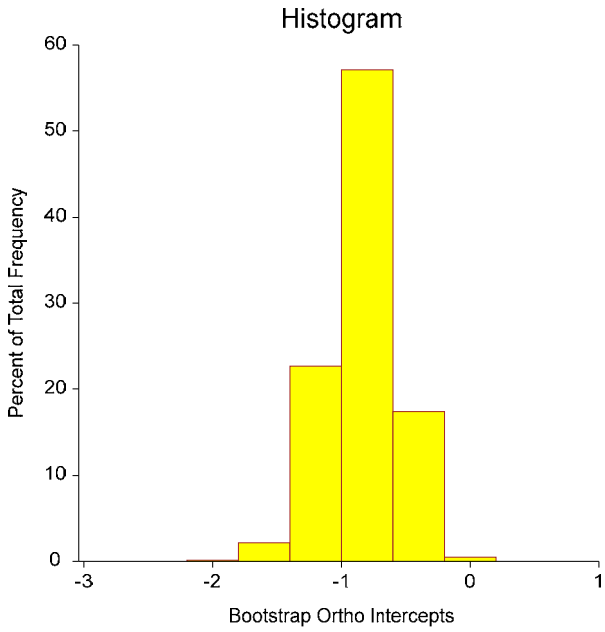


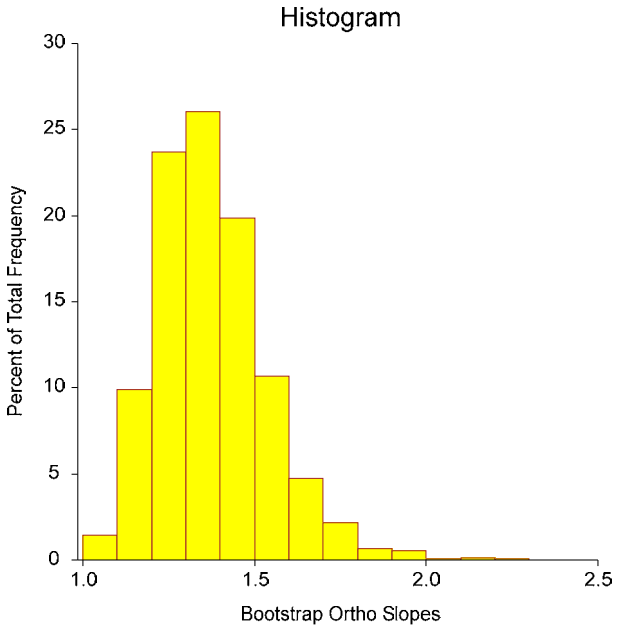


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8043	0.6468	0.8200
Lower 95% Conf. Limit (r dist'n)	0.6552		
Upper 95% Conf. Limit (r dist'n)	0.8887		
Lower 95% Conf. Limit (Fisher's z)	0.6599		0.6852
Upper 95% Conf. Limit (Fisher's z)	0.8914		0.9005
Adjusted (Rbar)		0.6378	
T-Value for H0: Rho = 0	8.4514	8.4514	8.9470
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	15.24484	15.24484			
Slope	1	123.3896	123.3896	71.4266	0.0000	1.0000
Error	39	67.37257	1.727502			
Lack of Fit	37	56.70074	1.532452	0.2872	0.9588	
Pure Error	2	10.67184	5.335918			
Adj. Total	40	190.7622	4.769054			
Total	41	206.007				

s = Square Root(1.727502) = 1.314345

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	25.00077	0.03389676	-0.009000641
1	43.30437	163.0859	146.7366	-0.009000641	0.008521686
2 (Y'Y)			206.007		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.05855672	-0.01554863
1	-0.01554863	0.01472123

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9642	0.219796	Yes
Anderson Darling	0.6197	0.106752	No
D'Agostino Skewness	0.4406	0.659494	Yes
D'Agostino Kurtosis	-1.5904	0.111756	No
D'Agostino Omnibus	2.7234	0.256230	Yes
Constant Residual Variance?			
Modified Levene Test	0.0030	0.956345	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2872	0.958842	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

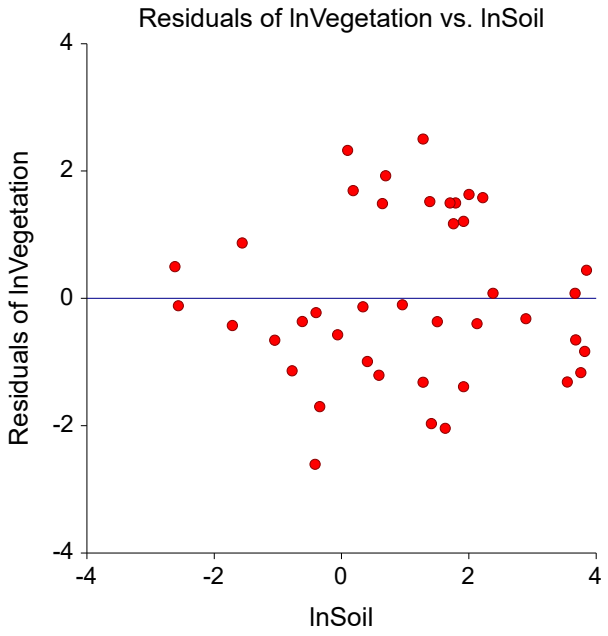
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

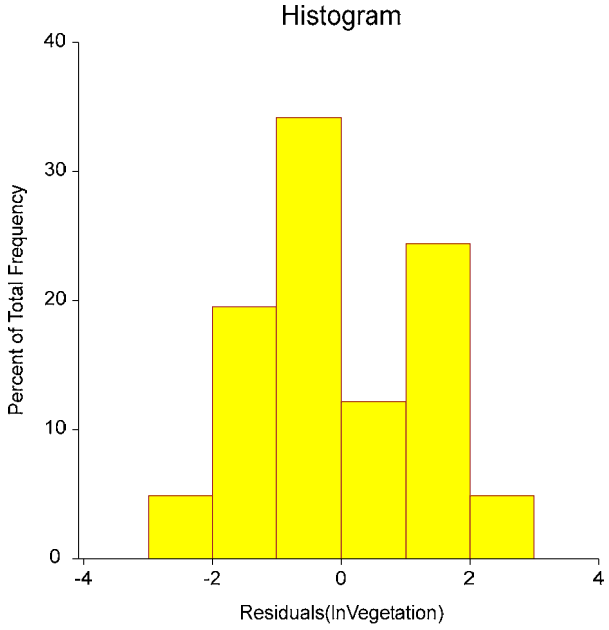
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

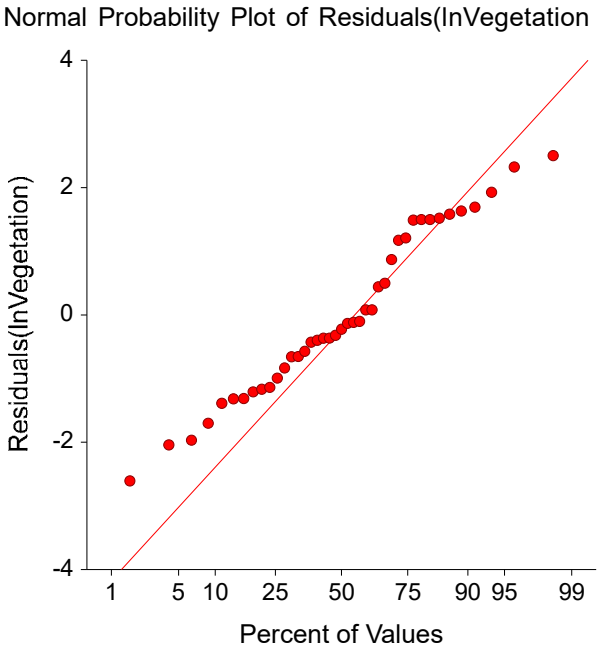
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Original Data Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual
11	1.7918	2.8622	1.3640	1.4982
12	3.8480	3.9140	3.4726	0.4415
13	0.1823	1.4061	-0.2863	1.6924
14	3.6788	2.6462	3.2991	-0.6529
15	1.4110	-0.9943	0.9736	-1.9678
16	-0.3425	-2.5257	-0.8245	-1.7013
17	1.6292	-0.8440	1.1974	-2.0413
18	-1.0498	-2.2073	-1.5498	-0.6575
19	1.2809	-0.4780	0.8402	-1.3183
20	0.9555	0.4055	0.5065	-0.1011
21	-0.4155	-3.5066	-0.8994	-2.6072
22	3.8199	2.6101	3.4437	-0.8337
23	1.5041	0.7031	1.0690	-0.3659
24	1.7579	2.5014	1.3293	1.1722
25	1.9169	2.7014	1.4924	1.2090
26	2.2192	3.3844	1.8023	1.5821
27	2.0015	3.2108	1.5791	1.6318
28	2.3795	2.0464	1.9668	0.0796
29	1.2809	3.3429	0.8402	2.5026
30	2.8959	2.1759	2.4962	-0.3204
31	3.7589	2.2138	3.3811	-1.1674
32	0.6419	1.6734	0.1849	1.4885
33	1.3863	2.4681	0.9483	1.5198
34	-0.7765	-2.4079	-1.2695	-1.1384
35	0.4055	-1.0498	-0.0575	-0.9923
36	0.5878	-1.0788	0.1294	-1.2083
37	1.9169	0.1044	1.4924	-1.3880
38	0.3365	-0.2614	-0.1283	-0.1331
39	-0.4005	-1.1087	-0.8839	-0.2247
40	-0.0619	-1.1087	-0.5367	-0.5719
41	-1.7148	-2.6593	-2.2317	-0.4276
42	-1.5606	-1.2040	-2.0736	0.8696
43	-0.6162	-1.4697	-1.1051	-0.3645
44	-2.6173	-2.6593	-3.1571	0.4978
45	-2.5639	-3.2189	-3.1024	-0.1165
46	2.1282	1.3110	1.7091	-0.3980
47	0.6931	2.1633	0.2375	1.9258
48	0.0953	1.9488	-0.3755	2.3243
49	3.6687	3.3673	3.2887	0.0786
50	3.5467	1.8500	3.1636	-1.3136
51	1.7047	2.7726	1.2748	1.4978

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	2.8622	1.3640	0.2238	0.9113	1.8168
12	3.8480	3.9140	3.4726	0.3961	2.6714	4.2737
13	0.1823	1.4061	-0.2863	0.2310	-0.7536	0.1810
14	3.6788	2.6462	3.2991	0.3787	2.5331	4.0650
15	1.4110	-0.9943	0.9736	0.2097	0.5494	1.3978
16	-0.3425	-2.5257	-0.8245	0.2663	-1.3632	-0.2858
17	1.6292	-0.8440	1.1974	0.2167	0.7590	1.6357
18	-1.0498	-2.2073	-1.5498	0.3278	-2.2127	-0.8868
19	1.2809	-0.4780	0.8402	0.2071	0.4214	1.2591
20	0.9555	0.4055	0.5065	0.2056	0.0906	0.9224
21	-0.4155	-3.5066	-0.8994	0.2721	-1.4497	-0.3491
22	3.8199	2.6101	3.4437	0.3932	2.6485	4.2390
23	1.5041	0.7031	1.0690	0.2123	0.6395	1.4985
24	1.7579	2.5014	1.3293	0.2222	0.8798	1.7787
25	1.9169	2.7014	1.4924	0.2303	1.0265	1.9582
26	2.2192	3.3844	1.8023	0.2491	1.2985	2.3062
27	2.0015	3.2108	1.5791	0.2351	1.1035	2.0547
28	2.3795	2.0464	1.9668	0.2606	1.4396	2.4939
29	1.2809	3.3429	0.8402	0.2071	0.4214	1.2591
30	2.8959	2.1759	2.4962	0.3032	1.8829	3.1096
31	3.7589	2.2138	3.3811	0.3869	2.5986	4.1637
32	0.6419	1.6734	0.1849	0.2113	-0.2426	0.6124
33	1.3863	2.4681	0.9483	0.2091	0.5252	1.3713
34	-0.7765	-2.4079	-1.2695	0.3026	-1.8817	-0.6574
35	0.4055	-1.0498	-0.0575	0.2199	-0.5024	0.3873
36	0.5878	-1.0788	0.1294	0.2130	-0.3014	0.5603
37	1.9169	0.1044	1.4924	0.2303	1.0265	1.9582
38	0.3365	-0.2614	-0.1283	0.2231	-0.5795	0.3229
39	-0.4005	-1.1087	-0.8839	0.2709	-1.4318	-0.3360
40	-0.0619	-1.1087	-0.5367	0.2460	-1.0344	-0.0391
41	-1.7148	-2.6593	-2.2317	0.3939	-3.0284	-1.4349
42	-1.5606	-1.2040	-2.0736	0.3781	-2.8383	-1.3089
43	-0.6162	-1.4697	-1.1051	0.2886	-1.6889	-0.5213
44	-2.6173	-2.6593	-3.1571	0.4907	-4.1497	-2.1646
45	-2.5639	-3.2189	-3.1024	0.4848	-4.0831	-2.1217
46	2.1282	1.3110	1.7091	0.2430	1.2175	2.2006
47	0.6931	2.1633	0.2375	0.2099	-0.1872	0.6621
48	0.0953	1.9488	-0.3755	0.2361	-0.8530	0.1019
49	3.6687	3.3673	3.2887	0.3776	2.5248	4.0525
50	3.5467	1.8500	3.1636	0.3653	2.4247	3.9025
51	1.7047	2.7726	1.2748	0.2198	0.8302	1.7195

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	2.8622	1.3640	1.3333	-1.3328	4.0608
12	3.8480	3.9140	3.4726	1.3727	0.6960	6.2492
13	0.1823	1.4061	-0.2863	1.3345	-2.9856	2.4129
14	3.6788	2.6462	3.2991	1.3678	0.5324	6.0657
15	1.4110	-0.9943	0.9736	1.3310	-1.7186	3.6657
16	-0.3425	-2.5257	-0.8245	1.3411	-3.5370	1.8881
17	1.6292	-0.8440	1.1974	1.3321	-1.4970	3.8918
18	-1.0498	-2.2073	-1.5498	1.3546	-4.2897	1.1901
19	1.2809	-0.4780	0.8402	1.3306	-1.8511	3.5315
20	0.9555	0.4055	0.5065	1.3303	-2.1843	3.1974
21	-0.4155	-3.5066	-0.8994	1.3422	-3.6142	1.8155
22	3.8199	2.6101	3.4437	1.3719	0.6688	6.2186
23	1.5041	0.7031	1.0690	1.3314	-1.6239	3.7620
24	1.7579	2.5014	1.3293	1.3330	-1.3670	4.0255
25	1.9169	2.7014	1.4924	1.3344	-1.2066	4.1914
26	2.2192	3.3844	1.8023	1.3377	-0.9035	4.5082
27	2.0015	3.2108	1.5791	1.3352	-1.1216	4.2798
28	2.3795	2.0464	1.9668	1.3399	-0.7435	4.6770
29	1.2809	3.3429	0.8402	1.3306	-1.8511	3.5315
30	2.8959	2.1759	2.4962	1.3489	-0.2321	5.2246
31	3.7589	2.2138	3.3811	1.3701	0.6099	6.1524
32	0.6419	1.6734	0.1849	1.3312	-2.5078	2.8776
33	1.3863	2.4681	0.9483	1.3309	-1.7437	3.6402
34	-0.7765	-2.4079	-1.2695	1.3487	-3.9976	1.4585
35	0.4055	-1.0498	-0.0575	1.3326	-2.7530	2.6380
36	0.5878	-1.0788	0.1294	1.3315	-2.5637	2.8226
37	1.9169	0.1044	1.4924	1.3344	-1.2066	4.1914
38	0.3365	-0.2614	-0.1283	1.3331	-2.8248	2.5683
39	-0.4005	-1.1087	-0.8839	1.3420	-3.5983	1.8304
40	-0.0619	-1.1087	-0.5367	1.3372	-3.2414	2.1680
41	-1.7148	-2.6593	-2.2317	1.3721	-5.0070	0.5437
42	-1.5606	-1.2040	-2.0736	1.3676	-4.8399	0.6927
43	-0.6162	-1.4697	-1.1051	1.3457	-3.8270	1.6167
44	-2.6173	-2.6593	-3.1571	1.4030	-5.9949	-0.3194
45	-2.5639	-3.2189	-3.1024	1.4009	-5.9360	-0.2688
46	2.1282	1.3110	1.7091	1.3366	-0.9945	4.4126
47	0.6931	2.1633	0.2375	1.3310	-2.4547	2.9297
48	0.0953	1.9488	-0.3755	1.3354	-3.0766	2.3255
49	3.6687	3.3673	3.2887	1.3675	0.5226	6.0547
50	3.5467	1.8500	3.1636	1.3642	0.4043	5.9229
51	1.7047	2.7726	1.2748	1.3326	-1.4206	3.9702

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	2.8622	1.3640	0.2238	0.7261	2.0019
12	3.8480	3.9140	3.4726	0.3961	2.3438	4.6013
13	0.1823	1.4061	-0.2863	0.2310	-0.9447	0.3721
14	3.6788	2.6462	3.2991	0.3787	2.2199	4.3782
15	1.4110	-0.9943	0.9736	0.2097	0.3759	1.5713
16	-0.3425	-2.5257	-0.8245	0.2663	-1.5835	-0.0655
17	1.6292	-0.8440	1.1974	0.2167	0.5797	1.8150
18	-1.0498	-2.2073	-1.5498	0.3278	-2.4839	-0.6157
19	1.2809	-0.4780	0.8402	0.2071	0.2501	1.4303
20	0.9555	0.4055	0.5065	0.2056	-0.0795	1.0925
21	-0.4155	-3.5066	-0.8994	0.2721	-1.6747	-0.1240
22	3.8199	2.6101	3.4437	0.3932	2.3233	4.5642
23	1.5041	0.7031	1.0690	0.2123	0.4639	1.6742
24	1.7579	2.5014	1.3293	0.2222	0.6960	1.9626
25	1.9169	2.7014	1.4924	0.2303	0.8360	2.1487
26	2.2192	3.3844	1.8023	0.2491	1.0925	2.5122
27	2.0015	3.2108	1.5791	0.2351	0.9090	2.2492
28	2.3795	2.0464	1.9668	0.2606	1.2241	2.7094
29	1.2809	3.3429	0.8402	0.2071	0.2501	1.4303
30	2.8959	2.1759	2.4962	0.3032	1.6320	3.3605
31	3.7589	2.2138	3.3811	0.3869	2.2786	4.4837
32	0.6419	1.6734	0.1849	0.2113	-0.4174	0.7872
33	1.3863	2.4681	0.9483	0.2091	0.3522	1.5443
34	-0.7765	-2.4079	-1.2695	0.3026	-2.1320	-0.4071
35	0.4055	-1.0498	-0.0575	0.2199	-0.6843	0.5693
36	0.5878	-1.0788	0.1294	0.2130	-0.4775	0.7364
37	1.9169	0.1044	1.4924	0.2303	0.8360	2.1487
38	0.3365	-0.2614	-0.1283	0.2231	-0.7640	0.5075
39	-0.4005	-1.1087	-0.8839	0.2709	-1.6559	-0.1120
40	-0.0619	-1.1087	-0.5367	0.2460	-1.2379	0.1645
41	-1.7148	-2.6593	-2.2317	0.3939	-3.3543	-1.1091
42	-1.5606	-1.2040	-2.0736	0.3781	-3.1511	-0.9961
43	-0.6162	-1.4697	-1.1051	0.2886	-1.9277	-0.2826
44	-2.6173	-2.6593	-3.1571	0.4907	-4.5556	-1.7587
45	-2.5639	-3.2189	-3.1024	0.4848	-4.4841	-1.7207
46	2.1282	1.3110	1.7091	0.2430	1.0165	2.4016
47	0.6931	2.1633	0.2375	0.2099	-0.3608	0.8358
48	0.0953	1.9488	-0.3755	0.2361	-1.0483	0.2972
49	3.6687	3.3673	3.2887	0.3776	2.2125	4.3649
50	3.5467	1.8500	3.1636	0.3653	2.1226	4.2047
51	1.7047	2.7726	1.2748	0.2198	0.6483	1.9013

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Section

Row	lnSoil (X)	lnVegetation (Y)	Predicted lnVegetation (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	2.8622	1.3640	1.4982	1.1568	52.3434
12	3.8480	3.9140	3.4726	0.4415	0.3523	11.2790
13	0.1823	1.4061	-0.2863	1.6924	1.3080	120.3629
14	3.6788	2.6462	3.2991	-0.6529	-0.5187	24.6731
15	1.4110	-0.9943	0.9736	-1.9678	-1.5166	197.9205
16	-0.3425	-2.5257	-0.8245	-1.7013	-1.3218	67.3569
17	1.6292	-0.8440	1.1974	-2.0413	-1.5747	241.8745
18	-1.0498	-2.2073	-1.5498	-0.6575	-0.5166	29.7873
19	1.2809	-0.4780	0.8402	-1.3183	-1.0157	275.7645
20	0.9555	0.4055	0.5065	-0.1011	-0.0778	24.9238
21	-0.4155	-3.5066	-0.8994	-2.6072	-2.0276	74.3521
22	3.8199	2.6101	3.4437	-0.8337	-0.6647	31.9403
23	1.5041	0.7031	1.0690	-0.3659	-0.2821	52.0462
24	1.7579	2.5014	1.3293	1.1722	0.9049	46.8599
25	1.9169	2.7014	1.4924	1.2090	0.9343	44.7548
26	2.2192	3.3844	1.8023	1.5821	1.2259	46.7456
27	2.0015	3.2108	1.5791	1.6318	1.2619	50.8204
28	2.3795	2.0464	1.9668	0.0796	0.0618	3.8919
29	1.2809	3.3429	0.8402	2.5026	1.9282	74.8653
30	2.8959	2.1759	2.4962	-0.3204	-0.2505	14.7233
31	3.7589	2.2138	3.3811	-1.1674	-0.9294	52.7336
32	0.6419	1.6734	0.1849	1.4885	1.1474	88.9508
33	1.3863	2.4681	0.9483	1.5198	1.1713	61.5795
34	-0.7765	-2.4079	-1.2695	-1.1384	-0.8900	47.2767
35	0.4055	-1.0498	-0.0575	-0.9923	-0.7658	94.5223
36	0.5878	-1.0788	0.1294	-1.2083	-0.9316	111.9993
37	1.9169	0.1044	1.4924	-1.3880	-1.0726	1330.0240
38	0.3365	-0.2614	-0.1283	-0.1331	-0.1028	50.9294
39	-0.4005	-1.1087	-0.8839	-0.2247	-0.1747	20.2700
40	-0.0619	-1.1087	-0.5367	-0.5719	-0.4430	51.5879
41	-1.7148	-2.6593	-2.2317	-0.4276	-0.3410	16.0793
42	-1.5606	-1.2040	-2.0736	0.8696	0.6908	72.2297
43	-0.6162	-1.4697	-1.1051	-0.3645	-0.2843	24.8046
44	-2.6173	-2.6593	-3.1571	0.4978	0.4083	18.7213
45	-2.5639	-3.2189	-3.1024	-0.1165	-0.0953	3.6183
46	2.1282	1.3110	1.7091	-0.3980	-0.3081	30.3595
47	0.6931	2.1633	0.2375	1.9258	1.4843	89.0220
48	0.0953	1.9488	-0.3755	2.3243	1.7976	119.2710
49	3.6687	3.3673	3.2887	0.0786	0.0625	2.3353
50	3.5467	1.8500	3.1636	-1.3136	-1.0404	71.0039
51	1.7047	2.7726	1.2748	1.4978	1.1558	54.0211

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	1.4982	1.1619	0.0290	0.0200	1.7121
12	3.8480	0.4415	0.3483	0.0908	0.0062	1.7673
13	0.1823	1.6924	1.3204	0.0309	0.0273	1.6952
14	3.6788	-0.6529	-0.5138	0.0830	0.0122	1.7607
15	1.4110	-1.9678	-1.5433	0.0255	0.0300	1.6684
16	-0.3425	-1.7013	-1.3350	0.0411	0.0374	1.6935
17	1.6292	-2.0413	-1.6063	0.0272	0.0347	1.6602
18	-1.0498	-0.6575	-0.5116	0.0622	0.0088	1.7608
19	1.2809	-1.3183	-1.0161	0.0248	0.0131	1.7261
20	0.9555	-0.1011	-0.0768	0.0245	0.0001	1.7727
21	-0.4155	-2.6072	*-2.1160	0.0428	0.0920	1.5861
22	3.8199	-0.8337	-0.6599	0.0895	0.0217	1.7529
23	1.5041	-0.3659	-0.2788	0.0261	0.0011	1.7693
24	1.7579	1.1722	0.9027	0.0286	0.0120	1.7357
25	1.9169	1.2090	0.9327	0.0307	0.0138	1.7333
26	2.2192	1.5821	1.2341	0.0359	0.0280	1.7046
27	2.0015	1.6318	1.2718	0.0320	0.0263	1.7006
28	2.3795	0.0796	0.0610	0.0393	0.0001	1.7728
29	1.2809	2.5026	*2.0011	0.0248	0.0473	1.6039
30	2.8959	-0.3204	-0.2475	0.0532	0.0018	1.7701
31	3.7589	-1.1674	-0.9277	0.0866	0.0410	1.7337
32	0.6419	1.4885	1.1522	0.0259	0.0175	1.7131
33	1.3863	1.5198	1.1770	0.0253	0.0178	1.7106
34	-0.7765	-1.1384	-0.8876	0.0530	0.0222	1.7369
35	0.4055	-0.9923	-0.7617	0.0280	0.0084	1.7463
36	0.5878	-1.2083	-0.9300	0.0263	0.0117	1.7335
37	1.9169	-1.3880	-1.0748	0.0307	0.0182	1.7207
38	0.3365	-0.1331	-0.1015	0.0288	0.0002	1.7725
39	-0.4005	-0.2247	-0.1725	0.0425	0.0007	1.7716
40	-0.0619	-0.5719	-0.4384	0.0350	0.0036	1.7640
41	-1.7148	-0.4276	-0.3371	0.0898	0.0057	1.7677
42	-1.5606	0.8696	0.6861	0.0827	0.0215	1.7513
43	-0.6162	-0.3645	-0.2809	0.0482	0.0020	1.7693
44	-2.6173	0.4978	*0.4039	0.1394	0.0135	1.7654
45	-2.5639	-0.1165	*-0.0941	0.1361	0.0007	1.7725
46	2.1282	-0.3980	-0.3045	0.0342	0.0017	1.7686
47	0.6931	1.9258	1.5084	0.0255	0.0288	1.6728
48	0.0953	2.3243	1.8529	0.0323	0.0539	1.6261
49	3.6687	0.0786	0.0617	0.0826	0.0002	1.7728
50	3.5467	-1.3136	-1.0416	0.0772	0.0453	1.7238
51	1.7047	1.4978	1.1610	0.0280	0.0192	1.7122

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	1.1619	0.2008	0.0200	1.0116	0.1138	0.0801
12	0.3483	0.1101	0.0062	* 1.1512	-0.0015	0.0941
13	1.3204	0.2358	0.0273	0.9936	0.2350	-0.1082
14	-0.5138	-0.1546	0.0122	1.1329	-0.0023	-0.1299
15	-1.5433	-0.2495	0.0300	0.9571	-0.1800	-0.0512
16	-1.3350	-0.2762	0.0374	1.0022	-0.2738	0.1760
17	-1.6063	-0.2685	0.0347	0.9495	-0.1701	-0.0861
18	-0.5116	-0.1318	0.0088	1.1079	-0.1244	0.1027
19	-1.0161	-0.1621	0.0131	1.0237	-0.1250	-0.0213
20	-0.0768	-0.0122	0.0001	1.0794	-0.0107	0.0007
21	* -2.1160	-0.4477	0.0920	0.8807	-0.4421	0.2938
22	-0.6599	-0.2069	0.0217	1.1308	0.0018	-0.1764
23	-0.2788	-0.0456	0.0011	1.0771	-0.0312	-0.0117
24	0.9027	0.1549	0.0120	1.0393	0.0899	0.0593
25	0.9327	0.1660	0.0138	1.0386	0.0856	0.0753
26	1.2341	0.2382	0.0280	1.0100	0.0950	0.1349
27	1.2718	0.2313	0.0263	1.0011	0.1115	0.1128
28	0.0610	0.0123	0.0001	1.0962	0.0042	0.0076
29	* 2.0011	0.3192	0.0473	0.8840	0.2462	0.0420
30	-0.2475	-0.0587	0.0018	1.1090	-0.0108	-0.0432
31	-0.9277	-0.2857	0.0410	1.1027	-0.0003	-0.2422
32	1.1522	0.1877	0.0175	1.0095	0.1783	-0.0447
33	1.1770	0.1897	0.0178	1.0060	0.1387	0.0363
34	-0.8876	-0.2100	0.0222	1.0676	-0.2026	0.1543
35	-0.7617	-0.1293	0.0084	1.0513	-0.1269	0.0464
36	-0.9300	-0.1527	0.0117	1.0341	-0.1464	0.0408
37	-1.0748	-0.1913	0.0182	1.0235	-0.0987	-0.0867
38	-0.1015	-0.0175	0.0002	1.0840	-0.0173	0.0068
39	-0.1725	-0.0363	0.0007	1.0983	-0.0359	0.0237
40	-0.4384	-0.0835	0.0036	1.0806	-0.0835	0.0461
41	-0.3371	-0.1059	0.0057	* 1.1504	-0.0947	0.0904
42	0.6861	0.2061	0.0215	1.1204	0.1866	-0.1731
43	-0.2809	-0.0632	0.0020	1.1021	-0.0617	0.0445
44	0.4039	0.1625	0.0135	* 1.2135	0.1359	-0.1476
45	-0.0941	-0.0374	0.0007	* 1.2187	-0.0313	0.0338
46	-0.3045	-0.0573	0.0017	1.0853	-0.0248	-0.0307
47	1.5084	0.2441	0.0288	0.9622	0.2295	-0.0512
48	1.8529	0.3383	0.0539	0.9155	0.3380	-0.1671
49	0.0617	0.0185	0.0002	* 1.1479	0.0003	0.0155
50	-1.0416	-0.3014	0.0453	1.0790	-0.0116	-0.2493
51	1.1610	0.1970	0.0192	1.0107	0.1187	0.0705

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	1.4982	||||||||.....	1.1568	||||||||.....	1.1619	||||||||.....
12	3.8480	0.4415	||.....	0.3523	||.....	0.3483	||.....
13	0.1823	1.6924	||||||||.....	1.3080	||||||||.....	1.3204	||||||||.....
14	3.6788	-0.6529	|||.....	-0.5187	|||.....	-0.5138	|||.....
15	1.4110	-1.9678	||||||||||....	-1.5166	||||||||||....	-1.5433	|||||||||.....
16	-0.3425	-1.7013	||||||||.....	-1.3218	||||||||.....	-1.3350	||||||||.....
17	1.6292	-2.0413	||||||||||....	-1.5747	||||||||||....	-1.6063	||||||||||....
18	-1.0498	-0.6575	|||.....	-0.5166	|||.....	-0.5116	|||.....
19	1.2809	-1.3183	|||||||.....	-1.0157	|||||||.....	-1.0161	||||||.....
20	0.9555	-0.1011	|.....	-0.0778	|.....	-0.0768	|.....
21	-0.4155	-2.6072	||||||||||||||	-2.0276	||||||||||||||	* -2.1160	||||||||||||||
22	3.8199	-0.8337	||||.....	-0.6647	||||.....	-0.6599	||||.....
23	1.5041	-0.3659	|.....	-0.2821	|.....	-0.2788	|.....
24	1.7579	1.1722	||||||.....	0.9049	||||||.....	0.9027	||||||.....
25	1.9169	1.2090	||||||.....	0.9343	||||||.....	0.9327	||||||.....
26	2.2192	1.5821	|||||||.....	1.2259	|||||||.....	1.2341	|||||||.....
27	2.0015	1.6318	||||||||.....	1.2619	||||||||.....	1.2718	|||||||.....
28	2.3795	0.0796	|.....	0.0618	|.....	0.0610	|.....
29	1.2809	2.5026	|||||||||||||.	1.9282	|||||||||||||.	* 2.0011	|||||||||||||.
30	2.8959	-0.3204	|.....	-0.2505	|.....	-0.2475	|.....
31	3.7589	-1.1674	||||||.....	-0.9294	||||||.....	-0.9277	||||||.....
32	0.6419	1.4885	|||||||.....	1.1474	|||||||.....	1.1522	|||||||.....
33	1.3863	1.5198	|||||||.....	1.1713	|||||||.....	1.1770	|||||||.....
34	-0.7765	-1.1384	||||||.....	-0.8900	||||||.....	-0.8876	||||||.....
35	0.4055	-0.9923	|||||.....	-0.7658	|||||.....	-0.7617	|||||.....
36	0.5878	-1.2083	||||||.....	-0.9316	||||||.....	-0.9300	||||||.....
37	1.9169	-1.3880	|||||||.....	-1.0726	|||||||.....	-1.0748	|||||||.....
38	0.3365	-0.1331	|.....	-0.1028	|.....	-0.1015	|.....
39	-0.4005	-0.2247	|.....	-0.1747	|.....	-0.1725	|.....
40	-0.0619	-0.5719	||.....	-0.4430	||.....	-0.4384	||.....
41	-1.7148	-0.4276	||.....	-0.3410	||.....	-0.3371	||.....
42	-1.5606	0.8696	||||.....	0.6908	||||.....	0.6861	||||.....
43	-0.6162	-0.3645	|.....	-0.2843	|.....	-0.2809	|.....
44	-2.6173	0.4978	||.....	0.4083	||.....	0.4039	||.....
45	-2.5639	-0.1165	|.....	-0.0953	|.....	-0.0941	|.....
46	2.1282	-0.3980	|.....	-0.3081	|.....	-0.3045	|.....
47	0.6931	1.9258	|||||||||.....	1.4843	|||||||||.....	1.5084	|||||||||.....
48	0.0953	2.3243	||||||||||||..	1.7976	||||||||||||..	1.8529	||||||||||||..
49	3.6687	0.0786	|.....	0.0625	|.....	0.0617	|.....
50	3.5467	-1.3136	|||||||.....	-1.0404	|||||||.....	-1.0416	|||||||.....
51	1.7047	1.4978	|||||||.....	1.1558	|||||||.....	1.1610	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.2008	||||||.....	0.0200	|||.....	0.0801	||||.....
12	3.8480	0.1101	|||.....	0.0062	|.....	0.0941	||||.....
13	0.1823	0.2358	|||||||.....	0.0273	||||.....	-0.1082	|||||.....
14	3.6788	-0.1546	||||.....	0.0122	|.....	-0.1299	||||||.....
15	1.4110	-0.2495	|||||||.....	0.0300	||||.....	-0.0512	||.....
16	-0.3425	-0.2762	|||||||||.....	0.0374	||||||.....	0.1760	|||||||.....
17	1.6292	-0.2685	|||||||.....	0.0347	|||||.....	-0.0861	||||.....
18	-1.0498	-0.1318	||||.....	0.0088	|.....	0.1027	|||||.....
19	1.2809	-0.1621	|||||.....	0.0131	||.....	-0.0213	|.....
20	0.9555	-0.0122	|.....	0.0001	|.....	0.0007	|.....
21	-0.4155	-0.4477	|||||||||||||||	0.0920	|||||||||||||||	0.2938	|||||||||||||||
22	3.8199	-0.2069	||||||.....	0.0217	|||.....	-0.1764	|||||||.....
23	1.5041	-0.0456	|.....	0.0011	|.....	-0.0117	|.....
24	1.7579	0.1549	||||.....	0.0120	|.....	0.0593	||.....
25	1.9169	0.1660	|||||.....	0.0138	||.....	0.0753	|||.....
26	2.2192	0.2382	|||||||.....	0.0280	||||.....	0.1349	||||||.....
27	2.0015	0.2313	|||||||.....	0.0263	||||.....	0.1128	|||||.....
28	2.3795	0.0123	|.....	0.0001	|.....	0.0076	|.....
29	1.2809	0.3192	||||||||.....	0.0473	||||||.....	0.0420	||.....
30	2.8959	-0.0587	|.....	0.0018	|.....	-0.0432	||.....
31	3.7589	-0.2857	|||||||||.....	0.0410	||||||.....	-0.2422	||||||||||...
32	0.6419	0.1877	||||||.....	0.0175	||.....	-0.0447	||.....
33	1.3863	0.1897	||||||.....	0.0178	||.....	0.0363	|.....
34	-0.7765	-0.2100	||||||.....	0.0222	|||.....	0.1543	|||||||.....
35	0.4055	-0.1293	||||.....	0.0084	|.....	0.0464	||.....
36	0.5878	-0.1527	||||.....	0.0117	|.....	0.0408	||.....
37	1.9169	-0.1913	||||||.....	0.0182	||.....	-0.0867	||||.....
38	0.3365	-0.0175	|.....	0.0002	|.....	0.0068	|.....
39	-0.4005	-0.0363	|.....	0.0007	|.....	0.0237	|.....
40	-0.0619	-0.0835	||.....	0.0036	|.....	0.0461	||.....
41	-1.7148	-0.1059	|||.....	0.0057	|.....	0.0904	||||.....
42	-1.5606	0.2061	||||||.....	0.0215	|||.....	-0.1731	|||||||.....
43	-0.6162	-0.0632	|.....	0.0020	|.....	0.0445	||.....
44	-2.6173	0.1625	|||||.....	0.0135	||.....	-0.1476	|||||||.....
45	-2.5639	-0.0374	|.....	0.0007	|.....	0.0338	|.....
46	2.1282	-0.0573	|.....	0.0017	|.....	-0.0307	|.....
47	0.6931	0.2441	|||||||.....	0.0288	||||.....	-0.0512	||.....
48	0.0953	0.3383	||||||||||....	0.0539	||||||||.....	-0.1671	|||||||.....
49	3.6687	0.0185	|.....	0.0002	|.....	0.0155	|.....
50	3.5467	-0.3014	|||||||||.....	0.0453	||||||.....	-0.2493	||||||||||...
51	1.7047	0.1970	||||||.....	0.0192	|||.....	0.0705	|||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	1.1619	||||||||.....	0.0200	|||.....	0.0290	|.....
12	3.8480	0.3483	||.....	0.0062	|.....	0.0908	||||||||.....
13	0.1823	1.3204	||||||||.....	0.0273	||||.....	0.0309	|.....
14	3.6788	-0.5138	|||.....	0.0122	|.....	0.0830	|||||||.....
15	1.4110	-1.5433	|||||||||.....	0.0300	||||.....	0.0255	|.....
16	-0.3425	-1.3350	||||||||.....	0.0374	||||||.....	0.0411	||.....
17	1.6292	-1.6063	||||||||||....	0.0347	|||||.....	0.0272	|.....
18	-1.0498	-0.5116	|||.....	0.0088	|.....	0.0622	||||.....
19	1.2809	-1.0161	||||||.....	0.0131	||.....	0.0248	|.....
20	0.9555	-0.0768	|.....	0.0001	|.....	0.0245	|.....
21	-0.4155	* -2.1160	||||||||||||||	0.0920	||||||||||||||	0.0428	||.....
22	3.8199	-0.6599	||||.....	0.0217	|||.....	0.0895	||||||||.....
23	1.5041	-0.2788	|.....	0.0011	|.....	0.0261	|.....
24	1.7579	0.9027	||||||.....	0.0120	|.....	0.0286	|.....
25	1.9169	0.9327	||||||.....	0.0138	||.....	0.0307	|.....
26	2.2192	1.2341	||||||||.....	0.0280	||||.....	0.0359	|.....
27	2.0015	1.2718	||||||||.....	0.0263	||||.....	0.0320	|.....
28	2.3795	0.0610	|.....	0.0001	|.....	0.0393	|.....
29	1.2809	* 2.0011	|||||||||||||.	0.0473	||||||.....	0.0248	|.....
30	2.8959	-0.2475	|.....	0.0018	|.....	0.0532	|||.....
31	3.7589	-0.9277	||||||.....	0.0410	||||||.....	0.0866	||||||||.....
32	0.6419	1.1522	|||||||.....	0.0175	||.....	0.0259	|.....
33	1.3863	1.1770	||||||||.....	0.0178	||.....	0.0253	|.....
34	-0.7765	-0.8876	||||||.....	0.0222	|||.....	0.0530	|||.....
35	0.4055	-0.7617	|||||.....	0.0084	|.....	0.0280	|.....
36	0.5878	-0.9300	||||||.....	0.0117	|.....	0.0263	|.....
37	1.9169	-1.0748	|||||||.....	0.0182	||.....	0.0307	|.....
38	0.3365	-0.1015	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.1725	|.....	0.0007	|.....	0.0425	||.....
40	-0.0619	-0.4384	||.....	0.0036	|.....	0.0350	|.....
41	-1.7148	-0.3371	||.....	0.0057	|.....	0.0898	||||||||.....
42	-1.5606	0.6861	||||.....	0.0215	|||.....	0.0827	|||||||.....
43	-0.6162	-0.2809	|.....	0.0020	|.....	0.0482	|||.....
44	-2.6173	0.4039	||.....	0.0135	||.....	0.1394	||||||||||||||
45	-2.5639	-0.0941	|.....	0.0007	|.....	0.1361	|||||||||||||.
46	2.1282	-0.3045	|.....	0.0017	|.....	0.0342	|.....
47	0.6931	1.5084	|||||||||.....	0.0288	||||.....	0.0255	|.....
48	0.0953	1.8529	||||||||||||..	0.0539	||||||||.....	0.0323	|.....
49	3.6687	0.0617	|.....	0.0002	|.....	0.0826	|||||||.....
50	3.5467	-1.0416	|||||||.....	0.0453	|||||||.....	0.0772	||||||.....
51	1.7047	1.1610	||||||||.....	0.0192	|||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Means

Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	2.8622	1.7918	3.2528	-1.4610	2.6899	4.0826
12	3.9140	3.8480	4.2785	-0.4305	3.5561	5.3925
13	1.4061	0.1823	1.8328	-1.6505	1.4187	2.3412
14	2.6462	3.6788	3.0421	0.6367	2.5085	3.8171
15	-0.9943	1.4110	-0.5081	1.9190	-1.1790	-0.0272
16	-2.5257	-0.3425	-2.0016	1.6591	-3.0686	-1.3062
17	-0.8440	1.6292	-0.3615	1.9907	-0.9985	0.1032
18	-2.2073	-1.0498	-1.6910	0.6412	-2.6705	-1.0453
19	-0.4780	1.2809	-0.0046	1.2856	-0.5655	0.4273
20	0.4055	0.9555	0.8570	0.0986	0.4248	1.2649
21	-3.5066	-0.4155	-2.9581	2.5426	-4.3031	-2.1009
22	2.6101	3.8199	3.0069	0.8130	2.4780	3.7729
23	0.7031	1.5041	1.1472	0.3569	0.7351	1.5704
24	2.5014	1.7579	2.9010	-1.1431	2.3860	3.6401
25	2.7014	1.9169	3.0959	-1.1790	2.5550	3.8847
26	3.3844	2.2192	3.7620	-1.5428	3.1228	4.7300
27	3.2108	2.0015	3.5928	-1.5913	2.9797	4.5141
28	2.0464	2.3795	2.4572	-0.0777	1.9942	3.0904
29	3.3429	1.2809	3.7215	-2.4406	3.0886	4.6783
30	2.1759	2.8959	2.5835	0.3124	2.1069	3.2457
31	2.2138	3.7589	2.6204	1.1385	2.1396	3.2913
32	1.6734	0.6419	2.0934	-1.4516	1.6632	2.6496
33	2.4681	1.3863	2.8685	-1.4822	2.3576	3.5995
34	-2.4079	-0.7765	-1.8867	1.1102	-2.9211	-1.2099
35	-1.0498	0.4055	-0.5623	0.9677	-1.2460	-0.0752
36	-1.0788	0.5878	-0.5905	1.1783	-1.2811	-0.1001
37	0.1044	1.9169	0.5633	1.3536	0.0980	0.9688
38	-0.2614	0.3365	0.2067	0.1298	-0.3144	0.6245
39	-1.1087	-0.4005	-0.6196	0.2192	-1.3172	-0.1257
40	-1.1087	-0.0619	-0.6196	0.5578	-1.3172	-0.1257
41	-2.6593	-1.7148	-2.1318	0.4170	-3.2360	-1.4150
42	-1.2040	-1.5606	-0.7126	-0.8481	-1.4329	-0.2072
43	-1.4697	-0.6162	-0.9717	0.3555	-1.7574	-0.4324
44	-2.6593	-2.6173	-2.1318	-0.4855	-3.2360	-1.4150
45	-3.2189	-2.5639	-2.6775	0.1136	-3.9400	-1.8688
46	1.3110	2.1282	1.7401	0.3882	1.3299	2.2333
47	2.1633	0.6931	2.5712	-1.8781	2.0960	3.2306
48	1.9488	0.0953	2.3620	-2.2667	1.9086	2.9741
49	3.3673	3.6687	3.7454	-0.0767	3.1088	4.7088
50	1.8500	3.5467	2.2657	1.2810	1.8213	2.8571
51	2.7726	1.7047	3.1654	-1.4607	2.6149	3.9723

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnVegetation X = lnSoil

Inverse Prediction of X Individuals

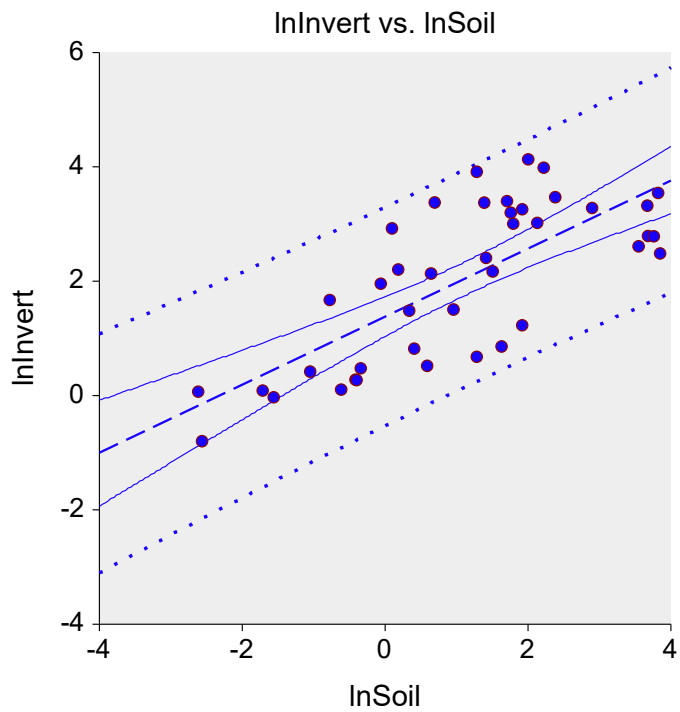
Row	lnVegetation (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	2.8622	1.7918	3.2528	-1.4610	0.6267	6.1458
12	3.9140	3.8480	4.2785	-0.4305	1.6506	7.2980
13	1.4061	0.1823	1.8328	-1.6505	-0.8298	4.5897
14	2.6462	3.6788	3.0421	0.6367	0.4136	5.9120
15	-0.9943	1.4110	-0.5081	1.9190	-3.3347	2.1285
16	-2.5257	-0.3425	-2.0016	1.6591	-4.9992	0.6245
17	-0.8440	1.6292	-0.3615	1.9907	-3.1741	2.2788
18	-2.2073	-1.0498	-1.6910	0.6412	-4.6490	0.9332
19	-0.4780	1.2809	-0.0046	1.2856	-2.7851	2.6469
20	0.4055	0.9555	0.8570	0.0986	-1.8582	3.5479
21	-3.5066	-0.4155	-2.9581	2.5426	-6.0903	-0.3136
22	2.6101	3.8199	3.0069	0.8130	0.3779	5.8730
23	0.7031	1.5041	1.1472	0.3569	-1.5499	3.8554
24	2.5014	1.7579	2.9010	-1.1431	0.2702	5.7559
25	2.7014	1.9169	3.0959	-1.1790	0.4681	5.9716
26	3.3844	2.2192	3.7620	-1.5428	1.1379	6.7150
27	3.2108	2.0015	3.5928	-1.5913	0.9687	6.5252
28	2.0464	2.3795	2.4572	-0.0777	-0.1835	5.2682
29	3.3429	1.2809	3.7215	-2.4406	1.0975	6.6695
30	2.1759	2.8959	2.5835	0.3124	-0.0540	5.4065
31	2.2138	3.7589	2.6204	1.1385	-0.0161	5.4471
32	1.6734	0.6419	2.0934	-1.4516	-0.5589	4.8718
33	2.4681	1.3863	2.8685	-1.4822	0.2371	5.7200
34	-2.4079	-0.7765	-1.8867	1.1102	-4.8695	0.7384
35	-1.0498	0.4055	-0.5623	0.9677	-3.3942	2.0730
36	-1.0788	0.5878	-0.5905	1.1783	-3.4253	2.0441
37	0.1044	1.9169	0.5633	1.3536	-2.1721	3.2388
38	-0.2614	0.3365	0.2067	0.1298	-2.5561	2.8662
39	-1.1087	-0.4005	-0.6196	0.2192	-3.4573	2.0144
40	-1.1087	-0.0619	-0.6196	0.5578	-3.4573	2.0144
41	-2.6593	-1.7148	-2.1318	0.4170	-5.1467	0.4957
42	-1.2040	-1.5606	-0.7126	-0.8481	-3.5597	1.9196
43	-1.4697	-0.6162	-0.9717	0.3555	-3.8461	1.6563
44	-2.6593	-2.6173	-2.1318	-0.4855	-5.1467	0.4957
45	-3.2189	-2.5639	-2.6775	0.1136	-5.7684	-0.0404
46	1.3110	2.1282	1.7401	0.3882	-0.9265	4.4898
47	2.1633	0.6931	2.5712	-1.8781	-0.0665	5.3931
48	1.9488	0.0953	2.3620	-2.2667	-0.2815	5.1642
49	3.3673	3.6687	3.7454	-0.0767	1.1213	6.6962
50	1.8500	3.5467	2.2657	1.2810	-0.3808	5.0592
51	2.7726	1.7047	3.1654	-1.4607	0.5384	6.0487

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnInvert	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.3793	Rows Prediction Only	0
Slope	0.5966	Sum of Frequencies	41
R-Squared	0.5538	Sum of Weights	41.0000
Correlation	0.7442	Coefficient of Variation	0.4623
Mean Square Error	0.8630409	Square Root of MSE	0.929

Linear Regression Report

Y = lnInvert X = lnSoil

Summary Statement

The equation of the straight line relating lnInvert and lnSoil is estimated as: lnInvert = (1.3793) + (0.5966) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnInvert when lnSoil is zero, is 1.3793 with a standard error of 0.1710. The slope, the estimated change in lnInvert per unit change in lnSoil, is 0.5966 with a standard error of 0.0858. The value of R-Squared, the proportion of the variation in lnInvert that can be accounted for by variation in lnSoil, is 0.5538. The correlation between lnInvert and lnSoil is 0.7442.

A significance test that the slope is zero resulted in a t-value of 6.9572. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5966. The lower limit of the 95% confidence interval for the slope is 0.4232 and the upper limit is 0.7701. The estimated intercept is 1.3793. The lower limit of the 95% confidence interval for the intercept is 1.0333 and the upper limit is 1.7252.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnInvert	lnSoil
Count	41	41
Mean	2.0094	1.0562
Standard Deviation	1.3732	1.7128
Minimum	-0.7985	-2.6173
Maximum	4.1320	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.3793	0.5966
Lower 95% Confidence Limit	1.0333	0.4232
Upper 95% Confidence Limit	1.7252	0.7701
Standard Error	0.1710	0.0858
Standardized Coefficient	0.0000	0.7442
T Value	8.0641	6.9572
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	1.0000
Regression of Y on X	1.3793	0.5966
Inverse Regression from X on Y	0.8715	1.0774
Orthogonal Regression of Y and X	1.2231	0.7445

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.37927513474856) + (0.596638015350715) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.3793	0.9000	1.1235	1.6146
Bootstrap Mean	1.3824	0.9500	1.0655	1.6665
Bias (BM - OV)	0.0032	0.9900	0.9301	1.7459
Bias Corrected	1.3761			
Standard Error	0.1513			
Slope				
Original Value	0.5966	0.9000	0.4752	0.7030
Bootstrap Mean	0.6007	0.9500	0.4526	0.7260
Bias (BM - OV)	0.0040	0.9900	0.3918	0.7718
Bias Corrected	0.5926			
Standard Error	0.0696			
Correlation				
Original Value	0.7442	0.9000	0.6555	0.8563
Bootstrap Mean	0.7424	0.9500	0.6449	0.8777
Bias (BM - OV)	-0.0017	0.9900	0.6240	0.9457
Bias Corrected	0.7459			
Standard Error	0.0604			
R-Squared				
Original Value	0.5538	0.9000	0.4139	0.7082
Bootstrap Mean	0.5549	0.9500	0.3961	0.7347
Bias (BM - OV)	0.0011	0.9900	0.3604	0.8131
Bias Corrected	0.5527			
Standard Error	0.0875			
Standard Error of Estimate				
Original Value	0.9290	0.9000	0.8333	1.0713
Bootstrap Mean	0.9071	0.9500	0.8095	1.0961
Bias (BM - OV)	-0.0219	0.9900	0.7630	1.1489
Bias Corrected	0.9509			
Standard Error	0.0733			
Orthogonal Intercept				
Original Value	1.2231	0.9000	0.9807	1.4798
Bootstrap Mean	1.2167	0.9500	0.9290	1.5308
Bias (BM - OV)	-0.0064	0.9900	0.8424	1.6492
Bias Corrected	1.2295			
Standard Error	0.1528			
Orthogonal Slope				
Original Value	0.7445	0.9000	0.5632	0.8705
Bootstrap Mean	0.7560	0.9500	0.5146	0.8949
Bias (BM - OV)	0.0115	0.9900	0.4138	0.9475
Bias Corrected	0.7330			
Standard Error	0.0964			

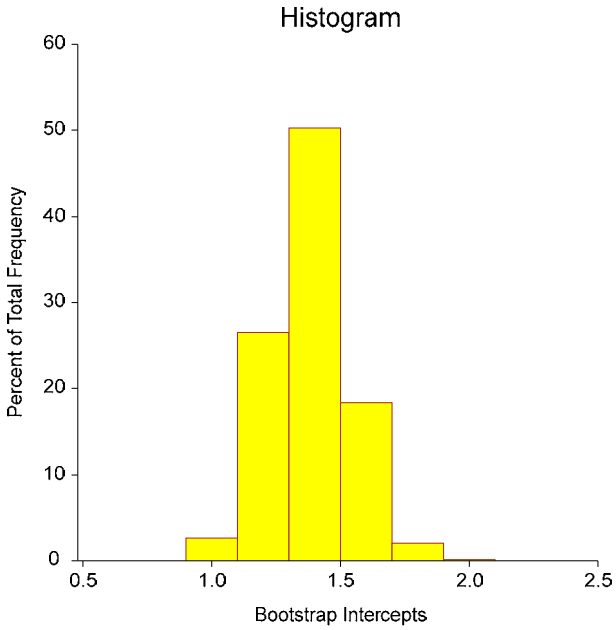
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

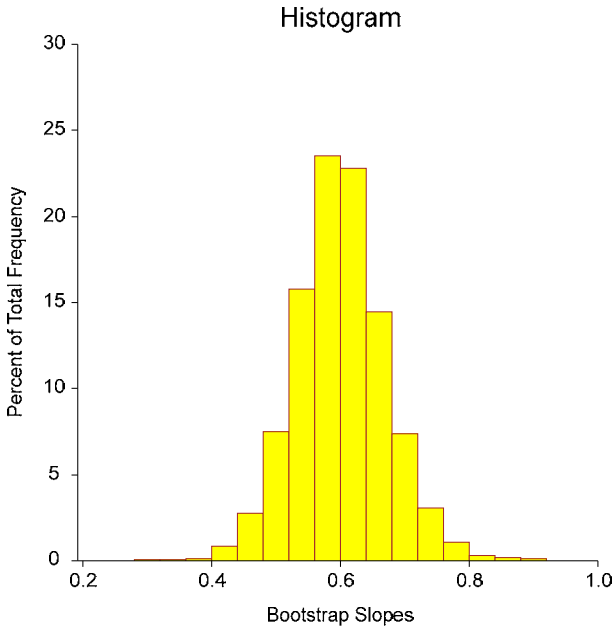
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

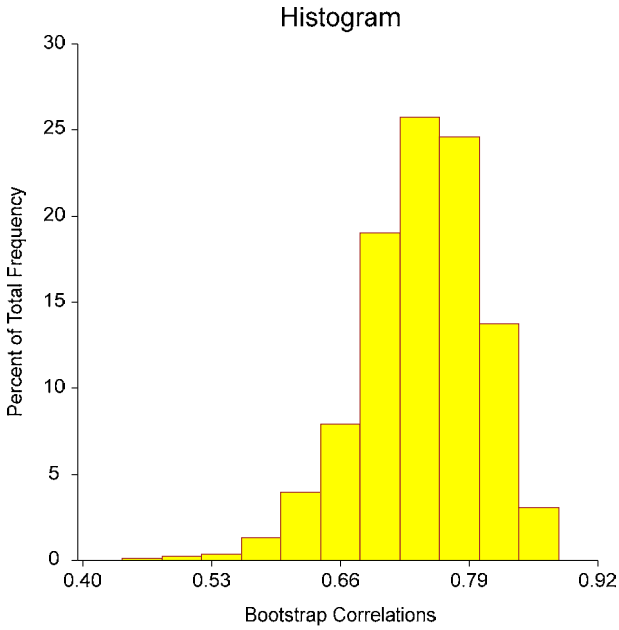
Linear Regression Report

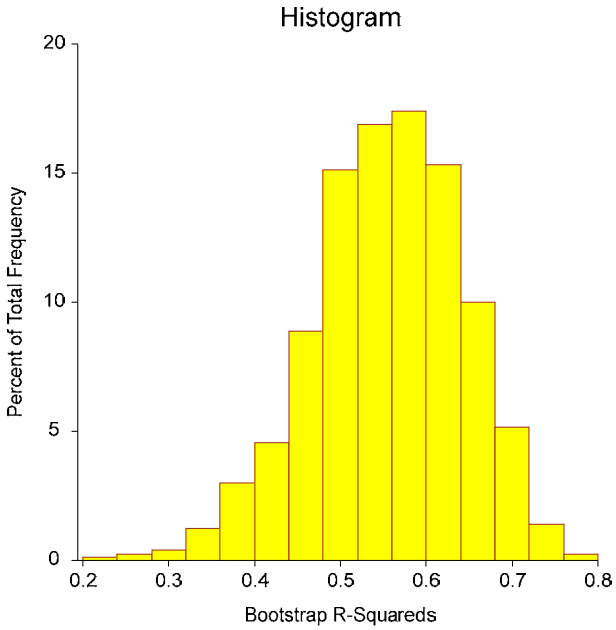
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Bootstrap Histograms Section



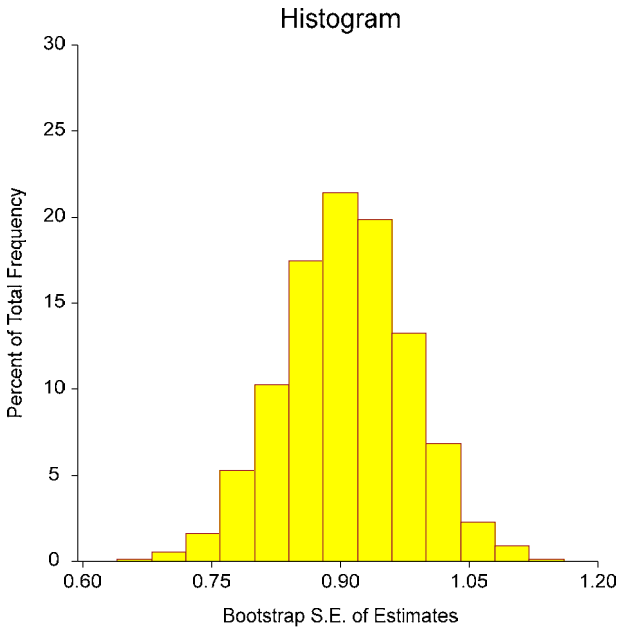


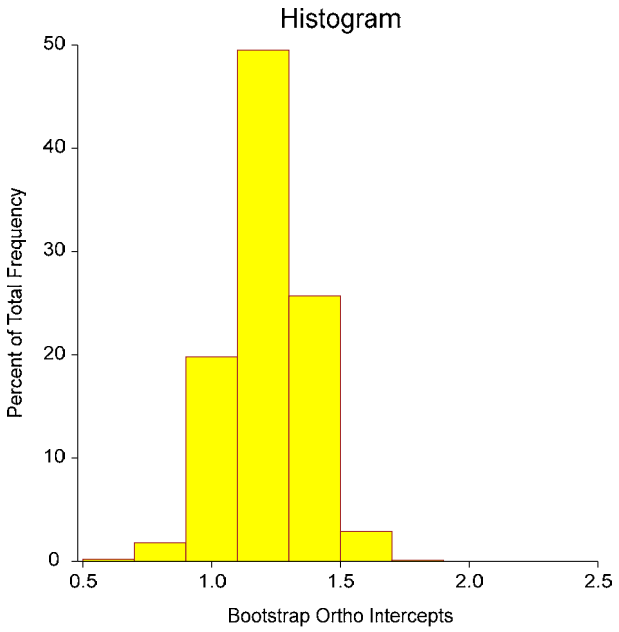


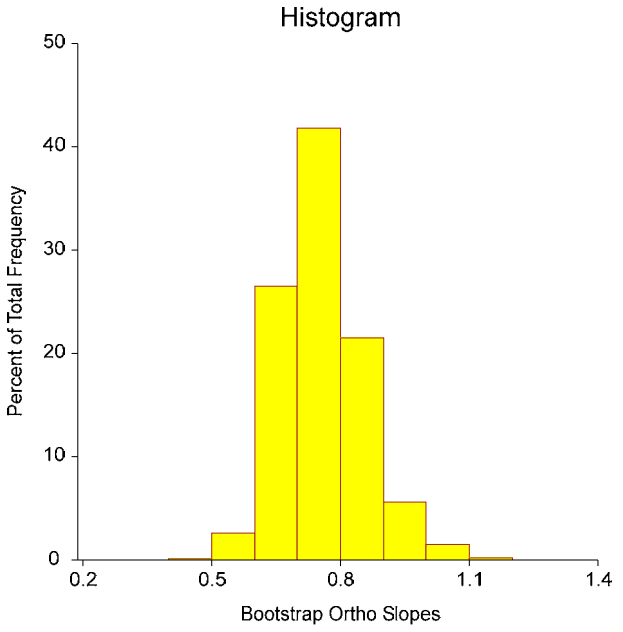


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.7442	0.5538	0.7444
Lower 95% Conf. Limit (r dist'n)	0.5612		
Upper 95% Conf. Limit (r dist'n)	0.8526		
Lower 95% Conf. Limit (Fisher's z)	0.5661		0.5665
Upper 95% Conf. Limit (Fisher's z)	0.8559		0.8560
Adjusted (Rbar)		0.5423	
T-Value for H0: Rho = 0	6.9572	6.9572	6.9621
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	165.5529	165.5529			
Slope	1	41.77306	41.77306	48.4022	0.0000	1.0000
Error	39	33.6586	0.8630409			
Lack of Fit	37	26.36547	0.7125803	0.1954	0.9891	
Pure Error	2	7.293124	3.646562			
Adj. Total	40	75.43166	1.885791			
Total	41	240.9846				

s = Square Root(0.8630409) = 0.929

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	82.38731	0.03389676	-0.009000641
1	43.30437	163.0859	157.0319	-0.009000641	0.008521686
2 (Y'Y)			240.9846		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.02925429	-0.007767921
1	-0.007767921	0.007354564

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9602	0.160175	No
Anderson Darling	0.4811	0.232211	Yes
D'Agostino Skewness	0.6295	0.529007	Yes
D'Agostino Kurtosis	-2.0347	0.041877	No
D'Agostino Omnibus	4.5365	0.103495	No
Constant Residual Variance?			
Modified Levene Test	0.0053	0.942532	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.1954	0.989089	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

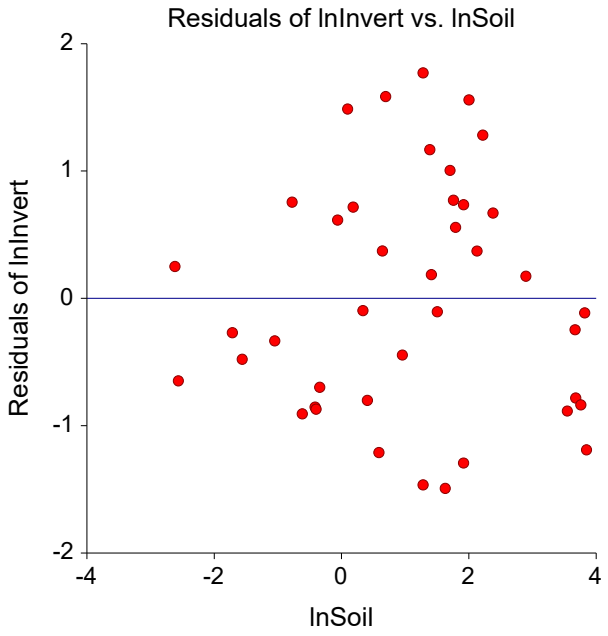
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

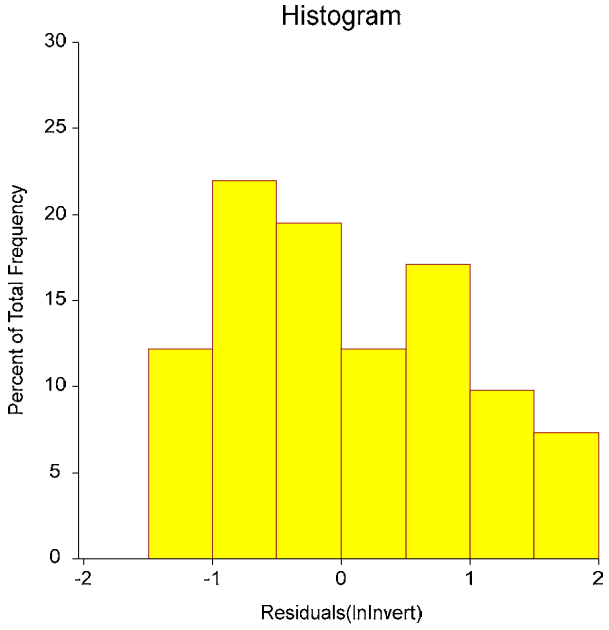
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

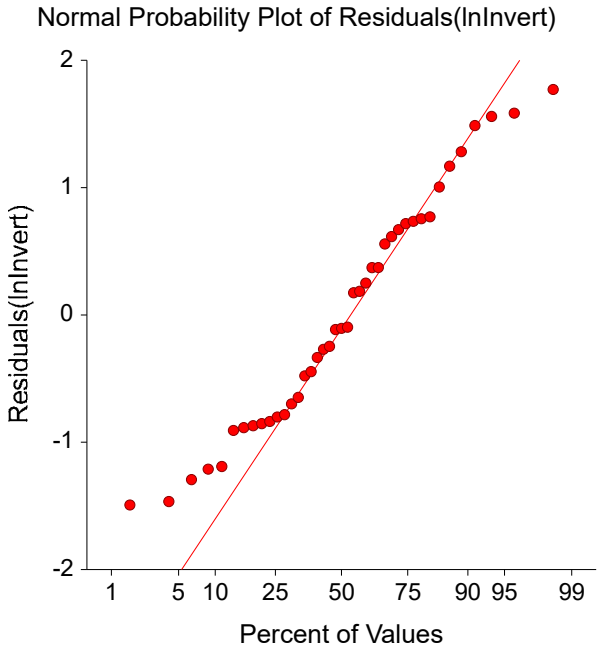
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Original Data Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual
11	1.7918	3.0057	2.4483	0.5574
12	3.8480	2.4849	3.6751	-1.1902
13	0.1823	2.2050	1.4881	0.7169
14	3.6788	2.7912	3.5742	-0.7830
15	1.4110	2.4069	2.2211	0.1858
16	-0.3425	0.4762	1.1749	-0.6987
17	1.6292	0.8587	2.3513	-1.4927
18	-1.0498	0.4187	0.7529	-0.3342
19	1.2809	0.6780	2.1435	-1.4655
20	0.9555	1.5041	1.9494	-0.4453
21	-0.4155	0.2776	1.1314	-0.8537
22	3.8199	3.5439	3.6584	-0.1145
23	1.5041	2.1713	2.2767	-0.1053
24	1.7579	3.1987	2.4281	0.7706
25	1.9169	3.2581	2.5230	0.7351
26	2.2192	3.9853	2.7033	1.2819
27	2.0015	4.1320	2.5734	1.5585
28	2.3795	3.4689	2.7990	0.6699
29	1.2809	3.9140	2.1435	1.7705
30	2.8959	3.2809	3.1071	0.1738
31	3.7589	2.7850	3.6220	-0.8369
32	0.6419	2.1342	1.7622	0.3719
33	1.3863	3.3742	2.2064	1.1678
34	-0.7765	1.6715	0.9160	0.7555
35	0.4055	0.8198	1.6212	-0.8014
36	0.5878	0.5188	1.7300	-1.2112
37	1.9169	1.2296	2.5230	-1.2933
38	0.3365	1.4839	1.5800	-0.0962
39	-0.4005	0.2700	1.1403	-0.8703
40	-0.0619	1.9573	1.3424	0.6149
41	-1.7148	0.0862	0.3562	-0.2700
42	-1.5606	-0.0305	0.4481	-0.4786
43	-0.6162	0.1044	1.0116	-0.9073
44	-2.6173	0.0677	-0.1823	0.2500
45	-2.5639	-0.7985	-0.1505	-0.6480
46	2.1282	3.0204	2.6491	0.3714
47	0.6931	3.3776	1.7928	1.5848
48	0.0953	2.9232	1.4361	1.4870
49	3.6687	3.3214	3.5681	-0.2467
50	3.5467	2.6101	3.4954	-0.8853
51	1.7047	3.4012	2.3964	1.0048

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	3.0057	2.4483	0.1582	2.1283	2.7683
12	3.8480	2.4849	3.6751	0.2800	3.1089	4.2414
13	0.1823	2.2050	1.4881	0.1633	1.1578	1.8184
14	3.6788	2.7912	3.5742	0.2676	3.0328	4.1156
15	1.4110	2.4069	2.2211	0.1482	1.9213	2.5210
16	-0.3425	0.4762	1.1749	0.1882	0.7942	1.5557
17	1.6292	0.8587	2.3513	0.1532	2.0415	2.6612
18	-1.0498	0.4187	0.7529	0.2317	0.2843	1.2215
19	1.2809	0.6780	2.1435	0.1464	1.8475	2.4396
20	0.9555	1.5041	1.9494	0.1453	1.6554	2.2434
21	-0.4155	0.2776	1.1314	0.1923	0.7424	1.5203
22	3.8199	3.5439	3.6584	0.2779	3.0963	4.2205
23	1.5041	2.1713	2.2767	0.1501	1.9731	2.5802
24	1.7579	3.1987	2.4281	0.1571	2.1104	2.7458
25	1.9169	3.2581	2.5230	0.1628	2.1937	2.8522
26	2.2192	3.9853	2.7033	0.1761	2.3472	3.0595
27	2.0015	4.1320	2.5734	0.1662	2.2373	2.9096
28	2.3795	3.4689	2.7990	0.1842	2.4264	3.1716
29	1.2809	3.9140	2.1435	0.1464	1.8475	2.4396
30	2.8959	3.2809	3.1071	0.2143	2.6735	3.5406
31	3.7589	2.7850	3.6220	0.2734	3.0689	4.1750
32	0.6419	2.1342	1.7622	0.1494	1.4601	2.0644
33	1.3863	3.3742	2.2064	0.1478	1.9074	2.5054
34	-0.7765	1.6715	0.9160	0.2139	0.4833	1.3486
35	0.4055	0.8198	1.6212	0.1554	1.3068	1.9356
36	0.5878	0.5188	1.7300	0.1505	1.4255	2.0345
37	1.9169	1.2296	2.5230	0.1628	2.1937	2.8522
38	0.3365	1.4839	1.5800	0.1577	1.2611	1.8989
39	-0.4005	0.2700	1.1403	0.1915	0.7531	1.5276
40	-0.0619	1.9573	1.3424	0.1739	0.9906	1.6941
41	-1.7148	0.0862	0.3562	0.2784	-0.2070	0.9193
42	-1.5606	-0.0305	0.4481	0.2672	-0.0924	0.9887
43	-0.6162	0.1044	1.0116	0.2040	0.5990	1.4243
44	-2.6173	0.0677	-0.1823	0.3468	-0.8838	0.5192
45	-2.5639	-0.7985	-0.1505	0.3427	-0.8436	0.5427
46	2.1282	3.0204	2.6491	0.1718	2.3016	2.9965
47	0.6931	3.3776	1.7928	0.1484	1.4927	2.0930
48	0.0953	2.9232	1.4361	0.1669	1.0986	1.7736
49	3.6687	3.3214	3.5681	0.2669	3.0283	4.1080
50	3.5467	2.6101	3.4954	0.2582	2.9731	4.0177
51	1.7047	3.4012	2.3964	0.1554	2.0821	2.7107

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	3.0057	2.4483	0.9424	0.5422	4.3544
12	3.8480	2.4849	3.6751	0.9703	1.7126	5.6377
13	0.1823	2.2050	1.4881	0.9432	-0.4198	3.3959
14	3.6788	2.7912	3.5742	0.9668	1.6187	5.5297
15	1.4110	2.4069	2.2211	0.9408	0.3183	4.1240
16	-0.3425	0.4762	1.1749	0.9479	-0.7423	3.0922
17	1.6292	0.8587	2.3513	0.9415	0.4469	4.2558
18	-1.0498	0.4187	0.7529	0.9575	-1.1837	2.6895
19	1.2809	0.6780	2.1435	0.9405	0.2413	4.0458
20	0.9555	1.5041	1.9494	0.9403	0.0474	3.8513
21	-0.4155	0.2776	1.1314	0.9487	-0.7876	3.0503
22	3.8199	3.5439	3.6584	0.9697	1.6970	5.6197
23	1.5041	2.1713	2.2767	0.9410	0.3732	4.1801
24	1.7579	3.1987	2.4281	0.9422	0.5223	4.3338
25	1.9169	3.2581	2.5230	0.9432	0.6153	4.4307
26	2.2192	3.9853	2.7033	0.9455	0.7908	4.6159
27	2.0015	4.1320	2.5734	0.9437	0.6645	4.4823
28	2.3795	3.4689	2.7990	0.9471	0.8833	4.7147
29	1.2809	3.9140	2.1435	0.9405	0.2413	4.0458
30	2.8959	3.2809	3.1071	0.9534	1.1786	5.0355
31	3.7589	2.7850	3.6220	0.9684	1.6632	5.5807
32	0.6419	2.1342	1.7622	0.9409	-0.1410	3.6654
33	1.3863	3.3742	2.2064	0.9407	0.3037	4.1091
34	-0.7765	1.6715	0.9160	0.9533	-1.0123	2.8442
35	0.4055	0.8198	1.6212	0.9419	-0.2840	3.5264
36	0.5878	0.5188	1.7300	0.9411	-0.1736	3.6336
37	1.9169	1.2296	2.5230	0.9432	0.6153	4.4307
38	0.3365	1.4839	1.5800	0.9423	-0.3259	3.4860
39	-0.4005	0.2700	1.1403	0.9485	-0.7782	3.0589
40	-0.0619	1.9573	1.3424	0.9451	-0.5694	3.2541
41	-1.7148	0.0862	0.3562	0.9698	-1.6055	2.3178
42	-1.5606	-0.0305	0.4481	0.9667	-1.5071	2.4034
43	-0.6162	0.1044	1.0116	0.9511	-0.9122	2.9355
44	-2.6173	0.0677	-0.1823	0.9916	-2.1881	1.8235
45	-2.5639	-0.7985	-0.1505	0.9902	-2.1533	1.8524
46	2.1282	3.0204	2.6491	0.9447	0.7381	4.5600
47	0.6931	3.3776	1.7928	0.9408	-0.1101	3.6957
48	0.0953	2.9232	1.4361	0.9439	-0.4730	3.3453
49	3.6687	3.3214	3.5681	0.9666	1.6130	5.5232
50	3.5467	2.6101	3.4954	0.9642	1.5451	5.4457
51	1.7047	3.4012	2.3964	0.9419	0.4912	4.3016

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	3.0057	2.4483	0.1582	1.9974	2.8992
12	3.8480	2.4849	3.6751	0.2800	2.8773	4.4730
13	0.1823	2.2050	1.4881	0.1633	1.0227	1.9534
14	3.6788	2.7912	3.5742	0.2676	2.8114	4.3370
15	1.4110	2.4069	2.2211	0.1482	1.7987	2.6436
16	-0.3425	0.4762	1.1749	0.1882	0.6384	1.7114
17	1.6292	0.8587	2.3513	0.1532	1.9148	2.7879
18	-1.0498	0.4187	0.7529	0.2317	0.0927	1.4131
19	1.2809	0.6780	2.1435	0.1464	1.7264	2.5606
20	0.9555	1.5041	1.9494	0.1453	1.5352	2.3636
21	-0.4155	0.2776	1.1314	0.1923	0.5833	1.6794
22	3.8199	3.5439	3.6584	0.2779	2.8664	4.4503
23	1.5041	2.1713	2.2767	0.1501	1.8489	2.7044
24	1.7579	3.1987	2.4281	0.1571	1.9805	2.8757
25	1.9169	3.2581	2.5230	0.1628	2.0591	2.9869
26	2.2192	3.9853	2.7033	0.1761	2.2016	3.2051
27	2.0015	4.1320	2.5734	0.1662	2.0998	3.0471
28	2.3795	3.4689	2.7990	0.1842	2.2741	3.3239
29	1.2809	3.9140	2.1435	0.1464	1.7264	2.5606
30	2.8959	3.2809	3.1071	0.2143	2.4962	3.7179
31	3.7589	2.7850	3.6220	0.2734	2.8427	4.4012
32	0.6419	2.1342	1.7622	0.1494	1.3365	2.1879
33	1.3863	3.3742	2.2064	0.1478	1.7851	2.6277
34	-0.7765	1.6715	0.9160	0.2139	0.3064	1.5256
35	0.4055	0.8198	1.6212	0.1554	1.1782	2.0642
36	0.5878	0.5188	1.7300	0.1505	1.3009	2.1590
37	1.9169	1.2296	2.5230	0.1628	2.0591	2.9869
38	0.3365	1.4839	1.5800	0.1577	1.1307	2.0294
39	-0.4005	0.2700	1.1403	0.1915	0.5947	1.6860
40	-0.0619	1.9573	1.3424	0.1739	0.8467	1.8380
41	-1.7148	0.0862	0.3562	0.2784	-0.4373	1.1496
42	-1.5606	-0.0305	0.4481	0.2672	-0.3134	1.2097
43	-0.6162	0.1044	1.0116	0.2040	0.4302	1.5930
44	-2.6173	0.0677	-0.1823	0.3468	-1.1707	0.8061
45	-2.5639	-0.7985	-0.1505	0.3427	-1.1271	0.8261
46	2.1282	3.0204	2.6491	0.1718	2.1596	3.1386
47	0.6931	3.3776	1.7928	0.1484	1.3699	2.2157
48	0.0953	2.9232	1.4361	0.1669	0.9606	1.9117
49	3.6687	3.3214	3.5681	0.2669	2.8075	4.3288
50	3.5467	2.6101	3.4954	0.2582	2.7596	4.2312
51	1.7047	3.4012	2.3964	0.1554	1.9536	2.8392

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Section

Row	lnSoil (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	3.0057	2.4483	0.5574	0.6089	18.5441
12	3.8480	2.4849	3.6751	-1.1902	-1.3437	47.8989
13	0.1823	2.2050	1.4881	0.7169	0.7839	32.5137
14	3.6788	2.7912	3.5742	-0.7830	-0.8802	28.0542
15	1.4110	2.4069	2.2211	0.1858	0.2026	7.7202
16	-0.3425	0.4762	1.1749	-0.6987	-0.7680	146.7132
17	1.6292	0.8587	2.3513	-1.4927	-1.6291	173.8380
18	-1.0498	0.4187	0.7529	-0.3342	-0.3715	79.8168
19	1.2809	0.6780	2.1435	-1.4655	-1.5974	216.1391
20	0.9555	1.5041	1.9494	-0.4453	-0.4853	29.6057
21	-0.4155	0.2776	1.1314	-0.8537	-0.9393	307.5049
22	3.8199	3.5439	3.6584	-0.1145	-0.1292	3.2316
23	1.5041	2.1713	2.2767	-0.1053	-0.1149	4.8508
24	1.7579	3.1987	2.4281	0.7706	0.8416	24.0910
25	1.9169	3.2581	2.5230	0.7351	0.8037	22.5626
26	2.2192	3.9853	2.7033	1.2819	1.4054	32.1669
27	2.0015	4.1320	2.5734	1.5585	1.7051	37.7188
28	2.3795	3.4689	2.7990	0.6699	0.7357	19.3105
29	1.2809	3.9140	2.1435	1.7705	1.9299	45.2346
30	2.8959	3.2809	3.1071	0.1738	0.1923	5.2981
31	3.7589	2.7850	3.6220	-0.8369	-0.9427	30.0519
32	0.6419	2.1342	1.7622	0.3719	0.4056	17.4277
33	1.3863	3.3742	2.2064	1.1678	1.2732	34.6093
34	-0.7765	1.6715	0.9160	0.7555	0.8357	45.1999
35	0.4055	0.8198	1.6212	-0.8014	-0.8750	97.7593
36	0.5878	0.5188	1.7300	-1.2112	-1.3212	233.4602
37	1.9169	1.2296	2.5230	-1.2933	-1.4141	105.1806
38	0.3365	1.4839	1.5800	-0.0962	-0.1050	6.4798
39	-0.4005	0.2700	1.1403	-0.8703	-0.9574	322.3038
40	-0.0619	1.9573	1.3424	0.6149	0.6738	31.4170
41	-1.7148	0.0862	0.3562	-0.2700	-0.3046	313.2870
42	-1.5606	-0.0305	0.4481	-0.4786	-0.5379	1571.2575
43	-0.6162	0.1044	1.0116	-0.9073	-1.0011	869.3704
44	-2.6173	0.0677	-0.1823	0.2500	0.2900	369.4453
45	-2.5639	-0.7985	-0.1505	-0.6480	-0.7505	81.1555
46	2.1282	3.0204	2.6491	0.3714	0.4068	12.2952
47	0.6931	3.3776	1.7928	1.5848	1.7281	46.9197
48	0.0953	2.9232	1.4361	1.4870	1.6271	50.8703
49	3.6687	3.3214	3.5681	-0.2467	-0.2773	7.4280
50	3.5467	2.6101	3.4954	-0.8853	-0.9921	33.9196
51	1.7047	3.4012	2.3964	1.0048	1.0971	29.5427

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	0.5574	0.6039	0.0290	0.0055	0.8773
12	3.8480	-1.1902	-1.3581	0.0908	0.0902	0.8447
13	0.1823	0.7169	0.7800	0.0309	0.0098	0.8718
14	3.6788	-0.7830	-0.8776	0.0830	0.0351	0.8682
15	1.4110	0.1858	0.2001	0.0255	0.0005	0.8848
16	-0.3425	-0.6987	-0.7639	0.0411	0.0126	0.8724
17	1.6292	-1.4927	-1.6657	0.0272	0.0371	0.8255
18	-1.0498	-0.3342	-0.3673	0.0622	0.0046	0.8826
19	1.2809	-1.4655	-1.6311	0.0248	0.0325	0.8278
20	0.9555	-0.4453	-0.4805	0.0245	0.0030	0.8804
21	-0.4155	-0.8537	-0.9379	0.0428	0.0197	0.8657
22	3.8199	-0.1145	-0.1276	0.0895	0.0008	0.8854
23	1.5041	-0.1053	-0.1134	0.0261	0.0002	0.8855
24	1.7579	0.7706	0.8384	0.0286	0.0104	0.8697
25	1.9169	0.7351	0.8000	0.0307	0.0102	0.8711
26	2.2192	1.2819	1.4238	0.0359	0.0368	0.8409
27	2.0015	1.5585	1.7496	0.0320	0.0481	0.8197
28	2.3795	0.6699	0.7313	0.0393	0.0111	0.8735
29	1.2809	1.7705	*2.0030	0.0248	0.0474	0.8012
30	2.8959	0.1738	0.1899	0.0532	0.0010	0.8849
31	3.7589	-0.8369	-0.9413	0.0866	0.0421	0.8656
32	0.6419	0.3719	0.4013	0.0259	0.0022	0.8820
33	1.3863	1.1678	1.2838	0.0253	0.0211	0.8489
34	-0.7765	0.7555	0.8324	0.0530	0.0195	0.8699
35	0.4055	-0.8014	-0.8723	0.0280	0.0110	0.8684
36	0.5878	-1.2112	-1.3344	0.0263	0.0235	0.8461
37	1.9169	-1.2933	-1.4330	0.0307	0.0317	0.8403
38	0.3365	-0.0962	-0.1037	0.0288	0.0002	0.8855
39	-0.4005	-0.8703	-0.9563	0.0425	0.0203	0.8649
40	-0.0619	0.6149	0.6690	0.0350	0.0082	0.8754
41	-1.7148	-0.2700	-0.3010	0.0898	0.0046	0.8836
42	-1.5606	-0.4786	-0.5329	0.0827	0.0131	0.8792
43	-0.6162	-0.9073	-1.0011	0.0482	0.0254	0.8630
44	-2.6173	0.2500	*0.2866	0.1394	0.0068	0.8838
45	-2.5639	-0.6480	*-0.7462	0.1361	0.0444	0.8730
46	2.1282	0.3714	0.4024	0.0342	0.0029	0.8820
47	0.6931	1.5848	1.7751	0.0255	0.0391	0.8179
48	0.0953	1.4870	1.6636	0.0323	0.0441	0.8256
49	3.6687	-0.2467	-0.2740	0.0826	0.0035	0.8840
50	3.5467	-0.8853	-0.9919	0.0772	0.0412	0.8634
51	1.7047	1.0048	1.1000	0.0280	0.0173	0.8584

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.6039	0.1044	0.0055	1.0643	0.0591	0.0416
12	-1.3581	-0.4292	0.0902	1.0537	0.0057	-0.3671
13	0.7800	0.1393	0.0098	1.0529	0.1388	-0.0639
14	-0.8776	-0.2640	0.0351	1.1035	-0.0039	-0.2219
15	0.2001	0.0323	0.0005	1.0786	0.0233	0.0066
16	-0.7639	-0.1581	0.0126	1.0655	-0.1567	0.1007
17	-1.6657	-0.2785	0.0371	0.9404	-0.1764	-0.0893
18	-0.3673	-0.0946	0.0046	1.1152	-0.0893	0.0737
19	-1.6311	-0.2602	0.0325	0.9434	-0.2007	-0.0343
20	-0.4805	-0.0761	0.0030	1.0668	-0.0668	0.0045
21	-0.9379	-0.1984	0.0197	1.0512	-0.1960	0.1302
22	-0.1276	-0.0400	0.0008	* 1.1558	0.0004	-0.0341
23	-0.1134	-0.0186	0.0002	1.0808	-0.0127	-0.0048
24	0.8384	0.1438	0.0104	1.0453	0.0835	0.0551
25	0.8000	0.1424	0.0102	1.0510	0.0735	0.0646
26	1.4238	0.2748	0.0368	0.9847	0.1097	0.1557
27	1.7496	0.3181	0.0481	0.9320	0.1534	0.1552
28	0.7313	0.1479	0.0111	1.0662	0.0506	0.0911
29	* 2.0030	0.3196	0.0474	0.8837	0.2464	0.0421
30	0.1899	0.0450	0.0010	1.1104	0.0083	0.0331
31	-0.9413	-0.2899	0.0421	1.1013	-0.0003	-0.2457
32	0.4013	0.0654	0.0022	1.0722	0.0621	-0.0156
33	1.2838	0.2069	0.0211	0.9927	0.1513	0.0396
34	0.8324	0.1969	0.0195	1.0728	0.1900	-0.1447
35	-0.8723	-0.1480	0.0110	1.0415	-0.1454	0.0532
36	-1.3344	-0.2191	0.0235	0.9871	-0.2101	0.0585
37	-1.4330	-0.2550	0.0317	0.9781	-0.1316	-0.1157
38	-0.1037	-0.0179	0.0002	1.0840	-0.0176	0.0070
39	-0.9563	-0.2014	0.0203	1.0489	-0.1991	0.1314
40	0.6690	0.1275	0.0082	1.0663	0.1275	-0.0703
41	-0.3010	-0.0946	0.0046	* 1.1518	-0.0846	0.0807
42	-0.5329	-0.1601	0.0131	1.1314	-0.1449	0.1344
43	-1.0011	-0.2253	0.0254	1.0506	-0.2198	0.1584
44	0.2866	0.1153	0.0068	* 1.2186	0.0964	-0.1048
45	-0.7462	-0.2961	0.0444	* 1.1843	-0.2484	0.2683
46	0.4024	0.0757	0.0029	1.0814	0.0328	0.0405
47	1.7751	0.2872	0.0391	0.9217	0.2701	-0.0603
48	1.6636	0.3037	0.0441	0.9457	0.3035	-0.1500
49	-0.2740	-0.0822	0.0035	1.1436	-0.0014	-0.0690
50	-0.9919	-0.2870	0.0412	1.0846	-0.0111	-0.2374
51	1.1000	0.1866	0.0173	1.0178	0.1124	0.0668

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	0.5574	||||.....	0.6089	||||.....	0.6039	|||.....
12	3.8480	-1.1902	|||||||||.....	-1.3437	|||||||||.....	-1.3581	|||||||||.....
13	0.1823	0.7169	|||||.....	0.7839	|||||.....	0.7800	|||||.....
14	3.6788	-0.7830	||||||.....	-0.8802	||||||.....	-0.8776	||||||.....
15	1.4110	0.1858	|.....	0.2026	|.....	0.2001	|.....
16	-0.3425	-0.6987	|||||.....	-0.7680	|||||.....	-0.7639	|||||.....
17	1.6292	-1.4927	||||||||||...	-1.6291	||||||||||...	-1.6657	||||||||||...
18	-1.0498	-0.3342	||.....	-0.3715	||.....	-0.3673	||.....
19	1.2809	-1.4655	||||||||||...	-1.5974	||||||||||...	-1.6311	||||||||||...
20	0.9555	-0.4453	|||.....	-0.4853	|||.....	-0.4805	||.....
21	-0.4155	-0.8537	||||||.....	-0.9393	||||||.....	-0.9379	||||||.....
22	3.8199	-0.1145	|.....	-0.1292	|.....	-0.1276	|.....
23	1.5041	-0.1053	|.....	-0.1149	|.....	-0.1134	|.....
24	1.7579	0.7706	||||||.....	0.8416	||||||.....	0.8384	|||||.....
25	1.9169	0.7351	|||||.....	0.8037	|||||.....	0.8000	|||||.....
26	2.2192	1.2819	|||||||||.....	1.4054	|||||||||.....	1.4238	|||||||||.....
27	2.0015	1.5585	||||||||||||..	1.7051	||||||||||||..	1.7496	||||||||||...
28	2.3795	0.6699	|||||.....	0.7357	|||||.....	0.7313	||||.....
29	1.2809	1.7705	|||||||||||||||	1.9299	|||||||||||||||	* 2.0030	|||||||||||||||
30	2.8959	0.1738	|.....	0.1923	|.....	0.1899	|.....
31	3.7589	-0.8369	||||||.....	-0.9427	||||||.....	-0.9413	||||||.....
32	0.6419	0.3719	||.....	0.4056	||.....	0.4013	||.....
33	1.3863	1.1678	|||||||||.....	1.2732	|||||||||.....	1.2838	|||||||||.....
34	-0.7765	0.7555	|||||.....	0.8357	|||||.....	0.8324	|||||.....
35	0.4055	-0.8014	||||||.....	-0.8750	||||||.....	-0.8723	||||||.....
36	0.5878	-1.2112	|||||||||.....	-1.3212	|||||||||.....	-1.3344	|||||||||.....
37	1.9169	-1.2933	|||||||||.....	-1.4141	|||||||||.....	-1.4330	|||||||||.....
38	0.3365	-0.0962	|.....	-0.1050	|.....	-0.1037	|.....
39	-0.4005	-0.8703	||||||.....	-0.9574	||||||.....	-0.9563	||||||.....
40	-0.0619	0.6149	||||.....	0.6738	||||.....	0.6690	||||.....
41	-1.7148	-0.2700	|.....	-0.3046	|.....	-0.3010	|.....
42	-1.5606	-0.4786	|||.....	-0.5379	|||.....	-0.5329	|||.....
43	-0.6162	-0.9073	|||||||.....	-1.0011	|||||||.....	-1.0011	|||||||.....
44	-2.6173	0.2500	|.....	0.2900	|.....	0.2866	|.....
45	-2.5639	-0.6480	||||.....	-0.7505	|||||.....	-0.7462	|||||.....
46	2.1282	0.3714	||.....	0.4068	||.....	0.4024	||.....
47	0.6931	1.5848	||||||||||||..	1.7281	||||||||||||..	1.7751	||||||||||||..
48	0.0953	1.4870	||||||||||||...	1.6271	||||||||||||...	1.6636	||||||||||||...
49	3.6687	-0.2467	|.....	-0.2773	|.....	-0.2740	|.....
50	3.5467	-0.8853	|||||||.....	-0.9921	|||||||.....	-0.9919	|||||||.....
51	1.7047	1.0048	|||||||.....	1.0971	|||||||.....	1.1000	|||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.1044	|||.....	0.0055	|.....	0.0416	|.....
12	3.8480	-0.4292	||||||||||||||	0.0902	||||||||||||||	-0.3671	||||||||||||||
13	0.1823	0.1393	||||.....	0.0098	|.....	-0.0639	||.....
14	3.6788	-0.2640	|||||||.....	0.0351	|||||.....	-0.2219	|||||||.....
15	1.4110	0.0323	|.....	0.0005	|.....	0.0066	|.....
16	-0.3425	-0.1581	|||||.....	0.0126	||.....	0.1007	|||.....
17	1.6292	-0.2785	||||||||.....	0.0371	||||||.....	-0.0893	|||.....
18	-1.0498	-0.0946	||.....	0.0046	|.....	0.0737	||.....
19	1.2809	-0.2602	|||||||.....	0.0325	|||||.....	-0.0343	|.....
20	0.9555	-0.0761	||.....	0.0030	|.....	0.0045	|.....
21	-0.4155	-0.1984	||||||.....	0.0197	|||.....	0.1302	|||||.....
22	3.8199	-0.0400	|.....	0.0008	|.....	-0.0341	|.....
23	1.5041	-0.0186	|.....	0.0002	|.....	-0.0048	|.....
24	1.7579	0.1438	||||.....	0.0104	|.....	0.0551	||.....
25	1.9169	0.1424	||||.....	0.0102	|.....	0.0646	||.....
26	2.2192	0.2748	||||||||.....	0.0368	||||||.....	0.1557	||||||.....
27	2.0015	0.3181	|||||||||.....	0.0481	|||||||.....	0.1552	||||||.....
28	2.3795	0.1479	||||.....	0.0111	|.....	0.0911	|||.....
29	1.2809	0.3196	||||||||||....	0.0474	|||||||.....	0.0421	|.....
30	2.8959	0.0450	|.....	0.0010	|.....	0.0331	|.....
31	3.7589	-0.2899	||||||||.....	0.0421	||||||.....	-0.2457	||||||||.....
32	0.6419	0.0654	|.....	0.0022	|.....	-0.0156	|.....
33	1.3863	0.2069	||||||.....	0.0211	|||.....	0.0396	|.....
34	-0.7765	0.1969	||||||.....	0.0195	|||.....	-0.1447	|||||.....
35	0.4055	-0.1480	||||.....	0.0110	|.....	0.0532	||.....
36	0.5878	-0.2191	|||||||.....	0.0235	|||.....	0.0585	||.....
37	1.9169	-0.2550	|||||||.....	0.0317	|||||.....	-0.1157	||||.....
38	0.3365	-0.0179	|.....	0.0002	|.....	0.0070	|.....
39	-0.4005	-0.2014	||||||.....	0.0203	|||.....	0.1314	|||||.....
40	-0.0619	0.1275	|||.....	0.0082	|.....	-0.0703	||.....
41	-1.7148	-0.0946	||.....	0.0046	|.....	0.0807	|||.....
42	-1.5606	-0.1601	|||||.....	0.0131	||.....	0.1344	|||||.....
43	-0.6162	-0.2253	|||||||.....	0.0254	||||.....	0.1584	||||||.....
44	-2.6173	0.1153	|||.....	0.0068	|.....	-0.1048	||||.....
45	-2.5639	-0.2961	||||||||.....	0.0444	|||||||.....	0.2683	||||||||.....
46	2.1282	0.0757	||.....	0.0029	|.....	0.0405	|.....
47	0.6931	0.2872	||||||||.....	0.0391	|||||.....	-0.0603	||.....
48	0.0953	0.3037	||||||||.....	0.0441	|||||||.....	-0.1500	||||||.....
49	3.6687	-0.0822	||.....	0.0035	|.....	-0.0690	||.....
50	3.5467	-0.2870	||||||||.....	0.0412	||||||.....	-0.2374	||||||||.....
51	1.7047	0.1866	||||||.....	0.0173	||.....	0.0668	||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	0.6039	|||.....	0.0055	|.....	0.0290	|.....
12	3.8480	-1.3581	||||||||.....	0.0902	||||||||||||||	0.0908	|||||||.....
13	0.1823	0.7800	|||||.....	0.0098	|.....	0.0309	|.....
14	3.6788	-0.8776	||||||.....	0.0351	|||||.....	0.0830	|||||||.....
15	1.4110	0.2001	|.....	0.0005	|.....	0.0255	|.....
16	-0.3425	-0.7639	|||||.....	0.0126	||.....	0.0411	||.....
17	1.6292	-1.6657	|||||||||||...	0.0371	||||||.....	0.0272	|.....
18	-1.0498	-0.3673	||.....	0.0046	|.....	0.0622	||||.....
19	1.2809	-1.6311	|||||||||||...	0.0325	|||||.....	0.0248	|.....
20	0.9555	-0.4805	||.....	0.0030	|.....	0.0245	|.....
21	-0.4155	-0.9379	||||||.....	0.0197	|||.....	0.0428	||.....
22	3.8199	-0.1276	|.....	0.0008	|.....	0.0895	|||||||.....
23	1.5041	-0.1134	|.....	0.0002	|.....	0.0261	|.....
24	1.7579	0.8384	|||||.....	0.0104	|.....	0.0286	|.....
25	1.9169	0.8000	|||||.....	0.0102	|.....	0.0307	|.....
26	2.2192	1.4238	|||||||||.....	0.0368	||||||.....	0.0359	|.....
27	2.0015	1.7496	|||||||||||...	0.0481	|||||||.....	0.0320	|.....
28	2.3795	0.7313	||||.....	0.0111	|.....	0.0393	|.....
29	1.2809	* 2.0030	||||||||||||||	0.0474	||||||.....	0.0248	|.....
30	2.8959	0.1899	|.....	0.0010	|.....	0.0532	|||.....
31	3.7589	-0.9413	||||||.....	0.0421	||||||.....	0.0866	|||||||.....
32	0.6419	0.4013	||.....	0.0022	|.....	0.0259	|.....
33	1.3863	1.2838	||||||||.....	0.0211	|||.....	0.0253	|.....
34	-0.7765	0.8324	|||||.....	0.0195	|||.....	0.0530	|||.....
35	0.4055	-0.8723	||||||.....	0.0110	|.....	0.0280	|.....
36	0.5878	-1.3344	||||||||.....	0.0235	|||.....	0.0263	|.....
37	1.9169	-1.4330	|||||||||.....	0.0317	|||||.....	0.0307	|.....
38	0.3365	-0.1037	|.....	0.0002	|.....	0.0288	|.....
39	-0.4005	-0.9563	||||||.....	0.0203	|||.....	0.0425	||.....
40	-0.0619	0.6690	||||.....	0.0082	|.....	0.0350	|.....
41	-1.7148	-0.3010	|.....	0.0046	|.....	0.0898	|||||||.....
42	-1.5606	-0.5329	|||.....	0.0131	||.....	0.0827	||||||.....
43	-0.6162	-1.0011	|||||||.....	0.0254	||||.....	0.0482	|||.....
44	-2.6173	0.2866	|.....	0.0068	|.....	0.1394	||||||||||||||
45	-2.5639	-0.7462	|||||.....	0.0444	||||||.....	0.1361	|||||||||||||.
46	2.1282	0.4024	||.....	0.0029	|.....	0.0342	|.....
47	0.6931	1.7751	||||||||||||..	0.0391	||||||.....	0.0255	|.....
48	0.0953	1.6636	|||||||||||...	0.0441	|||||||.....	0.0323	|.....
49	3.6687	-0.2740	|.....	0.0035	|.....	0.0826	|||||||.....
50	3.5467	-0.9919	|||||||.....	0.0412	||||||.....	0.0772	||||||.....
51	1.7047	1.1000	|||||||.....	0.0173	||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Means

Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	3.0057	1.7918	2.7260	-0.9342	2.1416	3.6187
12	2.4849	3.8480	1.8531	1.9949	1.3537	2.4997
13	2.2050	0.1823	1.3839	-1.2016	0.8897	1.9387
14	2.7912	3.6788	2.3664	1.3124	1.8260	3.1487
15	2.4069	1.4110	1.7224	-0.3114	1.2280	2.3399
16	0.4762	-0.3425	-1.5135	1.1711	-2.7153	-0.7863
17	0.8587	1.6292	-0.8726	2.5018	-1.8503	-0.2510
18	0.4187	-1.0498	-1.6100	0.5601	-2.8467	-0.8656
19	0.6780	1.2809	-1.1753	2.4563	-2.2569	-0.5059
20	1.5041	0.9555	0.2092	0.7463	-0.4492	0.7112
21	0.2776	-0.4155	-1.8464	1.4309	-3.1699	-1.0590
22	3.5439	3.8199	3.6280	0.1919	2.9004	4.8305
23	2.1713	1.5041	1.3275	0.1765	0.8314	1.8738
24	3.1987	1.7579	3.0494	-1.2916	2.4180	4.0489
25	3.2581	1.9169	3.1490	-1.2321	2.5020	4.1825
26	3.9853	2.2192	4.3678	-2.1486	3.5030	5.8442
27	4.1320	2.0015	4.6137	-2.6122	3.7009	6.1834
28	3.4689	2.3795	3.5023	-1.1227	2.7966	4.6596
29	3.9140	1.2809	4.2484	-2.9674	3.4065	5.6798
30	3.2809	2.8959	3.1873	-0.2913	2.5341	4.2339
31	2.7850	3.7589	2.3561	1.4028	1.8168	3.1354
32	2.1342	0.6419	1.2652	-0.6234	0.7662	1.8029
33	3.3742	1.3863	3.3436	-1.9573	2.6648	4.4447
34	1.6715	-0.7765	0.4897	-1.2663	-0.1072	0.9821
35	0.8198	0.4055	-0.9377	1.3432	-1.9375	-0.3062
36	0.5188	0.5878	-1.4422	2.0300	-2.6183	-0.7275
37	1.2296	1.9169	-0.2508	2.1677	-1.0322	0.2892
38	1.4839	0.3365	0.1753	0.1612	-0.4913	0.6792
39	0.2700	-0.4005	-1.8592	1.4587	-3.1873	-1.0693
40	1.9573	-0.0619	0.9688	-1.0306	0.4459	1.4755
41	0.0862	-1.7148	-2.1673	0.4525	-3.6105	-1.3194
42	-0.0305	-1.5606	-2.3628	0.8021	-3.8798	-1.4771
43	0.1044	-0.6162	-2.1368	1.5206	-3.5685	-1.2947
44	0.0677	-2.6173	-2.1983	-0.4190	-3.6532	-1.3445
45	-0.7985	-2.5639	-3.6501	1.0861	-5.6652	-2.5041
46	3.0204	2.1282	2.7507	-0.6224	2.1629	3.6513
47	3.3776	0.6931	3.3493	-2.6561	2.6696	4.4524
48	2.9232	0.0953	2.5876	-2.4923	2.0214	3.4367
49	3.3214	3.6687	3.2552	0.4135	2.5911	4.3254
50	2.6101	3.5467	2.0629	1.4839	1.5505	2.7612
51	3.4012	1.7047	3.3889	-1.6841	2.7025	4.5059

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnSoil

Inverse Prediction of X Individuals

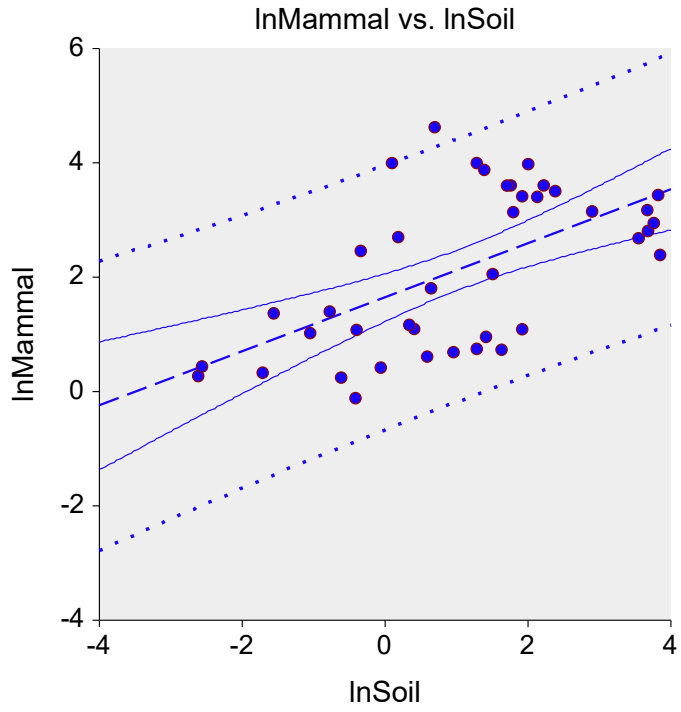
Row	lnInvert (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	3.0057	1.7918	2.7260	-0.9342	-0.4933	6.2536
12	2.4849	3.8480	1.8531	1.9949	-1.4145	5.2678
13	2.2050	0.1823	1.3839	-1.2016	-1.9190	4.7473
14	2.7912	3.6788	2.3664	1.3124	-0.8700	5.8448
15	2.4069	1.4110	1.7224	-0.3114	-1.5543	5.1222
16	0.4762	-0.3425	-1.5135	1.1711	-5.1809	1.6792
17	0.8587	1.6292	-0.8726	2.5018	-4.4380	2.3367
18	0.4187	-1.0498	-1.6100	0.5601	-5.2936	1.5813
19	0.6780	1.2809	-1.1753	2.4563	-4.7874	2.0247
20	1.5041	0.9555	0.2092	0.7463	-3.2114	3.4733
21	0.2776	-0.4155	-1.8464	1.4309	-5.5711	1.3423
22	3.5439	3.8199	3.6280	0.1919	0.4352	7.2956
23	2.1713	1.5041	1.3275	0.1765	-1.9801	4.6852
24	3.1987	1.7579	3.0494	-1.2916	-0.1577	6.6246
25	3.2581	1.9169	3.1490	-1.2321	-0.0549	6.7394
26	3.9853	2.2192	4.3678	-2.1486	1.1800	8.1672
27	4.1320	2.0015	4.6137	-2.6122	1.4242	8.4600
28	3.4689	2.3795	3.5023	-1.1227	0.3072	7.1490
29	3.9140	1.2809	4.2484	-2.9674	1.0608	8.0255
30	3.2809	2.8959	3.1873	-0.2913	-0.0156	6.7836
31	2.7850	3.7589	2.3561	1.4028	-0.8809	5.8331
32	2.1342	0.6419	1.2652	-0.6234	-2.0477	4.6167
33	3.3742	1.3863	3.3436	-1.9573	0.1449	6.9646
34	1.6715	-0.7765	0.4897	-1.2663	-2.8989	3.7738
35	0.8198	0.4055	-0.9377	1.3432	-4.5130	2.2693
36	0.5188	0.5878	-1.4422	2.0300	-5.0976	1.7518
37	1.2296	1.9169	-0.2508	2.1677	-3.7288	2.9858
38	1.4839	0.3365	0.1753	0.1612	-3.2493	3.4372
39	0.2700	-0.4005	-1.8592	1.4587	-5.5861	1.3294
40	1.9573	-0.0619	0.9688	-1.0306	-2.3710	4.2923
41	0.0862	-1.7148	-2.1673	0.4525	-5.9502	1.0203
42	-0.0305	-1.5606	-2.3628	0.8021	-6.1825	0.8255
43	0.1044	-0.6162	-2.1368	1.5206	-5.9141	1.0508
44	0.0677	-2.6173	-2.1983	-0.4190	-5.9870	0.9893
45	-0.7985	-2.5639	-3.6501	1.0861	-7.7361	-0.4332
46	3.0204	2.1282	2.7507	-0.6224	-0.4676	6.2818
47	3.3776	0.6931	3.3493	-2.6561	0.1508	6.9712
48	2.9232	0.0953	2.5876	-2.4923	-0.6378	6.0959
49	3.3214	3.6687	3.2552	0.4135	0.0543	6.8621
50	2.6101	3.5467	2.0629	1.4839	-1.1910	5.5027
51	3.4012	1.7047	3.3889	-1.6841	0.1913	7.0171

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnMammal	Rows Processed	58
Independent Variable	lnSoil	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.6437	Rows Prediction Only	0
Slope	0.4734	Sum of Frequencies	41
R-Squared	0.3482	Sum of Weights	41.0000
Correlation	0.5901	Coefficient of Variation	0.5241
Mean Square Error	1.262028	Square Root of MSE	1.1234

Linear Regression Report

Y = lnMammal X = lnSoil

Summary Statement
The equation of the straight line relating lnMammal and lnSoil is estimated as: lnMammal = (1.6437) + (0.4734) lnSoil using the 41 observations in this dataset. The y-intercept, the estimated value of lnMammal when lnSoil is zero, is 1.6437 with a standard error of 0.2068. The slope, the estimated change in lnMammal per unit change in lnSoil, is 0.4734 with a standard error of 0.1037. The value of R-Squared, the proportion of the variation in lnMammal that can be accounted for by variation in lnSoil, is 0.3482. The correlation between lnMammal and lnSoil is 0.5901.

A significance test that the slope is zero resulted in a t-value of 4.5645. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.4734. The lower limit of the 95% confidence interval for the slope is 0.2636 and the upper limit is 0.6831. The estimated intercept is 1.6437. The lower limit of the 95% confidence interval for the intercept is 1.2253 and the upper limit is 2.0620.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnMammal	lnSoil
Count	41	41
Mean	2.1436	1.0562
Standard Deviation	1.3740	1.7128
Minimum	-0.1165	-2.6173
Maximum	4.6240	3.8480

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.6437	0.4734
Lower 95% Confidence Limit	1.2253	0.2636
Upper 95% Confidence Limit	2.0620	0.6831
Standard Error	0.2068	0.1037
Standardized Coefficient	0.0000	0.5901
T Value	7.9470	4.5645
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	0.9936
Regression of Y on X	1.6437	0.4734
Inverse Regression from X on Y	0.7078	1.3594
Orthogonal Regression of Y and X	1.4128	0.6920

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.64367805589492) + (0.473354536224307) * (lnSoil)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.6437	0.9000	1.3238	1.9539
Bootstrap Mean	1.6426	0.9500	1.2651	2.0107
Bias (BM - OV)	-0.0010	0.9900	1.1080	2.1046
Bias Corrected	1.6447			
Standard Error	0.1897			
Slope				
Original Value	0.4734	0.9000	0.3621	0.5743
Bootstrap Mean	0.4775	0.9500	0.3347	0.5935
Bias (BM - OV)	0.0041	0.9900	0.2701	0.6324
Bias Corrected	0.4692			
Standard Error	0.0649			
Correlation				
Original Value	0.5901	0.9000	0.4628	0.7293
Bootstrap Mean	0.5932	0.9500	0.4395	0.7609
Bias (BM - OV)	0.0031	0.9900	0.4008	0.8250
Bias Corrected	0.5870			
Standard Error	0.0815			
R-Squared				
Original Value	0.3482	0.9000	0.1818	0.4931
Bootstrap Mean	0.3585	0.9500	0.1478	0.5206
Bias (BM - OV)	0.0103	0.9900	0.0891	0.5702
Bias Corrected	0.3379			
Standard Error	0.0946			
Standard Error of Estimate				
Original Value	1.1234	0.9000	0.9679	1.3267
Bootstrap Mean	1.0975	0.9500	0.9363	1.3612
Bias (BM - OV)	-0.0259	0.9900	0.8764	1.4417
Bias Corrected	1.1493			
Standard Error	0.1084			
Orthogonal Intercept				
Original Value	1.4128	0.9000	1.1029	1.8006
Bootstrap Mean	1.3867	0.9500	1.0394	1.9057
Bias (BM - OV)	-0.0260	0.9900	0.9219	2.2242
Bias Corrected	1.4388			
Standard Error	0.2239			
Orthogonal Slope				
Original Value	0.6920	0.9000	0.3992	0.8492
Bootstrap Mean	0.7186	0.9500	0.3071	0.8715
Bias (BM - OV)	0.0266	0.9900	0.0045	0.9200
Bias Corrected	0.6654			
Standard Error	0.1497			

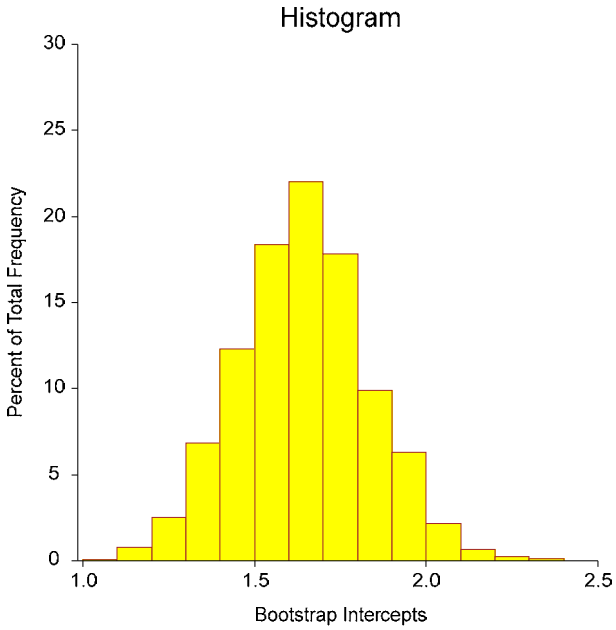
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

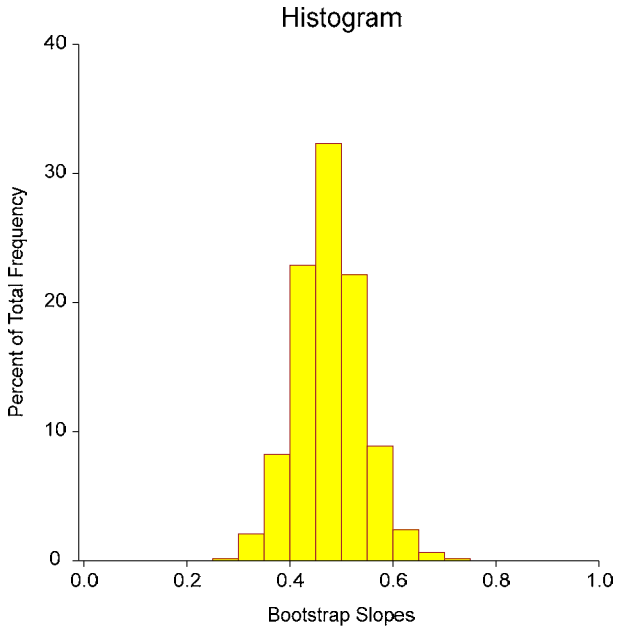
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

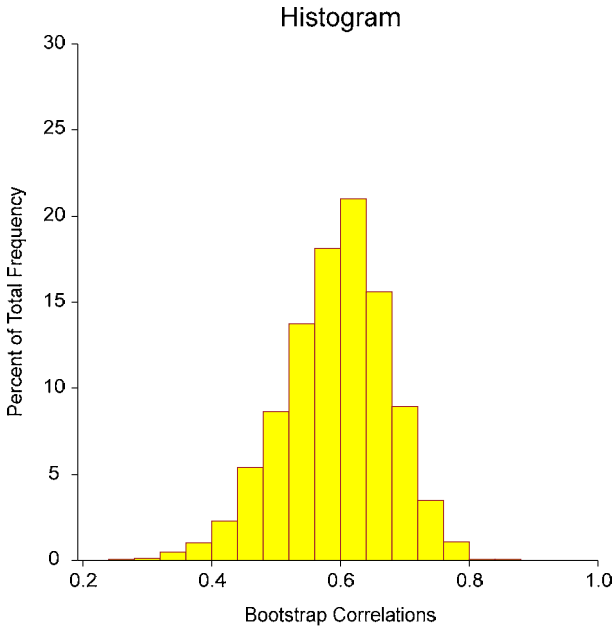
Linear Regression Report

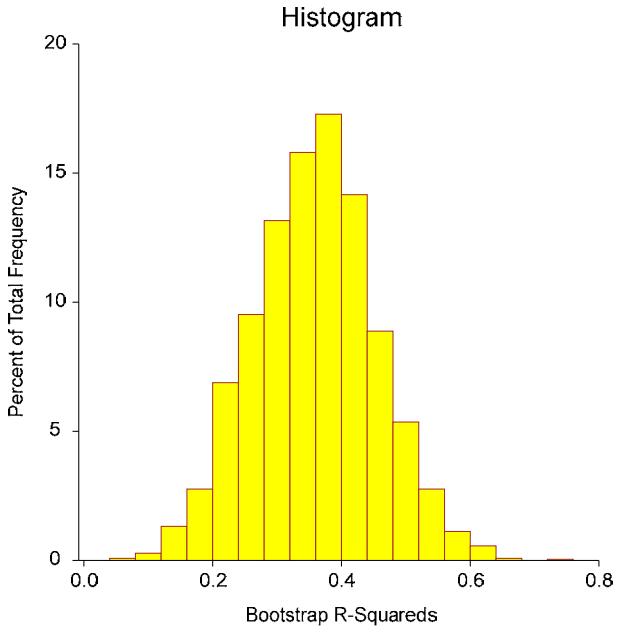
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Bootstrap Histograms Section



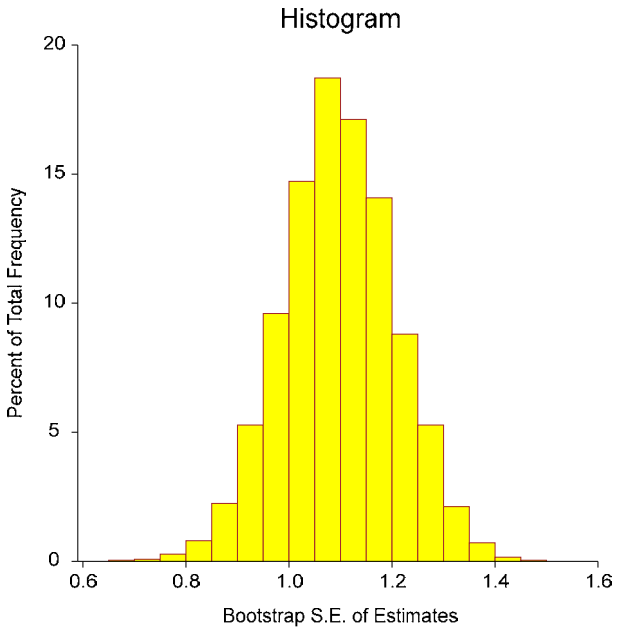


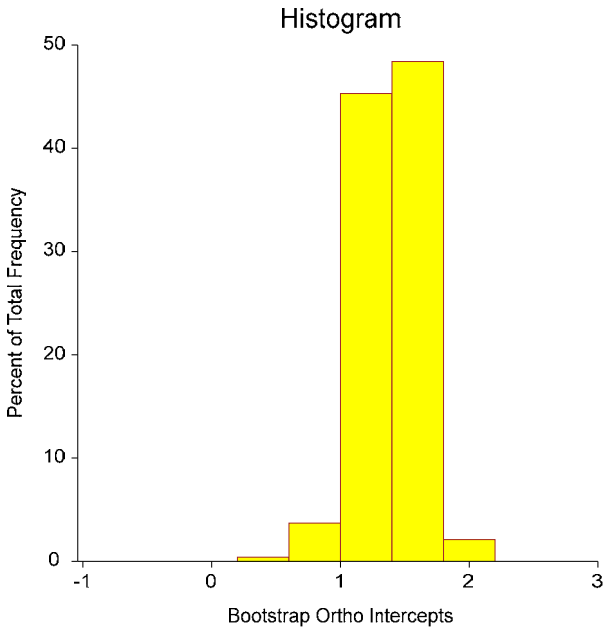


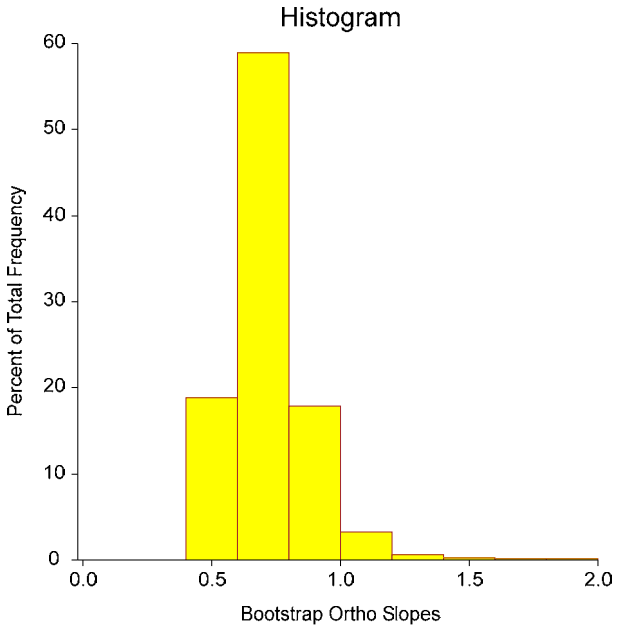


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.5901	0.3482	0.5719
Lower 95% Conf. Limit (r dist'n)	0.3409		
Upper 95% Conf. Limit (r dist'n)	0.7553		
Lower 95% Conf. Limit (Fisher's z)	0.3451		0.3206
Upper 95% Conf. Limit (Fisher's z)	0.7598		0.7479
Adjusted (Rbar)		0.3315	
T-Value for H0: Rho = 0	4.5645	4.5645	4.3532
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0001
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	188.4024	188.4024			
Slope	1	26.29345	26.29345	20.8343	0.0000	0.9936
Error	39	49.21909	1.262028			
Lack of Fit	37	41.23403	1.114433	0.2791	0.9622	
Pure Error	2	7.985058	3.992529			
Adj. Total	40	75.51254	1.887813			
Total	41	263.9149				

s = Square Root(1.262028) = 1.1234

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	43.30437	87.88912	0.03389676	-0.009000641
1	43.30437	163.0859	148.3759	-0.009000641	0.008521686
2 (Y'Y)			263.9149		
Determinant		4811.254			0.000207846

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.04277866	-0.01135906
1	-0.01135906	0.01075461

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9631	0.201044	Yes
Anderson Darling	0.4099	0.343615	Yes
D'Agostino Skewness	1.1736	0.240562	Yes
D'Agostino Kurtosis	-0.6192	0.535795	Yes
D'Agostino Omnibus	1.7607	0.414641	Yes
Constant Residual Variance?			
Modified Levene Test	0.1059	0.746581	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.2791	0.962177	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

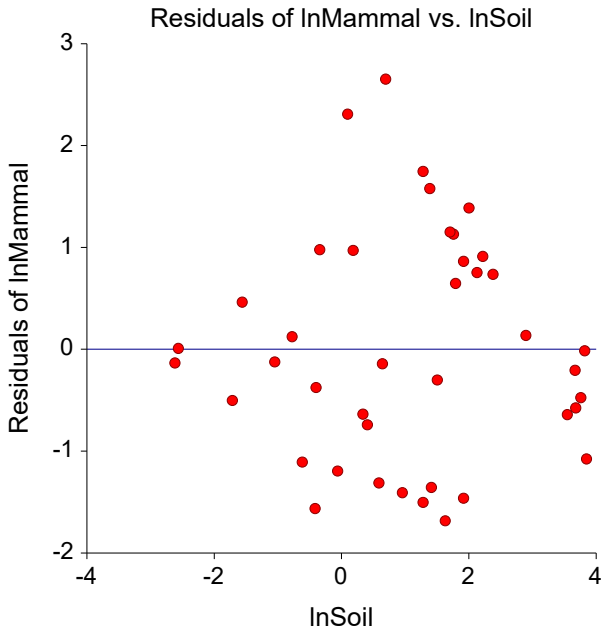
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

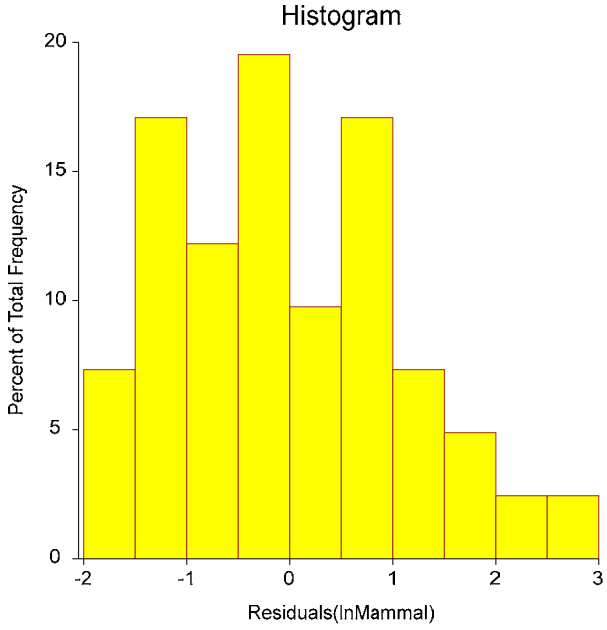
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

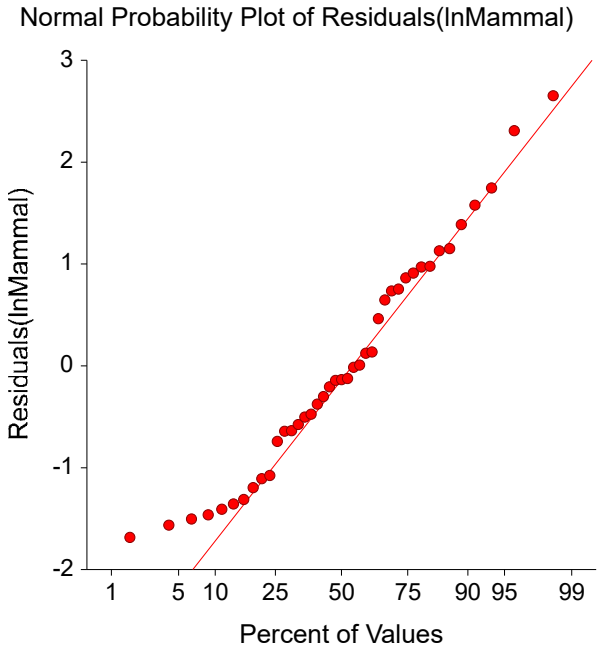
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Original Data Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual
11	1.7918	3.1384	2.4918	0.6466
12	3.8480	2.3888	3.4652	-1.0764
13	0.1823	2.7007	1.7300	0.9707
14	3.6788	2.8094	3.3851	-0.5757
15	1.4110	0.9555	2.3116	-1.3561
16	-0.3425	2.4592	1.4816	0.9776
17	1.6292	0.7308	2.4149	-1.6841
18	-1.0498	1.0225	1.1467	-0.1243
19	1.2809	0.7467	2.2500	-1.5033
20	0.9555	0.6881	2.0960	-1.4078
21	-0.4155	-0.1165	1.4470	-1.5635
22	3.8199	3.4372	3.4518	-0.0146
23	1.5041	2.0541	2.3556	-0.3015
24	1.7579	3.6055	2.4758	1.1297
25	1.9169	3.4144	2.5511	0.8634
26	2.2192	3.6055	2.6941	0.9113
27	2.0015	3.9782	2.5911	1.3872
28	2.3795	3.5056	2.7700	0.7355
29	1.2809	3.9964	2.2500	1.7464
30	2.8959	3.1506	3.0145	0.1361
31	3.7589	2.9481	3.4230	-0.4748
32	0.6419	1.8050	1.9475	-0.1425
33	1.3863	3.8774	2.2999	1.5775
34	-0.7765	1.3995	1.2761	0.1234
35	0.4055	1.0942	1.8356	-0.7414
36	0.5878	0.6098	1.9219	-1.3121
37	1.9169	1.0886	2.5511	-1.4625
38	0.3365	1.1663	1.8029	-0.6367
39	-0.4005	1.0784	1.4541	-0.3757
40	-0.0619	0.4187	1.6144	-1.1957
41	-1.7148	0.3293	0.8320	-0.5027
42	-1.5606	1.3678	0.9049	0.4629
43	-0.6162	0.2443	1.3520	-1.1078
44	-2.6173	0.2700	0.4048	-0.1347
45	-2.5639	0.4383	0.4300	0.0082
46	2.1282	3.4045	2.6511	0.7534
47	0.6931	4.6240	1.9718	2.6522
48	0.0953	3.9973	1.6888	2.3085
49	3.6687	3.1739	3.3803	-0.2064
50	3.5467	2.6810	3.3225	-0.6415
51	1.7047	3.6019	2.4506	1.1512

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Confidence Limits of Means

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
11	1.7918	3.1384	2.4918	0.1913	2.1049	2.8788
12	3.8480	2.3888	3.4652	0.3385	2.7804	4.1499
13	0.1823	2.7007	1.7300	0.1975	1.3306	2.1294
14	3.6788	2.8094	3.3851	0.3237	2.7304	4.0397
15	1.4110	0.9555	2.3116	0.1793	1.9490	2.6742
16	-0.3425	2.4592	1.4816	0.2276	1.0211	1.9420
17	1.6292	0.7308	2.4149	0.1852	2.0402	2.7896
18	-1.0498	1.0225	1.1467	0.2801	0.5801	1.7134
19	1.2809	0.7467	2.2500	0.1770	1.8920	2.6080
20	0.9555	0.6881	2.0960	0.1758	1.7405	2.4515
21	-0.4155	-0.1165	1.4470	0.2325	0.9766	1.9174
22	3.8199	3.4372	3.4518	0.3360	2.7721	4.1316
23	1.5041	2.0541	2.3556	0.1815	1.9885	2.7227
24	1.7579	3.6055	2.4758	0.1899	2.0916	2.8600
25	1.9169	3.4144	2.5511	0.1968	2.1529	2.9492
26	2.2192	3.6055	2.6941	0.2129	2.2635	3.1248
27	2.0015	3.9782	2.5911	0.2010	2.1846	2.9976
28	2.3795	3.5056	2.7700	0.2227	2.3195	3.2206
29	1.2809	3.9964	2.2500	0.1770	1.8920	2.6080
30	2.8959	3.1506	3.0145	0.2592	2.4902	3.5387
31	3.7589	2.9481	3.4230	0.3307	2.7541	4.0918
32	0.6419	1.8050	1.9475	0.1806	1.5821	2.3129
33	1.3863	3.8774	2.2999	0.1788	1.9383	2.6615
34	-0.7765	1.3995	1.2761	0.2587	0.7529	1.7993
35	0.4055	1.0942	1.8356	0.1880	1.4554	2.2158
36	0.5878	0.6098	1.9219	0.1820	1.5537	2.2901
37	1.9169	1.0886	2.5511	0.1968	2.1529	2.9492
38	0.3365	1.1663	1.8029	0.1907	1.4173	2.1886
39	-0.4005	1.0784	1.4541	0.2315	0.9858	1.9224
40	-0.0619	0.4187	1.6144	0.2103	1.1890	2.0398
41	-1.7148	0.3293	0.8320	0.3367	0.1510	1.5130
42	-1.5606	1.3678	0.9049	0.3232	0.2513	1.5586
43	-0.6162	0.2443	1.3520	0.2467	0.8530	1.8510
44	-2.6173	0.2700	0.4048	0.4194	-0.4436	1.2531
45	-2.5639	0.4383	0.4300	0.4144	-0.4082	1.2682
46	2.1282	3.4045	2.6511	0.2077	2.2310	3.0712
47	0.6931	4.6240	1.9718	0.1794	1.6088	2.3347
48	0.0953	3.9973	1.6888	0.2018	1.2807	2.0969
49	3.6687	3.1739	3.3803	0.3228	2.7274	4.0331
50	3.5467	2.6810	3.3225	0.3122	2.6910	3.9541
51	1.7047	3.6019	2.4506	0.1879	2.0706	2.8307

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Predicted Values and Prediction Limits

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
11	1.7918	3.1384	2.4918	1.1396	0.1868	4.7968
12	3.8480	2.3888	3.4652	1.1733	1.0919	5.8384
13	0.1823	2.7007	1.7300	1.1406	-0.5771	4.0371
14	3.6788	2.8094	3.3851	1.1691	1.0204	5.7498
15	1.4110	0.9555	2.3116	1.1376	0.0105	4.6126
16	-0.3425	2.4592	1.4816	1.1462	-0.8369	3.8000
17	1.6292	0.7308	2.4149	1.1386	0.1119	4.7179
18	-1.0498	1.0225	1.1467	1.1578	-1.1951	3.4886
19	1.2809	0.7467	2.2500	1.1373	-0.0503	4.5503
20	0.9555	0.6881	2.0960	1.1371	-0.2040	4.3959
21	-0.4155	-0.1165	1.4470	1.1472	-0.8735	3.7675
22	3.8199	3.4372	3.4518	1.1726	1.0801	5.8236
23	1.5041	2.0541	2.3556	1.1380	0.0539	4.6574
24	1.7579	3.6055	2.4758	1.1393	0.1712	4.7803
25	1.9169	3.4144	2.5511	1.1405	0.2442	4.8580
26	2.2192	3.6055	2.6941	1.1434	0.3814	5.0069
27	2.0015	3.9782	2.5911	1.1412	0.2827	4.8995
28	2.3795	3.5056	2.7700	1.1453	0.4535	5.0866
29	1.2809	3.9964	2.2500	1.1373	-0.0503	4.5503
30	2.8959	3.1506	3.0145	1.1529	0.6825	5.3465
31	3.7589	2.9481	3.4230	1.1711	1.0543	5.7916
32	0.6419	1.8050	1.9475	1.1378	-0.3540	4.2490
33	1.3863	3.8774	2.2999	1.1375	-0.0010	4.6008
34	-0.7765	1.3995	1.2761	1.1528	-1.0556	3.6078
35	0.4055	1.0942	1.8356	1.1390	-0.4683	4.1395
36	0.5878	0.6098	1.9219	1.1381	-0.3800	4.2238
37	1.9169	1.0886	2.5511	1.1405	0.2442	4.8580
38	0.3365	1.1663	1.8029	1.1395	-0.5018	4.1077
39	-0.4005	1.0784	1.4541	1.1470	-0.8659	3.7742
40	-0.0619	0.4187	1.6144	1.1429	-0.6974	3.9262
41	-1.7148	0.3293	0.8320	1.1728	-1.5402	3.2041
42	-1.5606	1.3678	0.9049	1.1690	-1.4595	3.2694
43	-0.6162	0.2443	1.3520	1.1502	-0.9744	3.6784
44	-2.6173	0.2700	0.4048	1.1991	-2.0207	2.8303
45	-2.5639	0.4383	0.4300	1.1974	-1.9919	2.8520
46	2.1282	3.4045	2.6511	1.1424	0.3403	4.9619
47	0.6931	4.6240	1.9718	1.1376	-0.3293	4.2729
48	0.0953	3.9973	1.6888	1.1414	-0.6199	3.9974
49	3.6687	3.1739	3.3803	1.1688	1.0160	5.7445
50	3.5467	2.6810	3.3225	1.1660	0.9641	5.6810
51	1.7047	3.6019	2.4506	1.1390	0.1468	4.7545

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Working-Hotelling Simultaneous Confidence Band

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
11	1.7918	3.1384	2.4918	0.1913	1.9466	3.0370
12	3.8480	2.3888	3.4652	0.3385	2.5004	4.4299
13	0.1823	2.7007	1.7300	0.1975	1.1672	2.2927
14	3.6788	2.8094	3.3851	0.3237	2.4627	4.3074
15	1.4110	0.9555	2.3116	0.1793	1.8007	2.8224
16	-0.3425	2.4592	1.4816	0.2276	0.8328	2.1303
17	1.6292	0.7308	2.4149	0.1852	1.8870	2.9428
18	-1.0498	1.0225	1.1467	0.2801	0.3484	1.9451
19	1.2809	0.7467	2.2500	0.1770	1.7456	2.7544
20	0.9555	0.6881	2.0960	0.1758	1.5951	2.5969
21	-0.4155	-0.1165	1.4470	0.2325	0.7843	2.1097
22	3.8199	3.4372	3.4518	0.3360	2.4942	4.4095
23	1.5041	2.0541	2.3556	0.1815	1.8384	2.8729
24	1.7579	3.6055	2.4758	0.1899	1.9345	3.0171
25	1.9169	3.4144	2.5511	0.1968	1.9901	3.1120
26	2.2192	3.6055	2.6941	0.2129	2.0874	3.3009
27	2.0015	3.9782	2.5911	0.2010	2.0183	3.1638
28	2.3795	3.5056	2.7700	0.2227	2.1353	3.4048
29	1.2809	3.9964	2.2500	0.1770	1.7456	2.7544
30	2.8959	3.1506	3.0145	0.2592	2.2758	3.7531
31	3.7589	2.9481	3.4230	0.3307	2.4806	4.3653
32	0.6419	1.8050	1.9475	0.1806	1.4327	2.4623
33	1.3863	3.8774	2.2999	0.1788	1.7905	2.8093
34	-0.7765	1.3995	1.2761	0.2587	0.5390	2.0133
35	0.4055	1.0942	1.8356	0.1880	1.2999	2.3713
36	0.5878	0.6098	1.9219	0.1820	1.4031	2.4407
37	1.9169	1.0886	2.5511	0.1968	1.9901	3.1120
38	0.3365	1.1663	1.8029	0.1907	1.2596	2.3463
39	-0.4005	1.0784	1.4541	0.2315	0.7943	2.1139
40	-0.0619	0.4187	1.6144	0.2103	1.0151	2.2137
41	-1.7148	0.3293	0.8320	0.3367	-0.1276	1.7915
42	-1.5606	1.3678	0.9049	0.3232	-0.0160	1.8259
43	-0.6162	0.2443	1.3520	0.2467	0.6489	2.0551
44	-2.6173	0.2700	0.4048	0.4194	-0.7905	1.6001
45	-2.5639	0.4383	0.4300	0.4144	-0.7510	1.6110
46	2.1282	3.4045	2.6511	0.2077	2.0592	3.2430
47	0.6931	4.6240	1.9718	0.1794	1.4604	2.4832
48	0.0953	3.9973	1.6888	0.2018	1.1138	2.2638
49	3.6687	3.1739	3.3803	0.3228	2.4604	4.3001
50	3.5467	2.6810	3.3225	0.3122	2.4327	4.2124
51	1.7047	3.6019	2.4506	0.1879	1.9152	2.9861

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Section

Row	lnSoil (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
11	1.7918	3.1384	2.4918	0.6466	0.5841	20.6021
12	3.8480	2.3888	3.4652	-1.0764	-1.0049	45.0606
13	0.1823	2.7007	1.7300	0.9707	0.8777	35.9430
14	3.6788	2.8094	3.3851	-0.5757	-0.5351	20.4907
15	1.4110	0.9555	2.3116	-1.3561	-1.2228	141.9202
16	-0.3425	2.4592	1.4816	0.9776	0.8887	39.7535
17	1.6292	0.7308	2.4149	-1.6841	-1.5199	230.4605
18	-1.0498	1.0225	1.1467	-0.1243	-0.1142	12.1560
19	1.2809	0.7467	2.2500	-1.5033	-1.3551	201.3326
20	0.9555	0.6881	2.0960	-1.4078	-1.2688	204.5877
21	-0.4155	-0.1165	1.4470	-1.5635	-1.4226	1341.6927
22	3.8199	3.4372	3.4518	-0.0146	-0.0137	0.4260
23	1.5041	2.0541	2.3556	-0.3015	-0.2720	14.6786
24	1.7579	3.6055	2.4758	1.1297	1.0203	31.3335
25	1.9169	3.4144	2.5511	0.8634	0.7806	25.2861
26	2.2192	3.6055	2.6941	0.9113	0.8262	25.2767
27	2.0015	3.9782	2.5911	1.3872	1.2550	34.8686
28	2.3795	3.5056	2.7700	0.7355	0.6680	20.9813
29	1.2809	3.9964	2.2500	1.7464	1.5742	43.6985
30	2.8959	3.1506	3.0145	0.1361	0.1245	4.3206
31	3.7589	2.9481	3.4230	-0.4748	-0.4423	16.1066
32	0.6419	1.8050	1.9475	-0.1425	-0.1285	7.8946
33	1.3863	3.8774	2.2999	1.5775	1.4224	40.6853
34	-0.7765	1.3995	1.2761	0.1234	0.1129	8.8197
35	0.4055	1.0942	1.8356	-0.7414	-0.6694	67.7643
36	0.5878	0.6098	1.9219	-1.3121	-1.1837	215.1883
37	1.9169	1.0886	2.5511	-1.4625	-1.3223	134.3516
38	0.3365	1.1663	1.8029	-0.6367	-0.5751	54.5909
39	-0.4005	1.0784	1.4541	-0.3757	-0.3418	34.8384
40	-0.0619	0.4187	1.6144	-1.1957	-1.0835	285.5623
41	-1.7148	0.3293	0.8320	-0.5027	-0.4690	152.6453
42	-1.5606	1.3678	0.9049	0.4629	0.4302	33.8394
43	-0.6162	0.2443	1.3520	-1.1078	-1.0107	453.5270
44	-2.6173	0.2700	0.4048	-0.1347	-0.1293	49.8995
45	-2.5639	0.4383	0.4300	0.0082	0.0079	1.8789
46	2.1282	3.4045	2.6511	0.7534	0.6824	22.1305
47	0.6931	4.6240	1.9718	2.6522	2.3916	57.3576
48	0.0953	3.9973	1.6888	2.3085	2.0889	57.7515
49	3.6687	3.1739	3.3803	-0.2064	-0.1918	6.5026
50	3.5467	2.6810	3.3225	-0.6415	-0.5945	23.9283
51	1.7047	3.6019	2.4506	1.1512	1.0394	31.9623

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Residual Diagnostics Section

Row	lnSoil (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
11	1.7918	0.6466	0.5791	0.0290	0.0051	1.2839
12	3.8480	-1.0764	-1.0050	0.0908	0.0504	1.2617
13	0.1823	0.9707	0.8751	0.0309	0.0123	1.2697
14	3.6788	-0.5757	-0.5302	0.0830	0.0130	1.2857
15	1.4110	-1.3561	-1.2308	0.0255	0.0195	1.2456
16	-0.3425	0.9776	0.8862	0.0411	0.0169	1.2690
17	1.6292	-1.6841	-1.5468	0.0272	0.0323	1.2185
18	-1.0498	-0.1243	-0.1128	0.0622	0.0004	1.2948
19	1.2809	-1.5033	-1.3703	0.0248	0.0234	1.2343
20	0.9555	-1.4078	-1.2791	0.0245	0.0202	1.2418
21	-0.4155	-1.5635	-1.4422	0.0428	0.0453	1.2280
22	3.8199	-0.0146	-0.0135	0.0895	0.0000	1.2952
23	1.5041	-0.3015	-0.2687	0.0261	0.0010	1.2928
24	1.7579	1.1297	1.0209	0.0286	0.0153	1.2607
25	1.9169	0.8634	0.7766	0.0307	0.0097	1.2750
26	2.2192	0.9113	0.8228	0.0359	0.0127	1.2726
27	2.0015	1.3872	1.2646	0.0320	0.0260	1.2429
28	2.3795	0.7355	0.6632	0.0393	0.0091	1.2804
29	1.2809	1.7464	1.6057	0.0248	0.0315	1.2129
30	2.8959	0.1361	0.1230	0.0532	0.0004	1.2947
31	3.7589	-0.4748	-0.4377	0.0866	0.0093	1.2887
32	0.6419	-0.1425	-0.1269	0.0259	0.0002	1.2947
33	1.3863	1.5775	1.4419	0.0253	0.0263	1.2280
34	-0.7765	0.1234	0.1115	0.0530	0.0004	1.2948
35	0.4055	-0.7414	-0.6646	0.0280	0.0065	1.2804
36	0.5878	-1.3121	-1.1900	0.0263	0.0189	1.2487
37	1.9169	-1.4625	-1.3355	0.0307	0.0277	1.2372
38	0.3365	-0.6367	-0.5701	0.0288	0.0049	1.2843
39	-0.4005	-0.3757	-0.3379	0.0425	0.0026	1.2914
40	-0.0619	-1.1957	-1.0860	0.0350	0.0213	1.2563
41	-1.7148	-0.5027	-0.4643	0.0898	0.0109	1.2879
42	-1.5606	0.4629	0.4257	0.0827	0.0083	1.2891
43	-0.6162	-1.1078	-1.0110	0.0482	0.0259	1.2613
44	-2.6173	-0.1347	*-0.1276	0.1394	0.0014	1.2947
45	-2.5639	0.0082	*0.0078	0.1361	0.0000	1.2952
46	2.1282	0.7534	0.6777	0.0342	0.0082	1.2798
47	0.6931	2.6522	*2.5555	0.0255	0.0749	1.1053
48	0.0953	2.3085	*2.1880	0.0323	0.0727	1.1503
49	3.6687	-0.2064	-0.1894	0.0826	0.0017	1.2940
50	3.5467	-0.6415	-0.5895	0.0772	0.0148	1.2835
51	1.7047	1.1512	1.0405	0.0280	0.0155	1.2594

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
11	0.5791	0.1001	0.0051	1.0659	0.0567	0.0399
12	-1.0050	-0.3176	0.0504	1.0993	0.0042	-0.2716
13	0.8751	0.1563	0.0123	1.0444	0.1557	-0.0717
14	-0.5302	-0.1595	0.0130	1.1319	-0.0024	-0.1340
15	-1.2308	-0.1990	0.0195	0.9996	-0.1435	-0.0408
16	0.8862	0.1834	0.0169	1.0544	0.1818	-0.1168
17	-1.5468	-0.2586	0.0323	0.9583	-0.1638	-0.0830
18	-0.1128	-0.0290	0.0004	1.1224	-0.0274	0.0226
19	-1.3703	-0.2186	0.0234	0.9808	-0.1686	-0.0288
20	-1.2791	-0.2026	0.0202	0.9924	-0.1779	0.0120
21	-1.4422	-0.3051	0.0453	0.9892	-0.3013	0.2003
22	-0.0135	-0.0042	0.0000	* 1.1568	0.0000	-0.0036
23	-0.2687	-0.0440	0.0010	1.0775	-0.0301	-0.0113
24	1.0209	0.1751	0.0153	1.0272	0.1017	0.0671
25	0.7766	0.1382	0.0097	1.0530	0.0713	0.0627
26	0.8228	0.1588	0.0127	1.0547	0.0634	0.0900
27	1.2646	0.2300	0.0260	1.0020	0.1109	0.1122
28	0.6632	0.1342	0.0091	1.0715	0.0459	0.0827
29	1.6057	0.2562	0.0315	0.9472	0.1975	0.0337
30	0.1230	0.0292	0.0004	1.1117	0.0054	0.0215
31	-0.4377	-0.1348	0.0093	1.1417	-0.0002	-0.1143
32	-0.1269	-0.0207	0.0002	1.0804	-0.0196	0.0049
33	1.4419	0.2324	0.0263	0.9715	0.1699	0.0445
34	0.1115	0.0264	0.0004	1.1116	0.0254	-0.0194
35	-0.6646	-0.1128	0.0065	1.0589	-0.1108	0.0405
36	-1.1900	-0.1954	0.0189	1.0054	-0.1874	0.0521
37	-1.3355	-0.2377	0.0277	0.9914	-0.1226	-0.1078
38	-0.5701	-0.0982	0.0049	1.0662	-0.0970	0.0384
39	-0.3379	-0.0712	0.0026	1.0935	-0.0703	0.0464
40	-1.0860	-0.2070	0.0213	1.0268	-0.2069	0.1141
41	-0.4643	-0.1458	0.0109	1.1443	-0.1304	0.1245
42	0.4257	0.1278	0.0083	1.1375	0.1157	-0.1074
43	-1.0110	-0.2276	0.0259	1.0495	-0.2220	0.1600
44	-0.1276	-0.0514	0.0014	* 1.2229	-0.0429	0.0467
45	0.0078	0.0031	0.0000	* 1.2192	0.0026	-0.0028
46	0.6777	0.1275	0.0082	1.0647	0.0552	0.0682
47	* 2.5555	0.4135	0.0749	0.7871	0.3889	-0.0868
48	* 2.1880	0.3995	0.0727	0.8585	0.3991	-0.1973
49	-0.1894	-0.0568	0.0017	1.1459	-0.0009	-0.0477
50	-0.5895	-0.1706	0.0148	1.1209	-0.0066	-0.1411
51	1.0405	0.1765	0.0155	1.0244	0.1064	0.0632

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier Detection Chart

Row	lnSoil (X)	Residual		Standardized Residual		RStudent	
11	1.7918	0.6466	|||.....	0.5841	|||.....	0.5791	|||.....
12	3.8480	-1.0764	||||||.....	-1.0049	||||||.....	-1.0050	|||||.....
13	0.1823	0.9707	|||||.....	0.8777	|||||.....	0.8751	|||||.....
14	3.6788	-0.5757	|||.....	-0.5351	|||.....	-0.5302	|||.....
15	1.4110	-1.3561	|||||||.....	-1.2228	|||||||.....	-1.2308	|||||||.....
16	-0.3425	0.9776	|||||.....	0.8887	|||||.....	0.8862	|||||.....
17	1.6292	-1.6841	||||||||.....	-1.5199	||||||||.....	-1.5468	||||||||.....
18	-1.0498	-0.1243	|.....	-0.1142	|.....	-0.1128	|.....
19	1.2809	-1.5033	|||||||.....	-1.3551	|||||||.....	-1.3703	|||||||.....
20	0.9555	-1.4078	||||||.....	-1.2688	||||||.....	-1.2791	||||||.....
21	-0.4155	-1.5635	|||||||.....	-1.4226	|||||||.....	-1.4422	|||||||.....
22	3.8199	-0.0146	|.....	-0.0137	|.....	-0.0135	|.....
23	1.5041	-0.3015	|.....	-0.2720	|.....	-0.2687	|.....
24	1.7579	1.1297	||||||.....	1.0203	||||||.....	1.0209	|||||.....
25	1.9169	0.8634	||||.....	0.7806	||||.....	0.7766	||||.....
26	2.2192	0.9113	|||||.....	0.8262	|||||.....	0.8228	||||.....
27	2.0015	1.3872	|||||||.....	1.2550	|||||||.....	1.2646	|||||||.....
28	2.3795	0.7355	||||.....	0.6680	||||.....	0.6632	|||.....
29	1.2809	1.7464	||||||||.....	1.5742	||||||||.....	1.6057	||||||||.....
30	2.8959	0.1361	|.....	0.1245	|.....	0.1230	|.....
31	3.7589	-0.4748	||.....	-0.4423	||.....	-0.4377	||.....
32	0.6419	-0.1425	|.....	-0.1285	|.....	-0.1269	|.....
33	1.3863	1.5775	|||||||.....	1.4224	|||||||.....	1.4419	|||||||.....
34	-0.7765	0.1234	|.....	0.1129	|.....	0.1115	|.....
35	0.4055	-0.7414	||||.....	-0.6694	||||.....	-0.6646	|||.....
36	0.5878	-1.3121	|||||||.....	-1.1837	|||||||.....	-1.1900	||||||.....
37	1.9169	-1.4625	||||||||.....	-1.3223	||||||||.....	-1.3355	|||||||.....
38	0.3365	-0.6367	|||.....	-0.5751	|||.....	-0.5701	|||.....
39	-0.4005	-0.3757	||.....	-0.3418	||.....	-0.3379	|.....
40	-0.0619	-1.1957	||||||.....	-1.0835	||||||.....	-1.0860	||||||.....
41	-1.7148	-0.5027	||.....	-0.4690	||.....	-0.4643	||.....
42	-1.5606	0.4629	||.....	0.4302	||.....	0.4257	||.....
43	-0.6162	-1.1078	||||||.....	-1.0107	||||||.....	-1.0110	|||||.....
44	-2.6173	-0.1347	|.....	-0.1293	|.....	-0.1276	|.....
45	-2.5639	0.0082	|.....	0.0079	|.....	0.0078	|.....
46	2.1282	0.7534	||||.....	0.6824	||||.....	0.6777	|||.....
47	0.6931	2.6522	||||||||||||||	2.3916	||||||||||||||	* 2.5555	||||||||||||||
48	0.0953	2.3085	||||||||||||..	2.0889	||||||||||||..	* 2.1880	|||||||||||...
49	3.6687	-0.2064	|.....	-0.1918	|.....	-0.1894	|.....
50	3.5467	-0.6415	|||.....	-0.5945	|||.....	-0.5895	|||.....
51	1.7047	1.1512	||||||.....	1.0394	||||||.....	1.0405	||||||.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influence Detection Chart

Row	lnSoil (X)	DFFITS		Cook's D		DFBETAS(1)	
11	1.7918	0.1001	|||.....	0.0051	|.....	0.0399	||.....
12	3.8480	-0.3176	||||||||||....	0.0504	|||||||||.....	-0.2716	||||||||||||||
13	0.1823	0.1563	|||||.....	0.0123	||.....	-0.0717	|||.....
14	3.6788	-0.1595	|||||.....	0.0130	||.....	-0.1340	||||||.....
15	1.4110	-0.1990	||||||.....	0.0195	|||.....	-0.0408	||.....
16	-0.3425	0.1834	||||||.....	0.0169	|||.....	-0.1168	||||||.....
17	1.6292	-0.2586	||||||||.....	0.0323	||||||.....	-0.0830	||||.....
18	-1.0498	-0.0290	|.....	0.0004	|.....	0.0226	|.....
19	1.2809	-0.2186	|||||||.....	0.0234	||||.....	-0.0288	|.....
20	0.9555	-0.2026	|||||||.....	0.0202	||||.....	0.0120	|.....
21	-0.4155	-0.3051	||||||||||....	0.0453	||||||||.....	0.2003	||||||||||....
22	3.8199	-0.0042	|.....	0.0000	|.....	-0.0036	|.....
23	1.5041	-0.0440	|.....	0.0010	|.....	-0.0113	|.....
24	1.7579	0.1751	||||||.....	0.0153	|||.....	0.0671	|||.....
25	1.9169	0.1382	||||.....	0.0097	|.....	0.0627	|||.....
26	2.2192	0.1588	|||||.....	0.0127	||.....	0.0900	||||.....
27	2.0015	0.2300	|||||||.....	0.0260	|||||.....	0.1122	||||||.....
28	2.3795	0.1342	||||.....	0.0091	|.....	0.0827	||||.....
29	1.2809	0.2562	||||||||.....	0.0315	||||||.....	0.0337	|.....
30	2.8959	0.0292	|.....	0.0004	|.....	0.0215	|.....
31	3.7589	-0.1348	||||.....	0.0093	|.....	-0.1143	||||||.....
32	0.6419	-0.0207	|.....	0.0002	|.....	0.0049	|.....
33	1.3863	0.2324	|||||||.....	0.0263	|||||.....	0.0445	||.....
34	-0.7765	0.0264	|.....	0.0004	|.....	-0.0194	|.....
35	0.4055	-0.1128	||||.....	0.0065	|.....	0.0405	||.....
36	0.5878	-0.1954	||||||.....	0.0189	|||.....	0.0521	||.....
37	1.9169	-0.2377	|||||||.....	0.0277	|||||.....	-0.1078	|||||.....
38	0.3365	-0.0982	|||.....	0.0049	|.....	0.0384	|.....
39	-0.4005	-0.0712	||.....	0.0026	|.....	0.0464	||.....
40	-0.0619	-0.2070	||||||.....	0.0213	||||.....	0.1141	||||||.....
41	-1.7148	-0.1458	|||||.....	0.0109	||.....	0.1245	||||||.....
42	-1.5606	0.1278	||||.....	0.0083	|.....	-0.1074	|||||.....
43	-0.6162	-0.2276	|||||||.....	0.0259	|||||.....	0.1600	|||||||.....
44	-2.6173	-0.0514	|.....	0.0014	|.....	0.0467	||.....
45	-2.5639	0.0031	|.....	0.0000	|.....	-0.0028	|.....
46	2.1282	0.1275	||||.....	0.0082	|.....	0.0682	|||.....
47	0.6931	0.4135	||||||||||||||	0.0749	||||||||||||||	-0.0868	||||.....
48	0.0953	0.3995	|||||||||||||.	0.0727	|||||||||||||.	-0.1973	|||||||||.....
49	3.6687	-0.0568	|.....	0.0017	|.....	-0.0477	||.....
50	3.5467	-0.1706	||||||.....	0.0148	||.....	-0.1411	|||||||.....
51	1.7047	0.1765	||||||.....	0.0155	|||.....	0.0632	|||.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Outlier & Influence Chart

Row	lnSoil (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
11	1.7918	0.5791	|||.....	0.0051	|.....	0.0290	|.....
12	3.8480	-1.0050	|||||.....	0.0504	|||||||||.....	0.0908	|||||||.....
13	0.1823	0.8751	|||||.....	0.0123	||.....	0.0309	|.....
14	3.6788	-0.5302	|||.....	0.0130	||.....	0.0830	||||||.....
15	1.4110	-1.2308	||||||.....	0.0195	|||.....	0.0255	|.....
16	-0.3425	0.8862	|||||.....	0.0169	|||.....	0.0411	||.....
17	1.6292	-1.5468	||||||||.....	0.0323	|||||.....	0.0272	|.....
18	-1.0498	-0.1128	|.....	0.0004	|.....	0.0622	||||.....
19	1.2809	-1.3703	|||||||.....	0.0234	||||.....	0.0248	|.....
20	0.9555	-1.2791	||||||.....	0.0202	||||.....	0.0245	|.....
21	-0.4155	-1.4422	|||||||.....	0.0453	||||||||.....	0.0428	||.....
22	3.8199	-0.0135	|.....	0.0000	|.....	0.0895	|||||||.....
23	1.5041	-0.2687	|.....	0.0010	|.....	0.0261	|.....
24	1.7579	1.0209	|||||.....	0.0153	|||.....	0.0286	|.....
25	1.9169	0.7766	||||.....	0.0097	|.....	0.0307	|.....
26	2.2192	0.8228	||||.....	0.0127	||.....	0.0359	|.....
27	2.0015	1.2646	||||||.....	0.0260	|||||.....	0.0320	|.....
28	2.3795	0.6632	|||.....	0.0091	|.....	0.0393	|.....
29	1.2809	1.6057	||||||||.....	0.0315	|||||.....	0.0248	|.....
30	2.8959	0.1230	|.....	0.0004	|.....	0.0532	|||.....
31	3.7589	-0.4377	||.....	0.0093	|.....	0.0866	|||||||.....
32	0.6419	-0.1269	|.....	0.0002	|.....	0.0259	|.....
33	1.3863	1.4419	|||||||.....	0.0263	|||||.....	0.0253	|.....
34	-0.7765	0.1115	|.....	0.0004	|.....	0.0530	|||.....
35	0.4055	-0.6646	|||.....	0.0065	|.....	0.0280	|.....
36	0.5878	-1.1900	|||||.....	0.0189	|||.....	0.0263	|.....
37	1.9169	-1.3355	||||||.....	0.0277	|||||.....	0.0307	|.....
38	0.3365	-0.5701	|||.....	0.0049	|.....	0.0288	|.....
39	-0.4005	-0.3379	|.....	0.0026	|.....	0.0425	||.....
40	-0.0619	-1.0860	|||||.....	0.0213	||||.....	0.0350	|.....
41	-1.7148	-0.4643	||.....	0.0109	||.....	0.0898	|||||||.....
42	-1.5606	0.4257	||.....	0.0083	|.....	0.0827	||||||.....
43	-0.6162	-1.0110	|||||.....	0.0259	|||||.....	0.0482	|||.....
44	-2.6173	-0.1276	|.....	0.0014	|.....	0.1394	|||||||||||||
45	-2.5639	0.0078	|.....	0.0000	|.....	0.1361	||||||||||||.
46	2.1282	0.6777	|||.....	0.0082	|.....	0.0342	|.....
47	0.6931	* 2.5555	||||||||||||||	0.0749	||||||||||||||	0.0255	|.....
48	0.0953	* 2.1880	|||||||||||...	0.0727	|||||||||||||.	0.0323	|.....
49	3.6687	-0.1894	|.....	0.0017	|.....	0.0826	||||||.....
50	3.5467	-0.5895	|||.....	0.0148	||.....	0.0772	|||||.....
51	1.7047	1.0405	|||||.....	0.0155	|||.....	0.0280	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Means

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
11	3.1384	1.7918	3.1577	-1.3659	2.2421	5.1003
12	2.3888	3.8480	1.5741	2.2740	0.8169	2.5843
13	2.7007	0.1823	2.2330	-2.0507	1.4621	3.5791
14	2.8094	3.6788	2.4627	1.2161	1.6658	3.9469
15	0.9555	1.4110	-1.4538	2.8648	-3.6843	-0.4500
16	2.4592	-0.3425	1.7228	-2.0653	0.9722	2.7992
17	0.7308	1.6292	-1.9286	3.5578	-4.5041	-0.8118
18	1.0225	-1.0498	-1.3124	0.2626	-3.4421	-0.3403
19	0.7467	1.2809	-1.8950	3.1759	-4.4458	-0.7865
20	0.6881	0.9555	-2.0187	2.9742	-4.6606	-0.8795
21	-0.1165	-0.4155	-3.7186	3.3031	-7.6479	-2.1228
22	3.4372	3.8199	3.7890	0.0309	2.7333	6.1802
23	2.0541	1.5041	0.8671	0.6370	-0.0219	1.6637
24	3.6055	1.7579	4.1445	-2.3866	3.0019	6.7964
25	3.4144	1.9169	3.7409	-1.8240	2.6966	6.0972
26	3.6055	2.2192	4.1445	-1.9253	3.0019	6.7964
27	3.9782	2.0015	4.9320	-2.9305	3.5841	8.1740
28	3.5056	2.3795	3.9334	-1.5538	2.8430	6.4299
29	3.9964	1.2809	4.9702	-3.6893	3.6120	8.2413
30	3.1506	2.8959	3.1835	-0.2876	2.2627	5.1439
31	2.9481	3.7589	2.7557	1.0031	1.9150	4.4271
32	1.8050	0.6419	0.3408	0.3010	-0.7587	1.0907
33	3.8774	1.3863	4.7190	-3.3327	3.4280	7.8001
34	1.3995	-0.7765	-0.5158	-0.2608	-2.1044	0.3046
35	1.0942	0.4055	-1.1609	1.5664	-3.1839	-0.2214
36	0.6098	0.5878	-2.1842	2.7720	-4.9489	-1.0032
37	1.0886	1.9169	-1.1727	3.0897	-3.2040	-0.2308
38	1.1663	0.3365	-1.0086	1.3450	-2.9258	-0.1004
39	1.0784	-0.4005	-1.1942	0.7937	-3.2405	-0.2477
40	0.4187	-0.0619	-2.5878	2.5260	-5.6548	-1.3018
41	0.3293	-1.7148	-2.7767	1.0619	-5.9863	-1.4403
42	1.3678	-1.5606	-0.5828	-0.9778	-2.2147	0.2480
43	0.2443	-0.6162	-2.9564	2.3402	-6.3023	-1.5715
44	0.2700	-2.6173	-2.9019	0.2847	-6.2065	-1.5318
45	0.4383	-2.5639	-2.5466	-0.0174	-5.5824	-1.2714
46	3.4045	2.1282	3.7199	-1.5917	2.6806	6.0611
47	4.6240	0.6931	6.2962	-5.6030	4.5686	10.5846
48	3.9973	0.0953	4.9722	-4.8769	3.6134	8.2447
49	3.1739	3.6687	3.2327	0.4360	2.3017	5.2273
50	2.6810	3.5467	2.1915	1.3553	1.4242	3.5135
51	3.6019	1.7047	4.1368	-2.4321	2.9962	6.7830

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnSoil

Inverse Prediction of X Individuals

Row	lnMammal (Y)	lnSoil (X)	Predicted lnSoil (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
11	3.1384	1.7918	3.1577	-1.3659	-1.8711	9.2135
12	2.3888	3.8480	1.5741	2.2740	-3.7267	7.1279
13	2.7007	0.1823	2.2330	-2.0507	-2.9379	7.9791
14	2.8094	3.6788	2.4627	1.2161	-2.6686	8.2814
15	0.9555	1.4110	-1.4538	2.8648	-7.6609	3.5266
16	2.4592	-0.3425	1.7228	-2.0653	-3.5466	7.3179
17	0.7308	1.6292	-1.9286	3.5578	-8.3222	3.0062
18	1.0225	-1.0498	-1.3124	0.2626	-7.4661	3.6838
19	0.7467	1.2809	-1.8950	3.1759	-8.2749	3.0427
20	0.6881	0.9555	-2.0187	2.9742	-8.4489	2.9088
21	-0.1165	-0.4155	-3.7186	3.3031	-10.9108	1.1401
22	3.4372	3.8199	3.7890	0.0309	-1.1686	10.0821
23	2.0541	1.5041	0.8671	0.6370	-4.5999	6.2417
24	3.6055	1.7579	4.1445	-2.3866	-0.7819	10.5802
25	3.4144	1.9169	3.7409	-1.8240	-1.2214	10.0152
26	3.6055	2.2192	4.1445	-1.9253	-0.7819	10.5802
27	3.9782	2.0015	4.9320	-2.9305	0.0531	11.7050
28	3.5056	2.3795	3.9334	-1.5538	-1.0108	10.2837
29	3.9964	1.2809	4.9702	-3.6893	0.0929	11.7604
30	3.1506	2.8959	3.1835	-0.2876	-1.8420	9.2486
31	2.9481	3.7589	2.7557	1.0031	-2.3292	8.6712
32	1.8050	0.6419	0.3408	0.3010	-5.2681	5.6001
33	3.8774	1.3863	4.7190	-3.3327	-0.1699	11.3979
34	1.3995	-0.7765	-0.5158	-0.2608	-6.3886	4.5888
35	1.0942	0.4055	-1.1609	1.5664	-7.2586	3.8533
36	0.6098	0.5878	-2.1842	2.7720	-8.6828	2.7307
37	1.0886	1.9169	-1.1727	3.0897	-7.2748	3.8400
38	1.1663	0.3365	-1.0086	1.3450	-7.0512	4.0250
39	1.0784	-0.4005	-1.1942	0.7937	-7.3041	3.8160
40	0.4187	-0.0619	-2.5878	2.5260	-9.2586	2.3020
41	0.3293	-1.7148	-2.7767	1.0619	-9.5307	2.1040
42	1.3678	-1.5606	-0.5828	-0.9778	-6.4780	4.5113
43	0.2443	-0.6162	-2.9564	2.3402	-9.7910	1.9171
44	0.2700	-2.6173	-2.9019	0.2847	-9.7119	1.9736
45	0.4383	-2.5639	-2.5466	-0.0174	-9.1993	2.3455
46	3.4045	2.1282	3.7199	-1.5917	-1.2445	9.9861
47	4.6240	0.6931	6.2962	-5.6030	1.4347	13.7185
48	3.9973	0.0953	4.9722	-4.8769	0.0950	11.7632
49	3.1739	3.6687	3.2327	0.4360	-1.7866	9.3156
50	2.6810	3.5467	2.1915	1.3553	-2.9869	7.9247
51	3.6019	1.7047	4.1368	-2.4321	-0.7902	10.5694

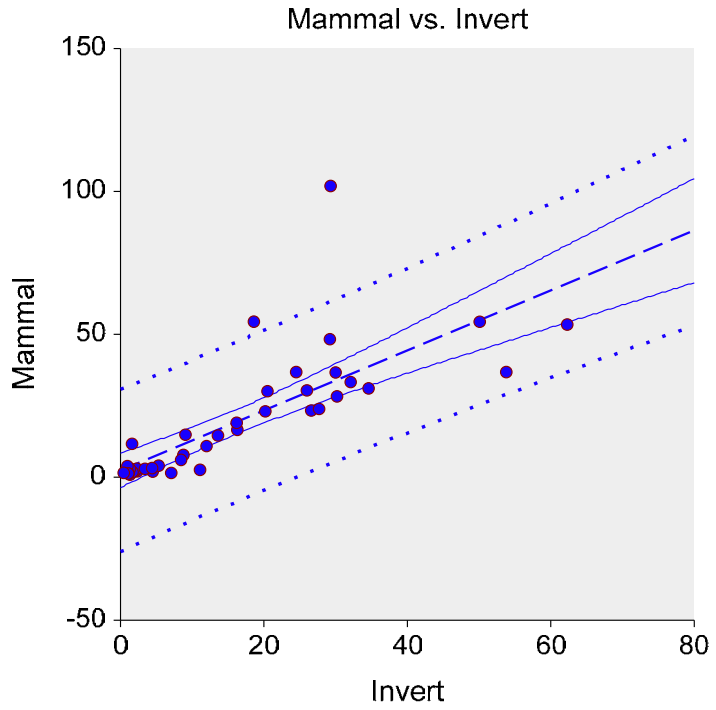
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Invertebrate to Small Mammal Tissue Linear Regressions
No Transformation – All Data

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Invert	Rows Used in Estimation	42
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	2.4643	Rows Prediction Only	0
Slope	1.0476	Sum of Frequencies	42
R-Squared	0.5974	Sum of Weights	42.0000
Correlation	0.7729	Coefficient of Variation	0.7282
Mean Square Error	187.2681	Square Root of MSE	13.68459

Linear Regression Report

Y = Mammal X = Invert

Summary Statement

The equation of the straight line relating Mammal and Invert is estimated as: Mammal = (2.4643) + (1.0476) Invert using the 42 observations in this dataset. The y-intercept, the estimated value of Mammal when Invert is zero, is 2.4643 with a standard error of 2.9917. The slope, the estimated change in Mammal per unit change in Invert, is 1.0476 with a standard error of 0.1360. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Invert, is 0.5974. The correlation between Mammal and Invert is 0.7729.

A significance test that the slope is zero resulted in a t-value of 7.7046. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 1.0476. The lower limit of the 95% confidence interval for the slope is 0.7728 and the upper limit is 1.3224. The estimated intercept is 2.4643. The lower limit of the 95% confidence interval for the intercept is -3.5823 and the upper limit is 8.5108.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Invert
Count	42	42
Mean	18.7931	15.5869
Standard Deviation	21.3033	15.7178
Minimum	0.8900	0.4500
Maximum	101.9000	62.3000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	2.4643	1.0476
Lower 95% Confidence Limit	-3.5823	0.7728
Upper 95% Confidence Limit	8.5108	1.3224
Standard Error	2.9917	0.1360
Standardized Coefficient	0.0000	0.7729
T Value	0.8237	7.7046
Prob Level (T Test)	0.4150	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	No	Yes
Power (Alpha = 0.0500)	0.1267	1.0000
Regression of Y on X	2.4643	1.0476
Inverse Regression from X on Y	-8.5389	1.7535
Orthogonal Regression of Y and X	-4.2182	1.4763

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(2.4642608076503) + (1.04760209691492) * (Invert)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	2.4643	0.9000	-0.0453	5.2452
Bootstrap Mean	2.2432	0.9500	-0.7903	5.9580
Bias (BM - OV)	-0.2211	0.9900	-1.9674	7.1243
Bias Corrected	2.6854			
Standard Error	1.6435			
Slope				
Original Value	1.0476	0.9000	0.7137	1.2392
Bootstrap Mean	1.0704	0.9500	0.6256	1.2632
Bias (BM - OV)	0.0228	0.9900	0.4657	1.2982
Bias Corrected	1.0248			
Standard Error	0.1638			
Correlation				
Original Value	0.7729	0.9000	0.6076	0.8610
Bootstrap Mean	0.7985	0.9500	0.5969	0.8758
Bias (BM - OV)	0.0256	0.9900	0.5821	0.9127
Bias Corrected	0.7473			
Standard Error	0.0778			
R-Squared				
Original Value	0.5974	0.9000	0.3145	0.7258
Bootstrap Mean	0.6437	0.9500	0.2944	0.7458
Bias (BM - OV)	0.0463	0.9900	0.2660	0.7939
Bias Corrected	0.5512			
Standard Error	0.1263			
Standard Error of Estimate				
Original Value	13.6846	0.9000	7.5742	21.8846
Bootstrap Mean	12.6092	0.9500	6.7383	22.5032
Bias (BM - OV)	-1.0754	0.9900	4.5490	23.3380
Bias Corrected	14.7600			
Standard Error	4.3476			
Orthogonal Intercept				
Original Value	-4.2182	0.9000	-9.7228	5.3287
Bootstrap Mean	-4.5912	0.9500	-10.1568	7.4275
Bias (BM - OV)	-0.3730	0.9900	-10.8676	11.6034
Bias Corrected	-3.8452			
Standard Error	4.7920			
Orthogonal Slope				
Original Value	1.4763	0.9000	0.6411	1.9899
Bootstrap Mean	1.5069	0.9500	0.4543	2.0337
Bias (BM - OV)	0.0305	0.9900	0.1776	2.0900
Bias Corrected	1.4458			
Standard Error	0.4268			

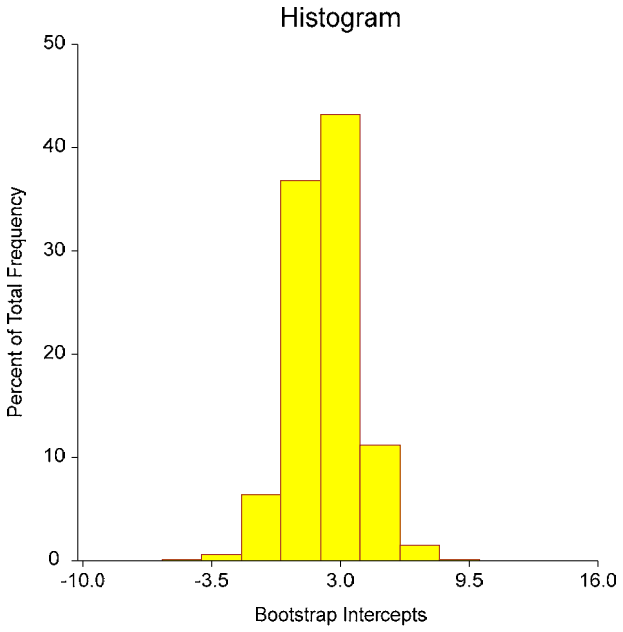
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

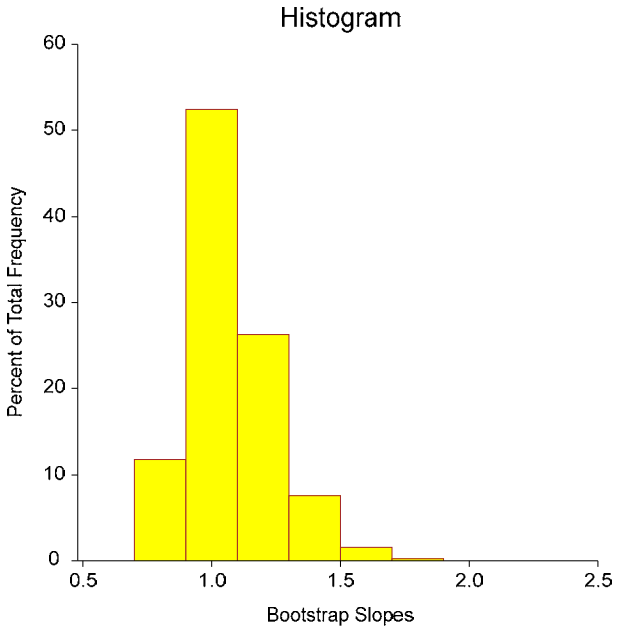
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

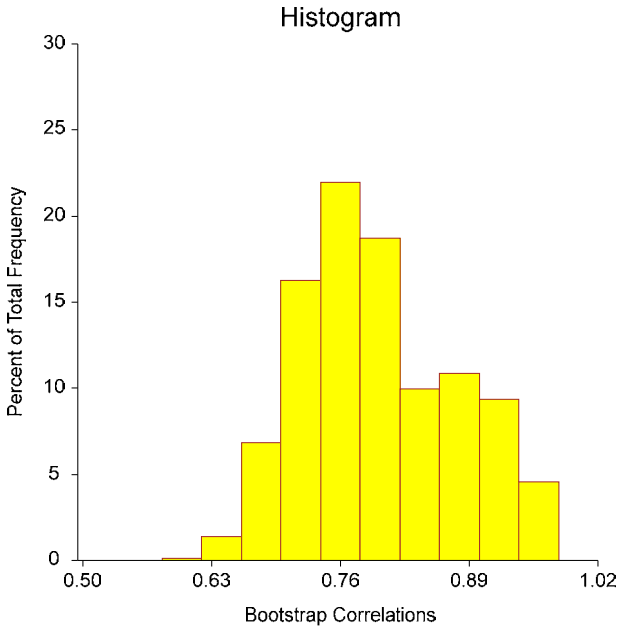
Linear Regression Report

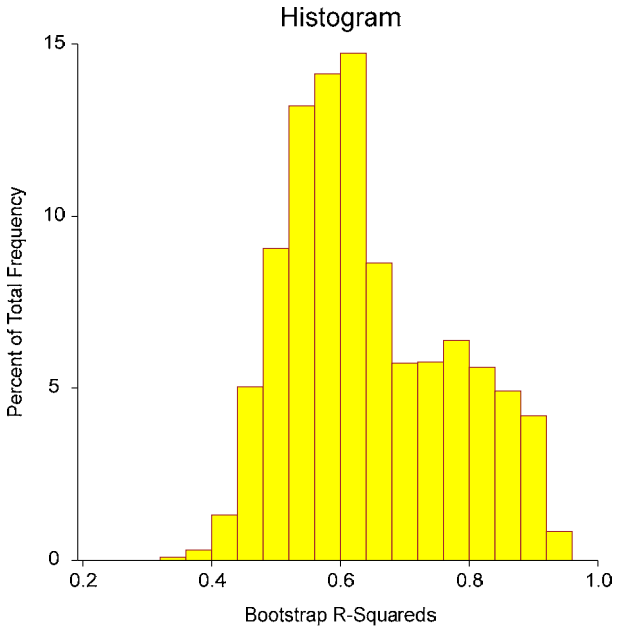
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Bootstrap Histograms Section



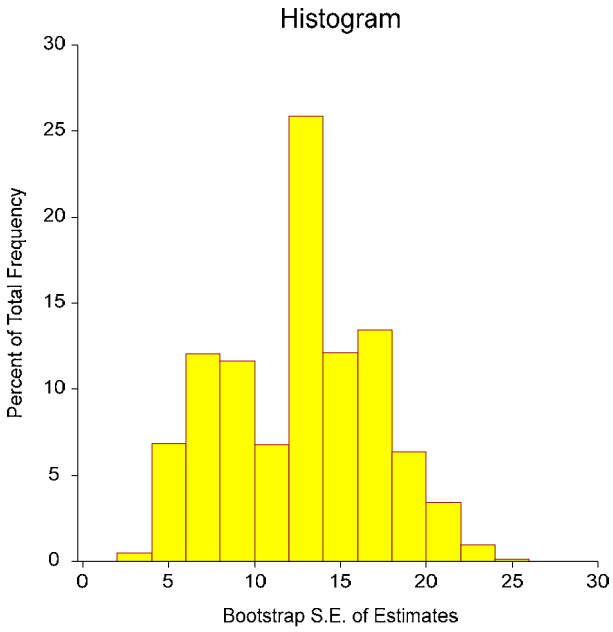


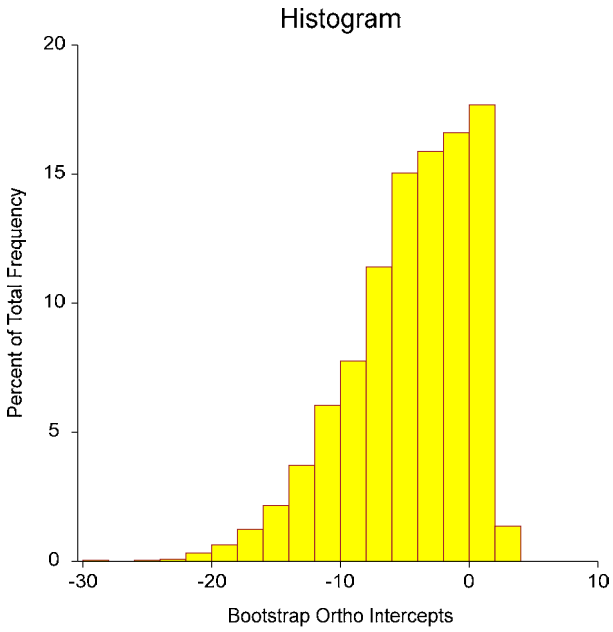


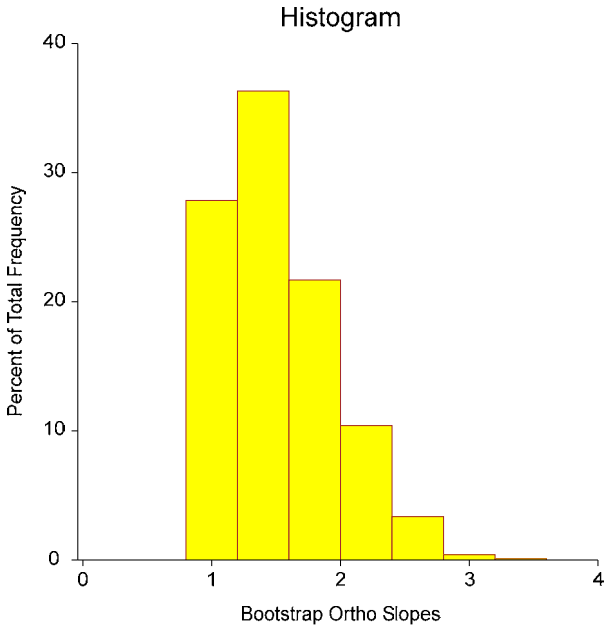


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.7729	0.5974	0.8859
Lower 95% Conf. Limit (r dist'n)	0.6083		
Upper 95% Conf. Limit (r dist'n)	0.8691		
Lower 95% Conf. Limit (Fisher's z)	0.6130		0.7963
Upper 95% Conf. Limit (Fisher's z)	0.8720		0.9374
Adjusted (Rbar)		0.5874	
T-Value for H0: Rho = 0	7.7046	7.7046	12.0762
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14833.64	14833.64			
Slope	1	11116.34	11116.34	59.3606	0.0000	1.0000
Error	40	7490.725	187.2681			
Adj. Total	41	18607.07	453.8309			
Total	42	33440.71				

s = Square Root(187.2681) = 13.68459

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	42	654.65	789.3116	0.04779512	-0.00153883
1	654.65	20333.03	22914.15	-0.00153883	9.872582E-05
2 (Y'Y)			33440.71		
Determinant		425420.6			2.350615E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	8.950502	-0.2881738
1	-0.2881738	0.0184882

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.6125	0.000000	No
Anderson Darling	5.2766	0.000000	No
D'Agostino Skewness	5.9452	0.000000	No
D'Agostino Kurtosis	4.9983	0.000001	No
D'Agostino Omnibus	60.3285	0.000000	No
Constant Residual Variance?			
Modified Levene Test	5.7078	0.021695	No
Relationship is a Straight Line?			
Lack of Linear Fit F(0, 0) Test	0.0000	0.000000	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

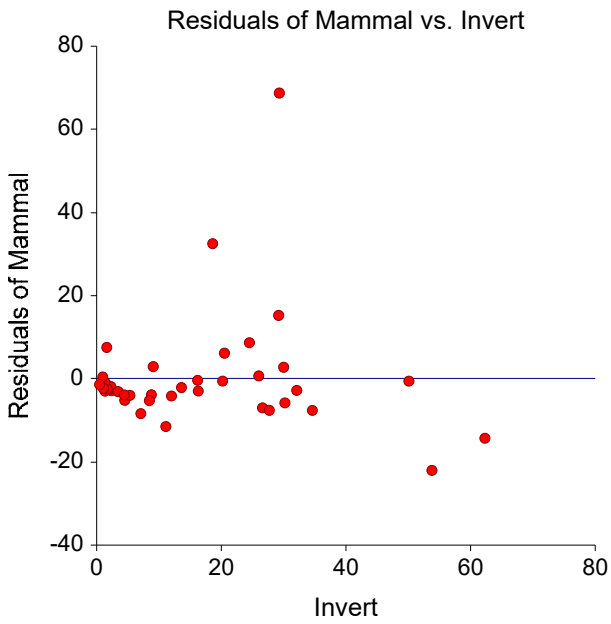
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

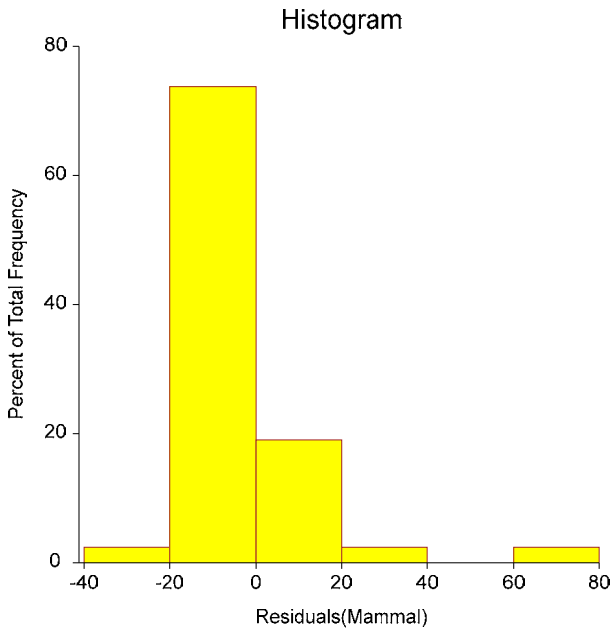
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

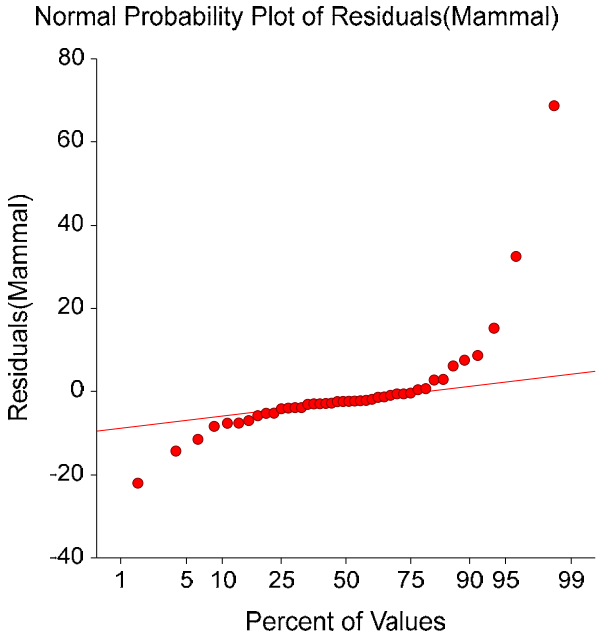
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Original Data Section

Row	Invert (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
10	30.2000	28.3000	34.1018	-5.8018
11	20.2000	23.0667	23.6258	-0.5592
12	12.0000	10.9000	15.0355	-4.1355
13	9.0700	14.8900	11.9660	2.9240
14	16.3000	16.6000	19.5402	-2.9402
15	11.1000	2.6000	14.0926	-11.4926
16	1.6100	11.6950	4.1509	7.5441
17	2.3600	2.0767	4.9366	-2.8599
18	1.5200	2.7800	4.0566	-1.2766
19	1.9700	2.1100	4.5280	-2.4180
20	4.5000	1.9900	7.1785	-5.1885
21	1.3200	0.8900	3.8471	-2.9571
22	34.6000	31.1000	38.7113	-7.6113
23	8.7700	7.8000	11.6517	-3.8517
24	24.5000	36.8000	28.1305	8.6695
25	26.0000	30.4000	29.7019	0.6981
26	53.8000	36.8000	58.8253	-22.0253
27	62.3000	53.4233	67.7299	-14.3065
28	32.1000	33.3000	36.0923	-2.7923
29	50.1000	54.4000	54.9491	-0.5491
30	26.6000	23.3500	30.3305	-6.9805
31	16.2000	19.0700	19.4354	-0.3654
32	8.4500	6.0800	11.3165	-5.2365
33	29.2000	48.3000	33.0542	15.2458
34	5.3200	4.0533	8.0375	-3.9842
35	2.2700	2.9867	4.8423	-1.8557
36	1.6800	1.8400	4.2242	-2.3842
37	3.4200	2.9700	6.0471	-3.0771
38	4.4100	3.2100	7.0842	-3.8742
39	1.3100	2.9400	3.8366	-0.8966
40	7.0800	1.5200	9.8813	-8.3613
41	1.0900	1.3900	3.6061	-2.2161
42	0.9700	3.9267	3.4804	0.4462
43	1.1100	1.2767	3.6271	-2.3504
44	1.0700	1.3100	3.5852	-2.2752
45	0.4500	1.5500	2.9357	-1.3857
46	20.5000	30.1000	23.9401	6.1599
47	29.3000	101.9000	33.1590	68.7410
48	18.6000	54.4500	21.9497	32.5003
49	27.7000	23.9000	31.4828	-7.5828
50	13.6000	14.6000	16.7116	-2.1116
51	30.0000	36.6667	33.8923	2.7743

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Predicted Values and Confidence Limits of Means

Row	Invert (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	30.2000	28.3000	34.1018	2.8994	28.2418	39.9618
11	20.2000	23.0667	23.6258	2.2028	19.1739	28.0778
12	12.0000	10.9000	15.0355	2.1672	10.6555	19.4155
13	9.0700	14.8900	11.9660	2.2900	7.3378	16.5942
14	16.3000	16.6000	19.5402	2.1138	15.2680	23.8123
15	11.1000	2.6000	14.0926	2.1979	9.6504	18.5349
16	1.6100	11.6950	4.1509	2.8409	-1.5907	9.8925
17	2.3600	2.0767	4.9366	2.7737	-0.6692	10.5424
18	1.5200	2.7800	4.0566	2.8491	-1.7016	9.8148
19	1.9700	2.1100	4.5280	2.8084	-1.1479	10.2039
20	4.5000	1.9900	7.1785	2.5945	1.9348	12.4221
21	1.3200	0.8900	3.8471	2.8674	-1.9481	9.6423
22	34.6000	31.1000	38.7113	3.3380	31.9650	45.4576
23	8.7700	7.8000	11.6517	2.3061	6.9910	16.3125
24	24.5000	36.8000	28.1305	2.4347	23.2099	33.0511
25	26.0000	30.4000	29.7019	2.5423	24.5637	34.8402
26	53.8000	36.8000	58.8253	5.6086	47.4899	70.1606
27	62.3000	53.4233	67.7299	6.6934	54.2019	81.2578
28	32.1000	33.3000	36.0923	3.0822	29.8629	42.3217
29	50.1000	54.4000	54.9491	5.1460	44.5487	65.3495
30	26.6000	23.3500	30.3305	2.5887	25.0986	35.5624
31	16.2000	19.0700	19.4354	2.1132	15.1644	23.7064
32	8.4500	6.0800	11.3165	2.3239	6.6197	16.0133
33	29.2000	48.3000	33.0542	2.8080	27.3790	38.7294
34	5.3200	4.0533	8.0375	2.5313	2.9215	13.1535
35	2.2700	2.9867	4.8423	2.7816	-0.7796	10.4642
36	1.6800	1.8400	4.2242	2.8345	-1.5045	9.9530
37	3.4200	2.9700	6.0471	2.6825	0.6256	11.4685
38	4.4100	3.2100	7.0842	2.6016	1.8261	12.3422
39	1.3100	2.9400	3.8366	2.8683	-1.9605	9.6337
40	7.0800	1.5200	9.8813	2.4076	5.0153	14.7473
41	1.0900	1.3900	3.6061	2.8886	-2.2320	9.4443
42	0.9700	3.9267	3.4804	2.8998	-2.3803	9.3411
43	1.1100	1.2767	3.6271	2.8868	-2.2073	9.4615
44	1.0700	1.3100	3.5852	2.8905	-2.2567	9.4271
45	0.4500	1.5500	2.9357	2.9487	-3.0239	8.8952
46	20.5000	30.1000	23.9401	2.2147	19.4640	28.4162
47	29.3000	101.9000	33.1590	2.8170	27.4656	38.8524
48	18.6000	54.4500	21.9497	2.1510	17.6024	26.2969
49	27.7000	23.9000	31.4828	2.6780	26.0705	36.8952
50	13.6000	14.6000	16.7116	2.1288	12.4092	21.0141
51	30.0000	36.6667	33.8923	2.8809	28.0699	39.7148

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Predicted Values and Prediction Limits

Row	Invert (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	30.2000	28.3000	34.1018	13.9884	5.8303	62.3734
11	20.2000	23.0667	23.6258	13.8607	-4.3878	51.6394
12	12.0000	10.9000	15.0355	13.8551	-12.9668	43.0378
13	9.0700	14.8900	11.9660	13.8749	-16.0762	40.0082
14	16.3000	16.6000	19.5402	13.8469	-8.4454	47.5258
15	11.1000	2.6000	14.0926	13.8600	-13.9194	42.1047
16	1.6100	11.6950	4.1509	13.9764	-24.0964	32.3982
17	2.3600	2.0767	4.9366	13.9629	-23.2834	33.1566
18	1.5200	2.7800	4.0566	13.9780	-24.1940	32.3073
19	1.9700	2.1100	4.5280	13.9698	-23.7060	32.7620
20	4.5000	1.9900	7.1785	13.9284	-20.9718	35.3288
21	1.3200	0.8900	3.8471	13.9818	-24.4111	32.1053
22	34.6000	31.1000	38.7113	14.0858	10.2428	67.1798
23	8.7700	7.8000	11.6517	13.8775	-16.3958	39.6993
24	24.5000	36.8000	28.1305	13.8995	0.0386	56.2224
25	26.0000	30.4000	29.7019	13.9188	1.5711	57.8328
26	53.8000	36.8000	58.8253	14.7893	28.9349	88.7156
27	62.3000	53.4233	67.7299	15.2339	36.9411	98.5186
28	32.1000	33.3000	36.0923	14.0274	7.7418	64.4427
29	50.1000	54.4000	54.9491	14.6202	25.4007	84.4976
30	26.6000	23.3500	30.3305	13.9273	2.1824	58.4786
31	16.2000	19.0700	19.4354	13.8468	-8.5500	47.4208
32	8.4500	6.0800	11.3165	13.8805	-16.7371	39.3701
33	29.2000	48.3000	33.0542	13.9697	4.8204	61.2881
34	5.3200	4.0533	8.0375	13.9167	-20.0893	36.1643
35	2.2700	2.9867	4.8423	13.9644	-23.3809	33.0655
36	1.6800	1.8400	4.2242	13.9751	-24.0204	32.4689
37	3.4200	2.9700	6.0471	13.9450	-22.1369	34.2310
38	4.4100	3.2100	7.0842	13.9297	-21.0688	35.2372
39	1.3100	2.9400	3.8366	13.9820	-24.4220	32.0952
40	7.0800	1.5200	9.8813	13.8948	-18.2011	37.9637
41	1.0900	1.3900	3.6061	13.9861	-24.6609	31.8732
42	0.9700	3.9267	3.4804	13.9885	-24.7913	31.7522
43	1.1100	1.2767	3.6271	13.9858	-24.6392	31.8934
44	1.0700	1.3100	3.5852	13.9865	-24.6826	31.8530
45	0.4500	1.5500	2.9357	13.9987	-25.3567	31.2281
46	20.5000	30.1000	23.9401	13.8627	-4.0774	51.9576
47	29.3000	101.9000	33.1590	13.9715	4.9215	61.3965
48	18.6000	54.4500	21.9497	13.8526	-6.0475	49.9468
49	27.7000	23.9000	31.4828	13.9442	3.3006	59.6650
50	13.6000	14.6000	16.7116	13.8492	-11.2786	44.7019
51	30.0000	36.6667	33.8923	13.9845	5.6285	62.1561

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Working-Hotelling Simultaneous Confidence Band

Row	Invert (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	30.2000	28.3000	34.1018	2.8994	25.8489	42.3548
11	20.2000	23.0667	23.6258	2.2028	17.3559	29.8958
12	12.0000	10.9000	15.0355	2.1672	8.8669	21.2041
13	9.0700	14.8900	11.9660	2.2900	5.4478	18.4842
14	16.3000	16.6000	19.5402	2.1138	13.5234	25.5569
15	11.1000	2.6000	14.0926	2.1979	7.8364	20.3489
16	1.6100	11.6950	4.1509	2.8409	-3.9353	12.2371
17	2.3600	2.0767	4.9366	2.7737	-2.9584	12.8316
18	1.5200	2.7800	4.0566	2.8491	-4.0530	12.1662
19	1.9700	2.1100	4.5280	2.8084	-3.4657	12.5217
20	4.5000	1.9900	7.1785	2.5945	-0.2065	14.5634
21	1.3200	0.8900	3.8471	2.8674	-4.3146	12.0088
22	34.6000	31.1000	38.7113	3.3380	29.2100	48.2126
23	8.7700	7.8000	11.6517	2.3061	5.0878	18.2157
24	24.5000	36.8000	28.1305	2.4347	21.2005	35.0605
25	26.0000	30.4000	29.7019	2.5423	22.4654	36.9384
26	53.8000	36.8000	58.8253	5.6086	42.8610	74.7895
27	62.3000	53.4233	67.7299	6.6934	48.6777	86.7821
28	32.1000	33.3000	36.0923	3.0822	27.3190	44.8656
29	50.1000	54.4000	54.9491	5.1460	40.3016	69.5966
30	26.6000	23.3500	30.3305	2.5887	22.9621	37.6988
31	16.2000	19.0700	19.4354	2.1132	13.4203	25.4505
32	8.4500	6.0800	11.3165	2.3239	4.7018	17.9312
33	29.2000	48.3000	33.0542	2.8080	25.0615	41.0470
34	5.3200	4.0533	8.0375	2.5313	0.8324	15.2427
35	2.2700	2.9867	4.8423	2.7816	-3.0753	12.7599
36	1.6800	1.8400	4.2242	2.8345	-3.8439	12.2924
37	3.4200	2.9700	6.0471	2.6825	-1.5883	13.6824
38	4.4100	3.2100	7.0842	2.6016	-0.3210	14.4894
39	1.3100	2.9400	3.8366	2.8683	-4.3277	12.0010
40	7.0800	1.5200	9.8813	2.4076	3.0282	16.7344
41	1.0900	1.3900	3.6061	2.8886	-4.6161	11.8284
42	0.9700	3.9267	3.4804	2.8998	-4.7736	11.7344
43	1.1100	1.2767	3.6271	2.8868	-4.5898	11.8440
44	1.0700	1.3100	3.5852	2.8905	-4.6423	11.8127
45	0.4500	1.5500	2.9357	2.9487	-5.4575	11.3289
46	20.5000	30.1000	23.9401	2.2147	17.6361	30.2441
47	29.3000	101.9000	33.1590	2.8170	25.1407	41.1773
48	18.6000	54.4500	21.9497	2.1510	15.8272	28.0721
49	27.7000	23.9000	31.4828	2.6780	23.8603	39.1054
50	13.6000	14.6000	16.7116	2.1288	10.6523	22.7710
51	30.0000	36.6667	33.8923	2.8809	25.6922	42.0924

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Residual Section

Row	Invert (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	30.2000	28.3000	34.1018	-5.8018	-0.4338	20.5012
11	20.2000	23.0667	23.6258	-0.5592	-0.0414	2.4241
12	12.0000	10.9000	15.0355	-4.1355	-0.3061	37.9402
13	9.0700	14.8900	11.9660	2.9240	0.2167	19.6373
14	16.3000	16.6000	19.5402	-2.9402	-0.2175	17.7119
15	11.1000	2.6000	14.0926	-11.4926	-0.8509	442.0248
16	1.6100	11.6950	4.1509	7.5441	0.5636	64.5071
17	2.3600	2.0767	4.9366	-2.8599	-0.2134	137.7176
18	1.5200	2.7800	4.0566	-1.2766	-0.0954	45.9214
19	1.9700	2.1100	4.5280	-2.4180	-0.1805	114.5989
20	4.5000	1.9900	7.1785	-5.1885	-0.3862	260.7271
21	1.3200	0.8900	3.8471	-2.9571	-0.2210	332.2579
22	34.6000	31.1000	38.7113	-7.6113	-0.5735	24.4736
23	8.7700	7.8000	11.6517	-3.8517	-0.2855	49.3812
24	24.5000	36.8000	28.1305	8.6695	0.6438	23.5584
25	26.0000	30.4000	29.7019	0.6981	0.0519	2.2963
26	53.8000	36.8000	58.8253	-22.0253	-1.7645	59.8512
27	62.3000	53.4233	67.7299	-14.3065	-1.1986	26.7796
28	32.1000	33.3000	36.0923	-2.7923	-0.2094	8.3852
29	50.1000	54.4000	54.9491	-0.5491	-0.0433	1.0094
30	26.6000	23.3500	30.3305	-6.9805	-0.5195	29.8950
31	16.2000	19.0700	19.4354	-0.3654	-0.0270	1.9162
32	8.4500	6.0800	11.3165	-5.2365	-0.3883	86.1266
33	29.2000	48.3000	33.0542	15.2458	1.1383	31.5647
34	5.3200	4.0533	8.0375	-3.9842	-0.2963	98.2937
35	2.2700	2.9867	4.8423	-1.8557	-0.1385	62.1312
36	1.6800	1.8400	4.2242	-2.3842	-0.1781	129.5778
37	3.4200	2.9700	6.0471	-3.0771	-0.2293	103.6047
38	4.4100	3.2100	7.0842	-3.8742	-0.2884	120.6912
39	1.3100	2.9400	3.8366	-0.8966	-0.0670	30.4973
40	7.0800	1.5200	9.8813	-8.3613	-0.6207	550.0845
41	1.0900	1.3900	3.6061	-2.2161	-0.1657	159.4350
42	0.9700	3.9267	3.4804	0.4462	0.0334	11.3641
43	1.1100	1.2767	3.6271	-2.3504	-0.1757	184.1070
44	1.0700	1.3100	3.5852	-2.2752	-0.1701	173.6790
45	0.4500	1.5500	2.9357	-1.3857	-0.1037	89.3988
46	20.5000	30.1000	23.9401	6.1599	0.4561	20.4648
47	29.3000	101.9000	33.1590	68.7410	5.1332	67.4593
48	18.6000	54.4500	21.9497	32.5003	2.4049	59.6884
49	27.7000	23.9000	31.4828	-7.5828	-0.5650	31.7274
50	13.6000	14.6000	16.7116	-2.1116	-0.1562	14.4634
51	30.0000	36.6667	33.8923	2.7743	0.2074	7.5664

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Residual Diagnostics Section

Row	Invert (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	30.2000	-5.8018	-0.4294	0.0449	0.0044	191.1662
11	20.2000	-0.5592	-0.0409	0.0259	0.0000	192.0616
12	12.0000	-4.1355	-0.3026	0.0251	0.0012	191.6201
13	9.0700	2.9240	0.2141	0.0280	0.0007	191.8443
14	16.3000	-2.9402	-0.2149	0.0239	0.0006	191.8428
15	11.1000	-11.4926	-0.8479	0.0258	0.0096	188.5935
16	1.6100	7.5441	0.5587	0.0431	0.0072	190.5448
17	2.3600	-2.8599	-0.2109	0.0411	0.0010	191.8512
18	1.5200	-1.2766	-0.0942	0.0433	0.0002	192.0262
19	1.9700	-2.4180	-0.1783	0.0421	0.0007	191.9134
20	4.5000	-5.1885	-0.3820	0.0359	0.0028	191.3539
21	1.3200	-2.9571	-0.2183	0.0439	0.0011	191.8354
22	34.6000	-7.6113	-0.5686	0.0595	0.0104	190.4905
23	8.7700	-3.8517	-0.2822	0.0284	0.0012	191.6783
24	24.5000	8.6695	0.6390	0.0317	0.0068	190.0797
25	26.0000	0.6981	0.0513	0.0345	0.0000	192.0569
26	53.8000	-22.0253	*-1.8143	0.1680	0.3143	177.1199
27	62.3000	-14.3065	*-1.2054	0.2392	0.2259	185.1713
28	32.1000	-2.7923	-0.2069	0.0507	0.0012	191.8593
29	50.1000	-0.5491	*-0.0428	0.1414	0.0002	192.0609
30	26.6000	-6.9805	-0.5147	0.0358	0.0050	190.7741
31	16.2000	-0.3654	-0.0267	0.0238	0.0000	192.0664
32	8.4500	-5.2365	-0.3841	0.0288	0.0022	191.3459
33	29.2000	15.2458	1.1426	0.0421	0.0285	185.8481
34	5.3200	-3.9842	-0.2929	0.0342	0.0016	191.6484
35	2.2700	-1.8557	-0.1368	0.0413	0.0004	191.9778
36	1.6800	-2.3842	-0.1759	0.0429	0.0007	191.9176
37	3.4200	-3.0771	-0.2266	0.0384	0.0011	191.8174
38	4.4100	-3.8742	-0.2850	0.0361	0.0016	191.6706
39	1.3100	-0.8966	-0.0662	0.0439	0.0001	192.0483
40	7.0800	-8.3613	-0.6158	0.0310	0.0062	190.2200
41	1.0900	-2.2161	-0.1636	0.0446	0.0006	191.9381
42	0.9700	0.4462	0.0329	0.0449	0.0000	192.0645
43	1.1100	-2.3504	-0.1736	0.0445	0.0007	191.9216
44	1.0700	-2.2752	-0.1680	0.0446	0.0007	191.9309
45	0.4500	-1.3857	-0.1024	0.0464	0.0003	192.0182
46	20.5000	6.1599	0.4516	0.0262	0.0028	191.0708
47	29.3000	68.7410	*8.6765	0.0424	0.5830	65.5463
48	18.6000	32.5003	*2.5674	0.0247	0.0733	164.2999
49	27.7000	-7.5828	-0.5602	0.0383	0.0064	190.5368
50	13.6000	-2.1116	-0.1543	0.0242	0.0003	191.9527
51	30.0000	2.7743	0.2049	0.0443	0.0010	191.8634

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.4294	-0.0931	0.0044	1.0910	-0.0027	-0.0638
11	-0.0409	-0.0067	0.0000	1.0798	-0.0032	-0.0019
12	-0.3026	-0.0485	0.0012	1.0740	-0.0411	0.0109
13	0.2141	0.0363	0.0007	1.0797	0.0336	-0.0141
14	-0.2149	-0.0336	0.0006	1.0751	-0.0226	-0.0015
15	-0.8479	-0.1380	0.0096	1.0411	-0.1207	0.0383
16	0.5587	0.1186	0.0072	1.0819	0.1184	-0.0793
17	-0.2109	-0.0436	0.0010	1.0945	-0.0435	0.0283
18	-0.0942	-0.0200	0.0002	1.0991	-0.0200	0.0135
19	-0.1783	-0.0374	0.0007	1.0964	-0.0373	0.0247
20	-0.3820	-0.0738	0.0028	1.0830	-0.0727	0.0429
21	-0.2183	-0.0468	0.0011	1.0976	-0.0467	0.0317
22	-0.5686	-0.1430	0.0104	1.1002	0.0146	-0.1108
23	-0.2822	-0.0483	0.0012	1.0783	-0.0449	0.0194
24	0.6390	0.1155	0.0068	1.0639	0.0300	0.0575
25	0.0513	0.0097	0.0000	1.0894	0.0019	0.0054
26	-1.8143	-0.8152	0.3143	1.0752	0.3184	-0.7552
27	-1.2054	-0.6760	0.2259	* 1.2852	0.3039	-0.6414
28	-0.2069	-0.0478	0.0012	1.1057	0.0016	-0.0348
29	-0.0428	-0.0174	0.0002	* 1.2251	0.0062	-0.0158
30	-0.5147	-0.0992	0.0050	1.0763	-0.0165	-0.0574
31	-0.0267	-0.0042	0.0000	1.0776	-0.0028	-0.0002
32	-0.3841	-0.0662	0.0022	1.0750	-0.0620	0.0276
33	1.1426	0.2396	0.0285	1.0282	0.0153	0.1579
34	-0.2929	-0.0551	0.0016	1.0844	-0.0540	0.0304
35	-0.1368	-0.0284	0.0004	1.0962	-0.0283	0.0185
36	-0.1759	-0.0372	0.0007	1.0974	-0.0372	0.0248
37	-0.2266	-0.0453	0.0011	1.0911	-0.0450	0.0279
38	-0.2850	-0.0552	0.0016	1.0869	-0.0545	0.0322
39	-0.0662	-0.0142	0.0001	1.1000	-0.0142	0.0096
40	-0.6158	-0.1101	0.0062	1.0647	-0.1056	0.0529
41	-0.1636	-0.0353	0.0006	1.0995	-0.0353	0.0241
42	0.0329	0.0071	0.0000	1.1013	0.0071	-0.0049
43	-0.1736	-0.0375	0.0007	1.0992	-0.0374	0.0255
44	-0.1680	-0.0363	0.0007	1.0995	-0.0363	0.0248
45	-0.1024	-0.0226	0.0003	1.1026	-0.0226	0.0158
46	0.4516	0.0741	0.0028	1.0690	0.0340	0.0223
47	* 8.6765	1.8252	* 0.5830	0.1279	0.1098	1.2081
48	* 2.5674	0.4086	0.0733	0.7892	0.2280	0.0778
49	-0.5602	-0.1118	0.0064	1.0764	-0.0135	-0.0687
50	-0.1543	-0.0243	0.0003	1.0767	-0.0192	0.0031
51	0.2049	0.0441	0.0010	1.0984	0.0016	0.0300

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Outlier Detection Chart

Row	Invert (X)	Residual		Standardized Residual		RStudent	
10	30.2000	-5.8018	|.....	-0.4338	|.....	-0.4294	|.....
11	20.2000	-0.5592	|.....	-0.0414	|.....	-0.0409	|.....
12	12.0000	-4.1355	|.....	-0.3061	|.....	-0.3026	|.....
13	9.0700	2.9240	|.....	0.2167	|.....	0.2141	|.....
14	16.3000	-2.9402	|.....	-0.2175	|.....	-0.2149	|.....
15	11.1000	-11.4926	||.....	-0.8509	||.....	-0.8479	|.....
16	1.6100	7.5441	|.....	0.5636	|.....	0.5587	|.....
17	2.3600	-2.8599	|.....	-0.2134	|.....	-0.2109	|.....
18	1.5200	-1.2766	|.....	-0.0954	|.....	-0.0942	|.....
19	1.9700	-2.4180	|.....	-0.1805	|.....	-0.1783	|.....
20	4.5000	-5.1885	|.....	-0.3862	|.....	-0.3820	|.....
21	1.3200	-2.9571	|.....	-0.2210	|.....	-0.2183	|.....
22	34.6000	-7.6113	|.....	-0.5735	|.....	-0.5686	|.....
23	8.7700	-3.8517	|.....	-0.2855	|.....	-0.2822	|.....
24	24.5000	8.6695	|.....	0.6438	|.....	0.6390	|.....
25	26.0000	0.6981	|.....	0.0519	|.....	0.0513	|.....
26	53.8000	-22.0253	||||.....	-1.7645	|||||.....	-1.8143	|||.....
27	62.3000	-14.3065	|||.....	-1.1986	|||.....	-1.2054	||.....
28	32.1000	-2.7923	|.....	-0.2094	|.....	-0.2069	|.....
29	50.1000	-0.5491	|.....	-0.0433	|.....	-0.0428	|.....
30	26.6000	-6.9805	|.....	-0.5195	|.....	-0.5147	|.....
31	16.2000	-0.3654	|.....	-0.0270	|.....	-0.0267	|.....
32	8.4500	-5.2365	|.....	-0.3883	|.....	-0.3841	|.....
33	29.2000	15.2458	|||.....	1.1383	|||.....	1.1426	|.....
34	5.3200	-3.9842	|.....	-0.2963	|.....	-0.2929	|.....
35	2.2700	-1.8557	|.....	-0.1385	|.....	-0.1368	|.....
36	1.6800	-2.3842	|.....	-0.1781	|.....	-0.1759	|.....
37	3.4200	-3.0771	|.....	-0.2293	|.....	-0.2266	|.....
38	4.4100	-3.8742	|.....	-0.2884	|.....	-0.2850	|.....
39	1.3100	-0.8966	|.....	-0.0670	|.....	-0.0662	|.....
40	7.0800	-8.3613	|.....	-0.6207	|.....	-0.6158	|.....
41	1.0900	-2.2161	|.....	-0.1657	|.....	-0.1636	|.....
42	0.9700	0.4462	|.....	0.0334	|.....	0.0329	|.....
43	1.1100	-2.3504	|.....	-0.1757	|.....	-0.1736	|.....
44	1.0700	-2.2752	|.....	-0.1701	|.....	-0.1680	|.....
45	0.4500	-1.3857	|.....	-0.1037	|.....	-0.1024	|.....
46	20.5000	6.1599	|.....	0.4561	|.....	0.4516	|.....
47	29.3000	68.7410	|||||||||||||||	5.1332	|||||||||||||||	* 8.6765	|||||||||||||||
48	18.6000	32.5003	|||||||.....	2.4049	|||||.....	* 2.5674	||||.....
49	27.7000	-7.5828	|.....	-0.5650	|.....	-0.5602	|.....
50	13.6000	-2.1116	|.....	-0.1562	|.....	-0.1543	|.....
51	30.0000	2.7743	|.....	0.2074	|.....	0.2049	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Influence Detection Chart

Row	Invert (X)	DFFITS		Cook's D		DFBETAS(1)	
10	30.2000	-0.0931	|.....	0.0044	|.....	-0.0638	|.....
11	20.2000	-0.0067	|.....	0.0000	|.....	-0.0019	|.....
12	12.0000	-0.0485	|.....	0.0012	|.....	0.0109	|.....
13	9.0700	0.0363	|.....	0.0007	|.....	-0.0141	|.....
14	16.3000	-0.0336	|.....	0.0006	|.....	-0.0015	|.....
15	11.1000	-0.1380	|.....	0.0096	|.....	0.0383	|.....
16	1.6100	0.1186	|.....	0.0072	|.....	-0.0793	|.....
17	2.3600	-0.0436	|.....	0.0010	|.....	0.0283	|.....
18	1.5200	-0.0200	|.....	0.0002	|.....	0.0135	|.....
19	1.9700	-0.0374	|.....	0.0007	|.....	0.0247	|.....
20	4.5000	-0.0738	|.....	0.0028	|.....	0.0429	|.....
21	1.3200	-0.0468	|.....	0.0011	|.....	0.0317	|.....
22	34.6000	-0.1430	|.....	0.0104	|.....	-0.1108	|.....
23	8.7700	-0.0483	|.....	0.0012	|.....	0.0194	|.....
24	24.5000	0.1155	|.....	0.0068	|.....	0.0575	|.....
25	26.0000	0.0097	|.....	0.0000	|.....	0.0054	|.....
26	53.8000	-0.8152	||||||.....	0.3143	||||||||.....	-0.7552	||||||||.....
27	62.3000	-0.6760	|||||.....	0.2259	|||||.....	-0.6414	|||||||.....
28	32.1000	-0.0478	|.....	0.0012	|.....	-0.0348	|.....
29	50.1000	-0.0174	|.....	0.0002	|.....	-0.0158	|.....
30	26.6000	-0.0992	|.....	0.0050	|.....	-0.0574	|.....
31	16.2000	-0.0042	|.....	0.0000	|.....	-0.0002	|.....
32	8.4500	-0.0662	|.....	0.0022	|.....	0.0276	|.....
33	29.2000	0.2396	|.....	0.0285	|.....	0.1579	|.....
34	5.3200	-0.0551	|.....	0.0016	|.....	0.0304	|.....
35	2.2700	-0.0284	|.....	0.0004	|.....	0.0185	|.....
36	1.6800	-0.0372	|.....	0.0007	|.....	0.0248	|.....
37	3.4200	-0.0453	|.....	0.0011	|.....	0.0279	|.....
38	4.4100	-0.0552	|.....	0.0016	|.....	0.0322	|.....
39	1.3100	-0.0142	|.....	0.0001	|.....	0.0096	|.....
40	7.0800	-0.1101	|.....	0.0062	|.....	0.0529	|.....
41	1.0900	-0.0353	|.....	0.0006	|.....	0.0241	|.....
42	0.9700	0.0071	|.....	0.0000	|.....	-0.0049	|.....
43	1.1100	-0.0375	|.....	0.0007	|.....	0.0255	|.....
44	1.0700	-0.0363	|.....	0.0007	|.....	0.0248	|.....
45	0.4500	-0.0226	|.....	0.0003	|.....	0.0158	|.....
46	20.5000	0.0741	|.....	0.0028	|.....	0.0223	|.....
47	29.3000	1.8252	|||||||||||||||	* 0.5830	|||||||||||||||	1.2081	|||||||||||||||
48	18.6000	0.4086	|||.....	0.0733	|.....	0.0778	|.....
49	27.7000	-0.1118	|.....	0.0064	|.....	-0.0687	|.....
50	13.6000	-0.0243	|.....	0.0003	|.....	0.0031	|.....
51	30.0000	0.0441	|.....	0.0010	|.....	0.0300	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Outlier & Influence Chart

Row	Invert (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	30.2000	-0.4294	|.....	0.0044	|.....	0.0449	|.....
11	20.2000	-0.0409	|.....	0.0000	|.....	0.0259	|.....
12	12.0000	-0.3026	|.....	0.0012	|.....	0.0251	|.....
13	9.0700	0.2141	|.....	0.0007	|.....	0.0280	|.....
14	16.3000	-0.2149	|.....	0.0006	|.....	0.0239	|.....
15	11.1000	-0.8479	|.....	0.0096	|.....	0.0258	|.....
16	1.6100	0.5587	|.....	0.0072	|.....	0.0431	|.....
17	2.3600	-0.2109	|.....	0.0010	|.....	0.0411	|.....
18	1.5200	-0.0942	|.....	0.0002	|.....	0.0433	|.....
19	1.9700	-0.1783	|.....	0.0007	|.....	0.0421	|.....
20	4.5000	-0.3820	|.....	0.0028	|.....	0.0359	|.....
21	1.3200	-0.2183	|.....	0.0011	|.....	0.0439	|.....
22	34.6000	-0.5686	|.....	0.0104	|.....	0.0595	||.....
23	8.7700	-0.2822	|.....	0.0012	|.....	0.0284	|.....
24	24.5000	0.6390	|.....	0.0068	|.....	0.0317	|.....
25	26.0000	0.0513	|.....	0.0000	|.....	0.0345	|.....
26	53.8000	-1.8143	|||.....	0.3143	||||||||.....	0.1680	|||||||||.....
27	62.3000	-1.2054	||.....	0.2259	||||.....	0.2392	|||||||||||||
28	32.1000	-0.2069	|.....	0.0012	|.....	0.0507	|.....
29	50.1000	-0.0428	|.....	0.0002	|.....	0.1414	|||||||.....
30	26.6000	-0.5147	|.....	0.0050	|.....	0.0358	|.....
31	16.2000	-0.0267	|.....	0.0000	|.....	0.0238	|.....
32	8.4500	-0.3841	|.....	0.0022	|.....	0.0288	|.....
33	29.2000	1.1426	|.....	0.0285	|.....	0.0421	|.....
34	5.3200	-0.2929	|.....	0.0016	|.....	0.0342	|.....
35	2.2700	-0.1368	|.....	0.0004	|.....	0.0413	|.....
36	1.6800	-0.1759	|.....	0.0007	|.....	0.0429	|.....
37	3.4200	-0.2266	|.....	0.0011	|.....	0.0384	|.....
38	4.4100	-0.2850	|.....	0.0016	|.....	0.0361	|.....
39	1.3100	-0.0662	|.....	0.0001	|.....	0.0439	|.....
40	7.0800	-0.6158	|.....	0.0062	|.....	0.0310	|.....
41	1.0900	-0.1636	|.....	0.0006	|.....	0.0446	|.....
42	0.9700	0.0329	|.....	0.0000	|.....	0.0449	|.....
43	1.1100	-0.1736	|.....	0.0007	|.....	0.0445	|.....
44	1.0700	-0.1680	|.....	0.0007	|.....	0.0446	|.....
45	0.4500	-0.1024	|.....	0.0003	|.....	0.0464	|.....
46	20.5000	0.4516	|.....	0.0028	|.....	0.0262	|.....
47	29.3000	* 8.6765	|||||||||||||||	* 0.5830	|||||||||||||||	0.0424	|.....
48	18.6000	* 2.5674	||||.....	0.0733	|.....	0.0247	|.....
49	27.7000	-0.5602	|.....	0.0064	|.....	0.0383	|.....
50	13.6000	-0.1543	|.....	0.0003	|.....	0.0242	|.....
51	30.0000	0.2049	|.....	0.0010	|.....	0.0443	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Inverse Prediction of X Means

Row	Mammal (Y)	Invert (X)	Predicted Invert (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	28.3000	30.2000	24.6618	5.5382	20.3971	30.2677
11	23.0667	20.2000	19.6663	0.5337	15.5925	24.3429
12	10.9000	12.0000	8.0524	3.9476	2.7705	12.2208
13	14.8900	9.0700	11.8611	-2.7911	7.2357	15.9359
14	16.6000	16.3000	13.4934	2.8066	9.0761	17.6013
15	2.6000	11.1000	0.1296	10.9704	-7.0776	5.0522
16	11.6950	1.6100	8.8113	-7.2013	3.6776	12.9436
17	2.0767	2.3600	-0.3700	2.7300	-7.7159	4.6175
18	2.7800	1.5200	0.3014	1.2186	-6.8584	5.2021
19	2.1100	1.9700	-0.3382	2.3082	-7.6752	4.6452
20	1.9900	4.5000	-0.4527	4.9527	-7.8217	4.5457
21	0.8900	1.3200	-1.5027	2.8227	-9.1686	3.6374
22	31.1000	34.6000	27.3346	7.2654	22.8386	33.5668
23	7.8000	8.7700	5.0933	3.6767	-0.8358	9.4715
24	36.8000	24.5000	32.7756	-8.2756	27.6217	40.4698
25	30.4000	26.0000	26.6664	-0.6664	22.2350	32.7352
26	36.8000	53.8000	32.7756	21.0244	27.6217	40.4698
27	53.4233	62.3000	48.6435	13.6565	40.8619	61.3108
28	33.3000	32.1000	29.4346	2.6654	24.7099	36.2059
29	54.4000	50.1000	49.5758	0.5242	41.6233	62.5518
30	23.3500	26.6000	19.9367	6.6633	15.8623	24.6540
31	19.0700	16.2000	15.8512	0.3488	11.6485	20.0930
32	6.0800	8.4500	3.4514	4.9986	-2.8775	7.9869
33	48.3000	29.2000	43.7530	-14.5530	36.8467	54.8221
34	4.0533	5.3200	1.5169	3.8031	-5.3136	6.2678
35	2.9867	2.2700	0.4987	1.7713	-6.6070	5.3743
36	1.8400	1.6800	-0.5959	2.2759	-8.0050	4.4215
37	2.9700	3.4200	0.4828	2.9372	-6.6272	5.3604
38	3.2100	4.4100	0.7119	3.6981	-6.3356	5.5608
39	2.9400	1.3100	0.4541	0.8559	-6.6637	5.3354
40	1.5200	7.0800	-0.9014	7.9814	-8.3964	4.1569
41	1.3900	1.0900	-1.0254	2.1154	-8.5556	4.0495
42	3.9267	0.9700	1.3960	-0.4260	-5.4668	6.1613
43	1.2767	1.1100	-1.1336	2.2436	-8.6945	3.9560
44	1.3100	1.0700	-1.1018	2.1718	-8.6536	3.9835
45	1.5500	0.4500	-0.8727	1.3227	-8.3597	4.1816
46	30.1000	20.5000	26.3800	-5.8800	21.9751	32.3801
47	101.9000	29.3000	94.9175	-65.6175	78.0367	123.5229
48	54.4500	18.6000	49.6236	-31.0236	41.6622	62.6153
49	23.9000	27.7000	20.4617	7.2383	16.3826	25.2613
50	14.6000	13.6000	11.5843	2.0157	6.9190	15.6581
51	36.6667	30.0000	32.6483	-2.6483	27.5120	40.3061

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Invert

Inverse Prediction of X Individuals

Row	Mammal (Y)	Invert (X)	Predicted Invert (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	28.3000	30.2000	24.6618	5.5382	-2.4681	53.1329
11	23.0667	20.2000	19.6663	0.5337	-7.7389	47.6743
12	10.9000	12.0000	8.0524	3.9476	-20.2683	35.2596
13	14.8900	9.0700	11.8611	-2.7911	-16.1168	39.2884
14	16.6000	16.3000	13.4934	2.8066	-14.3503	41.0277
15	2.6000	11.1000	0.1296	10.9704	-29.0358	27.0104
16	11.6950	1.6100	8.8113	-7.2013	-19.4379	36.0591
17	2.0767	2.3600	-0.3700	2.7300	-29.5945	26.4962
18	2.7800	1.5200	0.3014	1.2186	-28.8438	27.1875
19	2.1100	1.9700	-0.3382	2.3082	-29.5589	26.5289
20	1.9900	4.5000	-0.4527	4.9527	-29.6871	26.4111
21	0.8900	1.3200	-1.5027	2.8227	-30.8639	25.3326
22	31.1000	34.6000	27.3346	7.2654	0.3228	56.0825
23	7.8000	8.7700	5.0933	3.6767	-23.5223	32.1580
24	36.8000	24.5000	32.7756	-8.2756	5.9427	62.1488
25	30.4000	26.0000	26.6664	-0.6664	-0.3730	55.3432
26	36.8000	53.8000	32.7756	21.0244	5.9427	62.1488
27	53.4233	62.3000	48.6435	13.6565	21.8793	80.2934
28	33.3000	32.1000	29.4346	2.6654	2.5017	58.4141
29	54.4000	50.1000	49.5758	0.5242	22.7957	81.3794
30	23.3500	26.6000	19.9367	6.6633	-7.4517	47.9680
31	19.0700	16.2000	15.8512	0.3488	-11.8121	43.5536
32	6.0800	8.4500	3.4514	4.9986	-25.3384	30.4477
33	48.3000	29.2000	43.7530	-14.5530	17.0370	74.6318
34	4.0533	5.3200	1.5169	3.8031	-27.4879	28.4422
35	2.9867	2.2700	0.4987	1.7713	-28.6235	27.3908
36	1.8400	1.6800	-0.5959	2.2759	-29.8474	26.2638
37	2.9700	3.4200	0.4828	2.9372	-28.6412	27.3744
38	3.2100	4.4100	0.7119	3.6981	-28.3855	27.6107
39	2.9400	1.3100	0.4541	0.8559	-28.6732	27.3449
40	1.5200	7.0800	-0.9014	7.9814	-30.1895	25.9499
41	1.3900	1.0900	-1.0254	2.1154	-30.3286	25.8225
42	3.9267	0.9700	1.3960	-0.4260	-27.6226	28.3172
43	1.2767	1.1100	-1.1336	2.2436	-30.4498	25.7114
44	1.3100	1.0700	-1.1018	2.1718	-30.4142	25.7440
45	1.5500	0.4500	-0.8727	1.3227	-30.1574	25.9793
46	30.1000	20.5000	26.3800	-5.8800	-0.6716	55.0268
47	101.9000	29.3000	94.9175	-65.6175	65.2022	136.3574
48	54.4500	18.6000	49.6236	-31.0236	22.8425	81.4350
49	23.9000	27.7000	20.4617	7.2383	-6.8948	48.5387
50	14.6000	13.6000	11.5843	2.0157	-16.4172	38.9942
51	36.6667	30.0000	32.6483	-2.6483	5.8122	62.0060

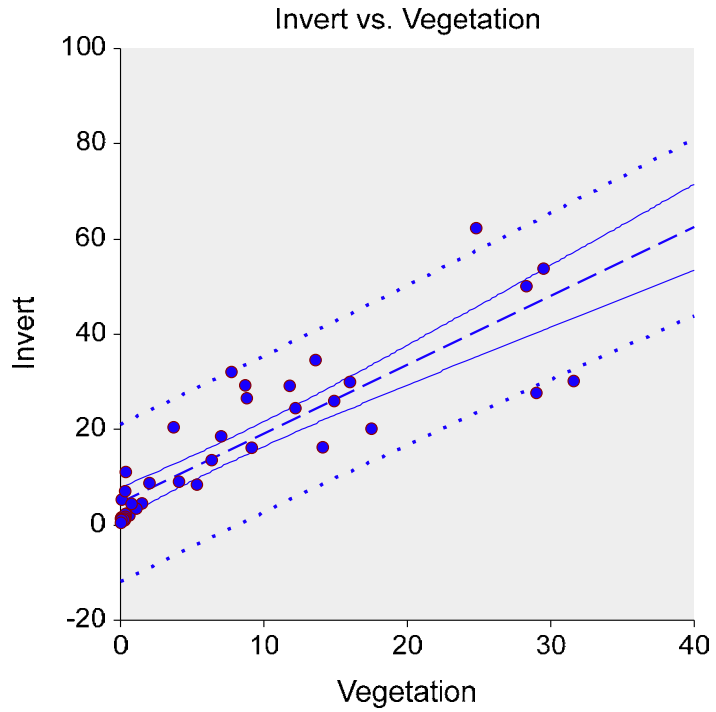
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Vegetation to Prey Tissue Linear Regressions
No Transformation – APL10 and PCO06 (SM Only) Removed

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Invert	Rows Processed	58
Independent Variable	Vegetation	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	4.6228	Rows Prediction Only	0
Slope	1.4459	Sum of Frequencies	41
R-Squared	0.7525	Sum of Weights	41.0000
Correlation	0.8675	Coefficient of Variation	0.5112
Mean Square Error	64.19453	Square Root of MSE	8.012149

Linear Regression Report

Y = Invert X = Vegetation

Summary Statement
The equation of the straight line relating Invert and Vegetation is estimated as: Invert = (4.6228) + (1.4459) Vegetation using the 41 observations in this dataset. The y-intercept, the estimated value of Invert when Vegetation is zero, is 4.6228 with a standard error of 1.6111. The slope, the estimated change in Invert per unit change in Vegetation, is 1.4459 with a standard error of 0.1328. The value of R-Squared, the proportion of the variation in Invert that can be accounted for by variation in Vegetation, is 0.7525. The correlation between Invert and Vegetation is 0.8675.

A significance test that the slope is zero resulted in a t-value of 10.8895. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 1.4459. The lower limit of the 95% confidence interval for the slope is 1.1773 and the upper limit is 1.7144. The estimated intercept is 4.6228. The lower limit of the 95% confidence interval for the intercept is 1.3640 and the upper limit is 7.8816.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Invert	Vegetation
Count	41	41
Mean	15.6744	7.6437
Standard Deviation	15.9027	9.5412
Minimum	0.4500	0.0300
Maximum	62.3000	31.6000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	4.6228	1.4459
Lower 95% Confidence Limit	1.3640	1.1773
Upper 95% Confidence Limit	7.8816	1.7144
Standard Error	1.6111	0.1328
Standardized Coefficient	0.0000	0.8675
T Value	2.8693	10.8895
Prob Level (T Test)	0.0066	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.7990	1.0000
Regression of Y on X	4.6228	1.4459
Inverse Regression from X on Y	0.9880	1.9214
Orthogonal Regression of Y and X	2.0015	1.7888

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(4.62277964766951) + (1.4458535194025) * (Vegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	4.6228	0.9000	2.6611	6.5324
Bootstrap Mean	4.5561	0.9500	2.1680	6.8149
Bias (BM - OV)	-0.0666	0.9900	1.2313	7.4428
Bias Corrected	4.6894			
Standard Error	1.1832			
Slope				
Original Value	1.4459	0.9000	1.0351	1.7719
Bootstrap Mean	1.4731	0.9500	0.9462	1.8286
Bias (BM - OV)	0.0272	0.9900	0.7937	1.9227
Bias Corrected	1.4186			
Standard Error	0.2253			
Correlation				
Original Value	0.8675	0.9000	0.7965	0.9326
Bootstrap Mean	0.8720	0.9500	0.7860	0.9451
Bias (BM - OV)	0.0045	0.9900	0.7720	0.9772
Bias Corrected	0.8630			
Standard Error	0.0415			
R-Squared				
Original Value	0.7525	0.9000	0.6243	0.8612
Bootstrap Mean	0.7621	0.9500	0.6046	0.8812
Bias (BM - OV)	0.0096	0.9900	0.5778	0.9309
Bias Corrected	0.7429			
Standard Error	0.0721			
Standard Error of Estimate				
Original Value	8.0121	0.9000	6.4538	10.6229
Bootstrap Mean	7.5695	0.9500	6.0631	11.0559
Bias (BM - OV)	-0.4426	0.9900	5.3206	11.8927
Bias Corrected	8.4548			
Standard Error	1.2487			
Orthogonal Intercept				
Original Value	2.0015	0.9000	0.4708	3.5530
Bootstrap Mean	2.0408	0.9500	0.1664	3.9020
Bias (BM - OV)	0.0392	0.9900	-0.4940	4.7235
Bias Corrected	1.9623			
Standard Error	0.9483			
Orthogonal Slope				
Original Value	1.7888	0.9000	1.4139	2.1515
Bootstrap Mean	1.7991	0.9500	1.3460	2.2233
Bias (BM - OV)	0.0104	0.9900	1.2039	2.3402
Bias Corrected	1.7784			
Standard Error	0.2207			

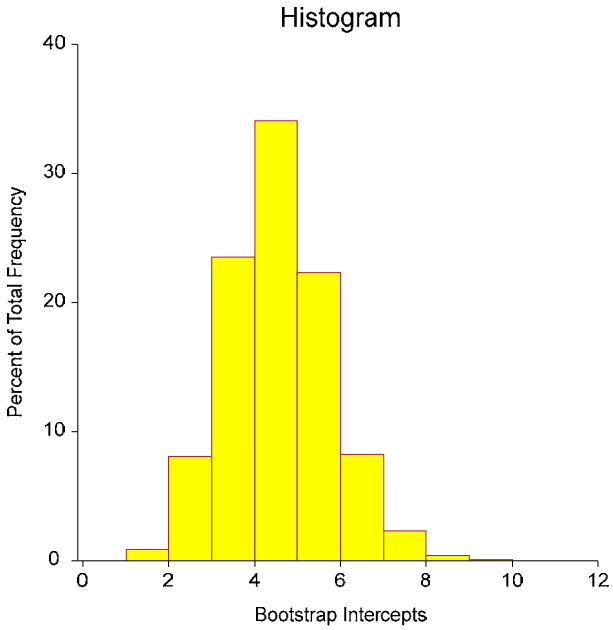
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

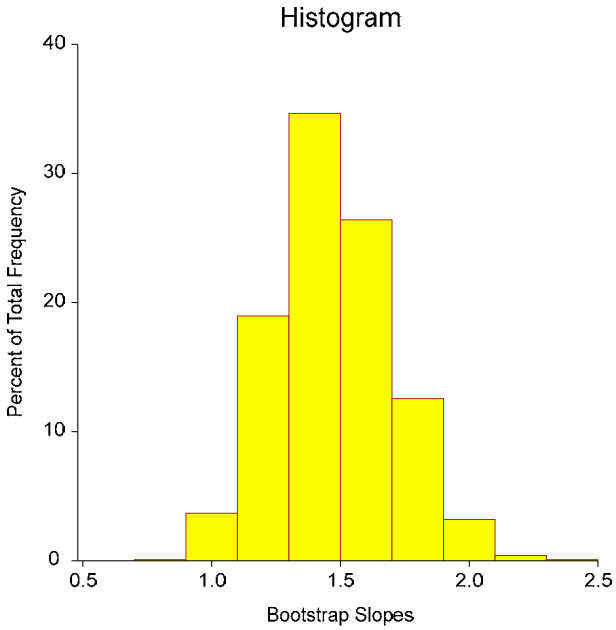
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

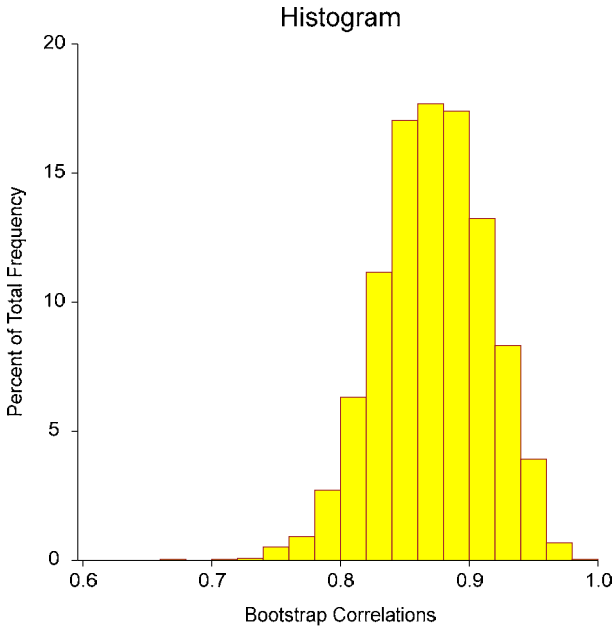
Linear Regression Report

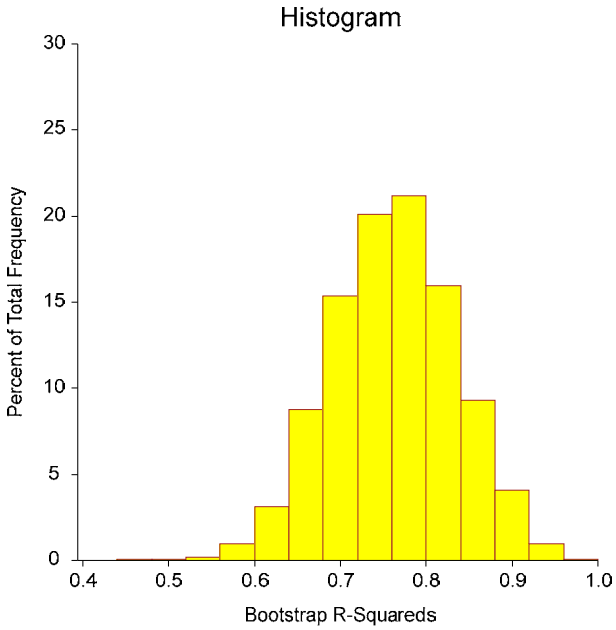
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Bootstrap Histograms Section



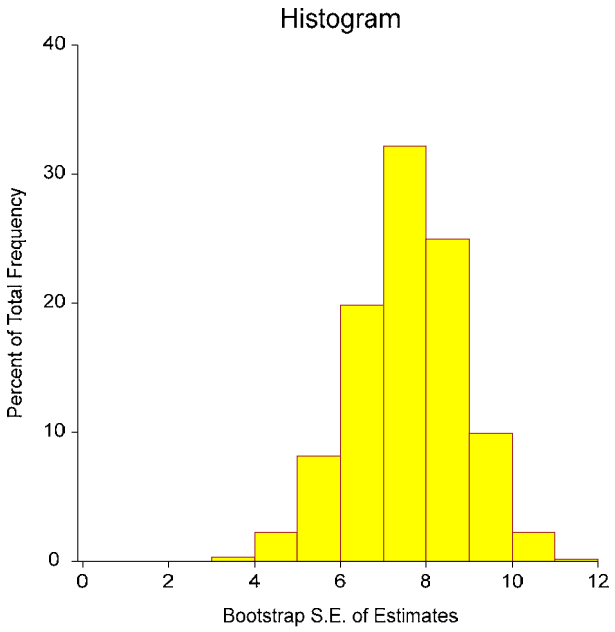


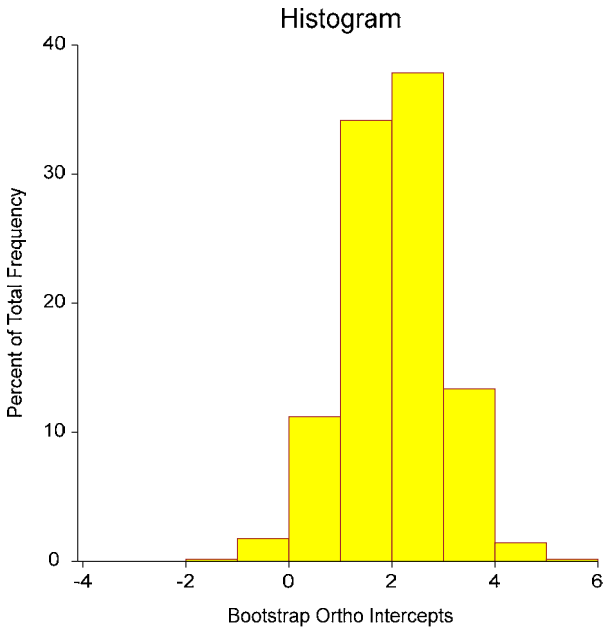


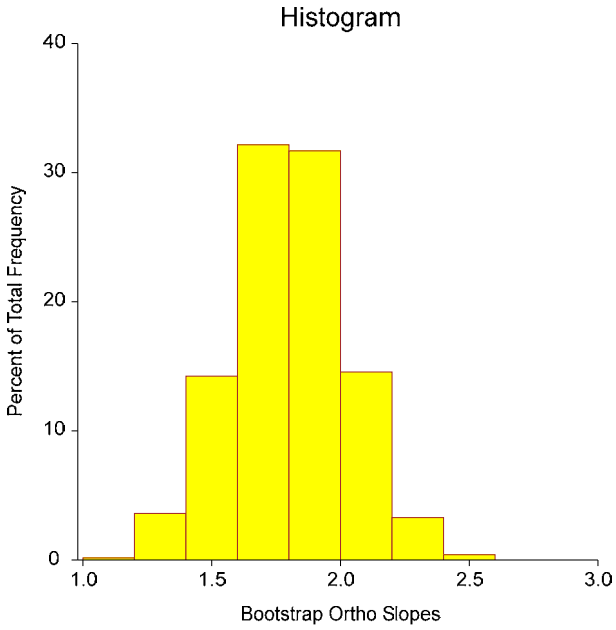


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8675	0.7525	0.9120
Lower 95% Conf. Limit (r dist'n)	0.7597		
Upper 95% Conf. Limit (r dist'n)	0.9257		
Lower 95% Conf. Limit (Fisher's z)	0.7636		0.8401
Upper 95% Conf. Limit (Fisher's z)	0.9276		0.9524
Adjusted (Rbar)		0.7462	
T-Value for H0: Rho = 0	10.8895	10.8895	13.8861
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	10073.15	10073.15			
Slope	1	7612.295	7612.295	118.5817	0.0000	1.0000
Error	39	2503.586	64.19453			
Lack of Fit	37	2486.94	67.21459	8.0754	0.1161	
Pure Error	2	16.64665	8.323325			
Adj. Total	40	10115.88	252.897			
Total	41	20189.03				

s = Square Root(64.19453) = 8.012149

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	313.39	642.65	0.04043509	-0.002099105
1	313.39	6036.835	10177.11	-0.002099105	0.0002746205
2 (Y'Y)			20189.03		
Determinant		149296.9			6.698061E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	2.595711	-0.1347511
1	-0.1347511	0.01762913

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9263	0.010931	No
Anderson Darling	1.3936	0.001325	No
D'Agostino Skewness	0.5305	0.595752	Yes
D'Agostino Kurtosis	1.8775	0.060448	No
D'Agostino Omnibus	3.8065	0.149083	No
Constant Residual Variance?			
Modified Levene Test	11.4344	0.001651	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	8.0754	0.116107	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

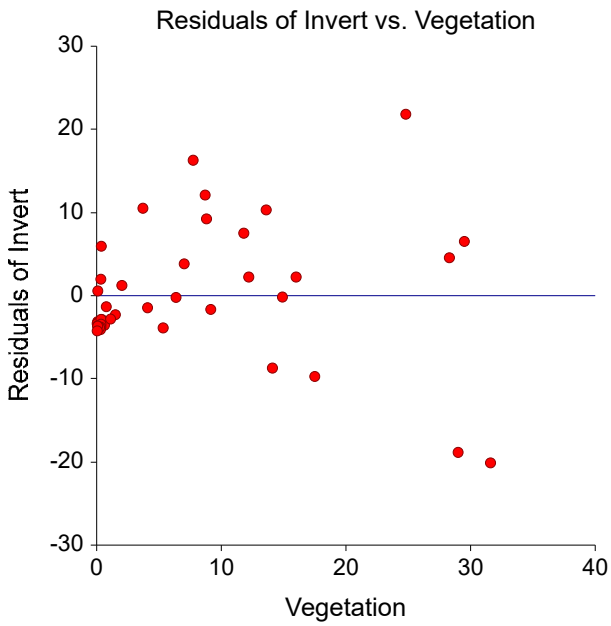
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

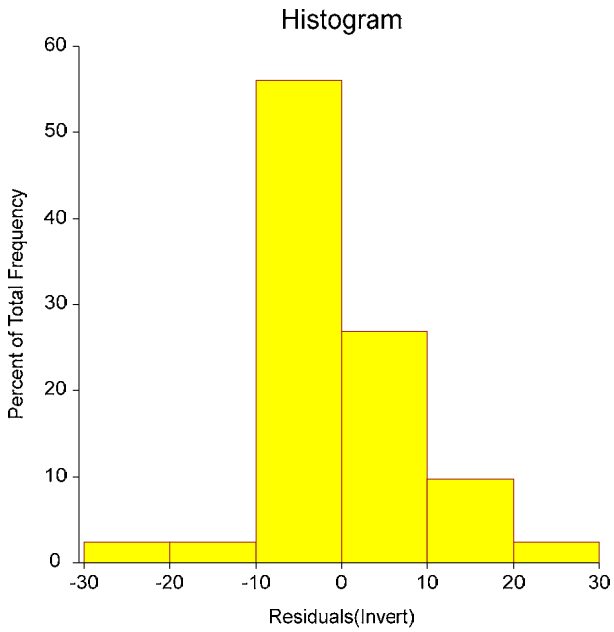
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

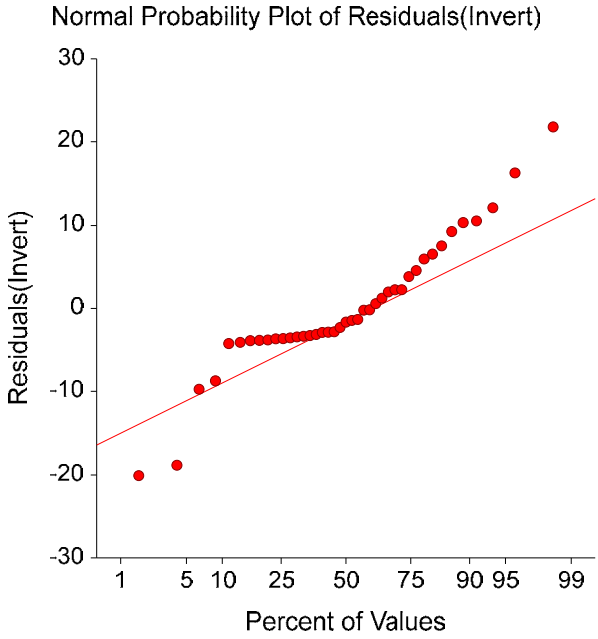
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Original Data Section

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual
10	31.6000	30.2000	50.3118	-20.1118
11	17.5000	20.2000	29.9252	-9.7252
13	4.0800	9.0700	10.5219	-1.4519
14	14.1000	16.3000	25.0093	-8.7093
15	0.3700	11.1000	5.1577	5.9423
16	0.0800	1.6100	4.7384	-3.1284
17	0.4300	2.3600	5.2445	-2.8845
18	0.1100	1.5200	4.7818	-3.2618
19	0.6200	1.9700	5.5192	-3.5492
20	1.5000	4.5000	6.7916	-2.2916
21	0.0300	1.3200	4.6662	-3.3462
22	13.6000	34.6000	24.2864	10.3136
23	2.0200	8.7700	7.5434	1.2266
24	12.2000	24.5000	22.2622	2.2378
25	14.9000	26.0000	26.1660	-0.1660
26	29.5000	53.8000	47.2755	6.5245
27	24.8000	62.3000	40.4799	21.8201
28	7.7400	32.1000	15.8137	16.2863
29	28.3000	50.1000	45.5404	4.5596
30	8.8100	26.6000	17.3607	9.2393
31	9.1500	16.2000	17.8523	-1.6523
32	5.3300	8.4500	12.3292	-3.8792
33	11.8000	29.2000	21.6839	7.5161
34	0.0900	5.3200	4.7529	0.5671
35	0.3500	2.2700	5.1288	-2.8588
36	0.3400	1.6800	5.1144	-3.4344
37	1.1100	3.4200	6.2277	-2.8077
38	0.7700	4.4100	5.7361	-1.3261
39	0.3300	1.3100	5.0999	-3.7899
40	0.3300	7.0800	5.0999	1.9801
41	0.0700	1.0900	4.7240	-3.6340
42	0.3000	0.9700	5.0565	-4.0865
43	0.2300	1.1100	4.9553	-3.8453
44	0.0700	1.0700	4.7240	-3.6540
45	0.0400	0.4500	4.6806	-4.2306
46	3.7100	20.5000	9.9869	10.5131
47	8.7000	29.3000	17.2017	12.0983
48	7.0200	18.6000	14.7727	3.8273
49	29.0000	27.7000	46.5525	-18.8525
50	6.3600	13.6000	13.8184	-0.2184
51	16.0000	30.0000	27.7564	2.2436

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Predicted Values and Confidence Limits of Means

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	31.6000	30.2000	50.3118	3.4181	43.3981	57.2254
11	17.5000	20.2000	29.9252	1.8106	26.2629	33.5875
13	4.0800	9.0700	10.5219	1.3378	7.8160	13.2277
14	14.1000	16.3000	25.0093	1.5168	21.9414	28.0773
15	0.3700	11.1000	5.1577	1.5806	1.9606	8.3549
16	0.0800	1.6100	4.7384	1.6045	1.4931	7.9838
17	0.4300	2.3600	5.2445	1.5758	2.0572	8.4318
18	0.1100	1.5200	4.7818	1.6020	1.5416	8.0221
19	0.6200	1.9700	5.5192	1.5606	2.3626	8.6758
20	1.5000	4.5000	6.7916	1.4937	3.7703	9.8128
21	0.0300	1.3200	4.6662	1.6086	1.4124	7.9199
22	13.6000	34.6000	24.2864	1.4803	21.2923	27.2805
23	2.0200	8.7700	7.5434	1.4571	4.5961	10.4907
24	12.2000	24.5000	22.2622	1.3899	19.4509	25.0734
25	14.9000	26.0000	26.1660	1.5792	22.9717	29.3603
26	29.5000	53.8000	47.2755	3.1602	40.8833	53.6677
27	24.8000	62.3000	40.4799	2.5990	35.2230	45.7369
28	7.7400	32.1000	15.8137	1.2514	13.2826	18.3448
29	28.3000	50.1000	45.5404	3.0146	39.4428	51.6380
30	8.8100	26.6000	17.3607	1.2608	14.8105	19.9110
31	9.1500	16.2000	17.8523	1.2672	15.2892	20.4154
32	5.3300	8.4500	12.3292	1.2884	9.7231	14.9353
33	11.8000	29.2000	21.6839	1.3676	18.9177	24.4500
34	0.0900	5.3200	4.7529	1.6036	1.5093	7.9965
35	0.3500	2.2700	5.1288	1.5823	1.9284	8.3293
36	0.3400	1.6800	5.1144	1.5831	1.9123	8.3164
37	1.1100	3.4200	6.2277	1.5226	3.1479	9.3074
38	0.7700	4.4100	5.7361	1.5488	2.6034	8.8687
39	0.3300	1.3100	5.0999	1.5839	1.8962	8.3036
40	0.3300	7.0800	5.0999	1.5839	1.8962	8.3036
41	0.0700	1.0900	4.7240	1.6053	1.4770	7.9710
42	0.3000	0.9700	5.0565	1.5863	1.8479	8.2652
43	0.2300	1.1100	4.9553	1.5921	1.7351	8.1756
44	0.0700	1.0700	4.7240	1.6053	1.4770	7.9710
45	0.0400	0.4500	4.6806	1.6078	1.4286	7.9327
46	3.7100	20.5000	9.9869	1.3559	7.2443	12.7295
47	8.7000	29.3000	17.2017	1.2591	14.6549	19.7485
48	7.0200	18.6000	14.7727	1.2540	12.2362	17.3092
49	29.0000	27.7000	46.5525	3.0994	40.2834	52.8216
50	6.3600	13.6000	13.8184	1.2628	11.2641	16.3727
51	16.0000	30.0000	27.7564	1.6723	24.3738	31.1391

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Predicted Values and Prediction Limits

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	31.6000	30.2000	50.3118	8.7108	32.6925	67.9310
11	17.5000	20.2000	29.9252	8.2142	13.3105	46.5400
13	4.0800	9.0700	10.5219	8.1231	-5.9086	26.9523
14	14.1000	16.3000	25.0093	8.1545	8.5154	41.5033
15	0.3700	11.1000	5.1577	8.1666	-11.3607	21.6762
16	0.0800	1.6100	4.7384	8.1712	-11.7894	21.2663
17	0.4300	2.3600	5.2445	8.1656	-11.2721	21.7611
18	0.1100	1.5200	4.7818	8.1707	-11.7450	21.3087
19	0.6200	1.9700	5.5192	8.1627	-10.9914	22.0299
20	1.5000	4.5000	6.7916	8.1502	-9.6938	23.2769
21	0.0300	1.3200	4.6662	8.1720	-11.8633	21.1957
22	13.6000	34.6000	24.2864	8.1477	7.8060	40.7668
23	2.0200	8.7700	7.5434	8.1436	-8.9285	24.0153
24	12.2000	24.5000	22.2622	8.1318	5.8141	38.7103
25	14.9000	26.0000	26.1660	8.1663	9.6481	42.6839
26	29.5000	53.8000	47.2755	8.6129	29.8543	64.6966
27	24.8000	62.3000	40.4799	8.4231	23.4425	57.5173
28	7.7400	32.1000	15.8137	8.1093	-0.5889	32.2163
29	28.3000	50.1000	45.5404	8.5605	28.2252	62.8557
30	8.8100	26.6000	17.3607	8.1107	0.9552	33.7663
31	9.1500	16.2000	17.8523	8.1117	1.4448	34.2599
32	5.3300	8.4500	12.3292	8.1151	-4.0851	28.7435
33	11.8000	29.2000	21.6839	8.1280	5.2434	38.1243
34	0.0900	5.3200	4.7529	8.1711	-11.7746	21.2804
35	0.3500	2.2700	5.1288	8.1669	-11.3903	21.6479
36	0.3400	1.6800	5.1144	8.1670	-11.4050	21.6338
37	1.1100	3.4200	6.2277	8.1555	-10.2685	22.7238
38	0.7700	4.4100	5.7361	8.1605	-10.7700	22.2422
39	0.3300	1.3100	5.0999	8.1672	-11.4198	21.6196
40	0.3300	7.0800	5.0999	8.1672	-11.4198	21.6196
41	0.0700	1.0900	4.7240	8.1714	-11.8042	21.2522
42	0.3000	0.9700	5.0565	8.1677	-11.4642	21.5772
43	0.2300	1.1100	4.9553	8.1688	-11.5676	21.4783
44	0.0700	1.0700	4.7240	8.1714	-11.8042	21.2522
45	0.0400	0.4500	4.6806	8.1719	-11.8486	21.2098
46	3.7100	20.5000	9.9869	8.1261	-6.4496	26.4234
47	8.7000	29.3000	17.2017	8.1105	0.7967	33.6067
48	7.0200	18.6000	14.7727	8.1097	-1.6307	31.1761
49	29.0000	27.7000	46.5525	8.5907	29.1761	63.9289
50	6.3600	13.6000	13.8184	8.1111	-2.5878	30.2246
51	16.0000	30.0000	27.7564	8.1848	11.2011	44.3118

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Working-Hotelling Simultaneous Confidence Band

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	31.6000	30.2000	50.3118	3.4181	40.5707	60.0528
11	17.5000	20.2000	29.9252	1.8106	24.7652	35.0852
13	4.0800	9.0700	10.5219	1.3378	6.7094	14.3343
14	14.1000	16.3000	25.0093	1.5168	20.6867	29.3319
15	0.3700	11.1000	5.1577	1.5806	0.6531	9.6624
16	0.0800	1.6100	4.7384	1.6045	0.1660	9.3109
17	0.4300	2.3600	5.2445	1.5758	0.7537	9.7353
18	0.1100	1.5200	4.7818	1.6020	0.2164	9.3472
19	0.6200	1.9700	5.5192	1.5606	1.0718	9.9666
20	1.5000	4.5000	6.7916	1.4937	2.5347	11.0484
21	0.0300	1.3200	4.6662	1.6086	0.0818	9.2505
22	13.6000	34.6000	24.2864	1.4803	20.0678	28.5049
23	2.0200	8.7700	7.5434	1.4571	3.3907	11.6961
24	12.2000	24.5000	22.2622	1.3899	18.3013	26.2231
25	14.9000	26.0000	26.1660	1.5792	21.6654	30.6666
26	29.5000	53.8000	47.2755	3.1602	38.2692	56.2817
27	24.8000	62.3000	40.4799	2.5990	33.0732	47.8867
28	7.7400	32.1000	15.8137	1.2514	12.2475	19.3799
29	28.3000	50.1000	45.5404	3.0146	36.9492	54.1316
30	8.8100	26.6000	17.3607	1.2608	13.7675	20.9540
31	9.1500	16.2000	17.8523	1.2672	14.2411	21.4636
32	5.3300	8.4500	12.3292	1.2884	8.6573	16.0011
33	11.8000	29.2000	21.6839	1.3676	17.7864	25.5813
34	0.0900	5.3200	4.7529	1.6036	0.1828	9.3230
35	0.3500	2.2700	5.1288	1.5823	0.6196	9.6381
36	0.3400	1.6800	5.1144	1.5831	0.6028	9.6259
37	1.1100	3.4200	6.2277	1.5226	1.8885	10.5669
38	0.7700	4.4100	5.7361	1.5488	1.3223	10.1498
39	0.3300	1.3100	5.0999	1.5839	0.5860	9.6138
40	0.3300	7.0800	5.0999	1.5839	0.5860	9.6138
41	0.0700	1.0900	4.7240	1.6053	0.1491	9.2988
42	0.3000	0.9700	5.0565	1.5863	0.5357	9.5774
43	0.2300	1.1100	4.9553	1.5921	0.4182	9.4925
44	0.0700	1.0700	4.7240	1.6053	0.1491	9.2988
45	0.0400	0.4500	4.6806	1.6078	0.0986	9.2626
46	3.7100	20.5000	9.9869	1.3559	6.1227	13.8511
47	8.7000	29.3000	17.2017	1.2591	13.6134	20.7900
48	7.0200	18.6000	14.7727	1.2540	11.1989	18.3465
49	29.0000	27.7000	46.5525	3.0994	37.7197	55.3854
50	6.3600	13.6000	13.8184	1.2628	10.2195	17.4173
51	16.0000	30.0000	27.7564	1.6723	22.9905	32.5224

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Section

Row	Vegetation (X)	Invert (Y)	Predicted Invert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	31.6000	30.2000	50.3118	-20.1118	-2.7754	66.5952
11	17.5000	20.2000	29.9252	-9.7252	-1.2460	48.1446
13	4.0800	9.0700	10.5219	-1.4519	-0.1838	16.0073
14	14.1000	16.3000	25.0093	-8.7093	-1.1070	53.4314
15	0.3700	11.1000	5.1577	5.9423	0.7565	53.5338
16	0.0800	1.6100	4.7384	-3.1284	-0.3985	194.3135
17	0.4300	2.3600	5.2445	-2.8845	-0.3672	122.2244
18	0.1100	1.5200	4.7818	-3.2618	-0.4155	214.5937
19	0.6200	1.9700	5.5192	-3.5492	-0.4516	180.1629
20	1.5000	4.5000	6.7916	-2.2916	-0.2911	50.9236
21	0.0300	1.3200	4.6662	-3.3462	-0.4263	253.4966
22	13.6000	34.6000	24.2864	10.3136	1.3098	29.8081
23	2.0200	8.7700	7.5434	1.2266	0.1557	13.9863
24	12.2000	24.5000	22.2622	2.2378	0.2836	9.1339
25	14.9000	26.0000	26.1660	-0.1660	-0.0211	0.6385
26	29.5000	53.8000	47.2755	6.5245	0.8862	12.1274
27	24.8000	62.3000	40.4799	21.8201	2.8790	35.0242
28	7.7400	32.1000	15.8137	16.2863	2.0580	50.7362
29	28.3000	50.1000	45.5404	4.5596	0.6142	9.1009
30	8.8100	26.6000	17.3607	9.2393	1.1677	34.7340
31	9.1500	16.2000	17.8523	-1.6523	-0.2089	10.1996
32	5.3300	8.4500	12.3292	-3.8792	-0.4905	45.9074
33	11.8000	29.2000	21.6839	7.5161	0.9521	25.7402
34	0.0900	5.3200	4.7529	0.5671	0.0722	10.6597
35	0.3500	2.2700	5.1288	-2.8588	-0.3640	125.9396
36	0.3400	1.6800	5.1144	-3.4344	-0.4373	204.4268
37	1.1100	3.4200	6.2277	-2.8077	-0.3569	82.0958
38	0.7700	4.4100	5.7361	-1.3261	-0.1687	30.0700
39	0.3300	1.3100	5.0999	-3.7899	-0.4825	289.3062
40	0.3300	7.0800	5.0999	1.9801	0.2521	27.9674
41	0.0700	1.0900	4.7240	-3.6340	-0.4629	333.3935
42	0.3000	0.9700	5.0565	-4.0865	-0.5203	421.2923
43	0.2300	1.1100	4.9553	-3.8453	-0.4897	346.4258
44	0.0700	1.0700	4.7240	-3.6540	-0.4655	341.4943
45	0.0400	0.4500	4.6806	-4.2306	-0.5390	940.1364
46	3.7100	20.5000	9.9869	10.5131	1.3313	51.2834
47	8.7000	29.3000	17.2017	12.0983	1.5290	41.2911
48	7.0200	18.6000	14.7727	3.8273	0.4837	20.5770
49	29.0000	27.7000	46.5525	-18.8525	-2.5516	68.0597
50	6.3600	13.6000	13.8184	-0.2184	-0.0276	1.6059
51	16.0000	30.0000	27.7564	2.2436	0.2863	7.4785

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Residual Diagnostics Section

Row	Vegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	31.6000	-20.1118	**-3.0582	0.1820	0.8569	52.8713
11	17.5000	-9.7252	-1.2552	0.0511	0.0418	63.2610
13	4.0800	-1.4519	-0.1815	0.0279	0.0005	65.8268
14	14.1000	-8.7093	-1.1103	0.0358	0.0228	63.8136
15	0.3700	5.9423	0.7523	0.0389	0.0116	64.9170
16	0.0800	-3.1284	-0.3942	0.0401	0.0033	65.6155
17	0.4300	-2.8845	-0.3631	0.0387	0.0027	65.6561
18	0.1100	-3.2618	-0.4110	0.0400	0.0036	65.5922
19	0.6200	-3.5492	-0.4470	0.0379	0.0040	65.5393
20	1.5000	-2.2916	-0.2877	0.0348	0.0015	65.7407
21	0.0300	-3.3462	-0.4218	0.0403	0.0038	65.5768
22	13.6000	10.3136	1.3223	0.0341	0.0303	62.9857
23	2.0200	1.2266	0.1537	0.0331	0.0004	65.8429
24	12.2000	2.2378	0.2802	0.0301	0.0012	65.7480
25	14.9000	-0.1660	-0.0209	0.0389	0.0000	65.8831
26	29.5000	6.5245	*0.8837	0.1556	0.0723	64.5572
27	24.8000	21.8201	**3.2025	0.1052	0.4874	51.8811
28	7.7400	16.2863	*2.1516	0.0244	0.0529	58.7292
29	28.3000	4.5596	*0.6092	0.1416	0.0311	65.2465
30	8.8100	9.2393	1.1733	0.0248	0.0173	63.5804
31	9.1500	-1.6523	-0.2063	0.0250	0.0006	65.8102
32	5.3300	-3.8792	-0.4857	0.0259	0.0032	65.4773
33	11.8000	7.5161	0.9509	0.0291	0.0136	64.3526
34	0.0900	0.5671	0.0713	0.0401	0.0001	65.8750
35	0.3500	-2.8588	-0.3599	0.0390	0.0027	65.6601
36	0.3400	-3.4344	-0.4327	0.0390	0.0039	65.5609
37	1.1100	-2.8077	-0.3529	0.0361	0.0024	65.6686
38	0.7700	-1.3261	-0.1666	0.0374	0.0006	65.8358
39	0.3300	-3.7899	-0.4777	0.0391	0.0047	65.4905
40	0.3300	1.9801	0.2491	0.0391	0.0013	65.7765
41	0.0700	-3.6340	-0.4582	0.0401	0.0045	65.5218
42	0.3000	-4.0865	-0.5154	0.0392	0.0055	65.4265
43	0.2300	-3.8453	-0.4849	0.0395	0.0049	65.4787
44	0.0700	-3.6540	-0.4608	0.0401	0.0045	65.5178
45	0.0400	-4.2306	-0.5340	0.0403	0.0061	65.3931
46	3.7100	10.5131	1.3451	0.0286	0.0261	62.8895
47	8.7000	12.0983	1.5566	0.0247	0.0296	61.9345
48	7.0200	3.8273	0.4788	0.0245	0.0029	65.4887
49	29.0000	-18.8525	**-2.7596	0.1496	0.5729	54.8848
50	6.3600	-0.2184	-0.0272	0.0248	0.0000	65.8826
51	16.0000	2.2436	0.2829	0.0436	0.0019	65.7454

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	* -3.0582	-1.4425	* 0.8569	0.8293	0.4355	-1.3424
11	-1.2552	-0.2912	0.0418	1.0234	-0.0237	-0.2105
13	-0.1815	-0.0307	0.0005	1.0817	-0.0292	0.0109
14	-1.1103	-0.2141	0.0228	1.0249	-0.0609	-0.1210
15	0.7523	0.1514	0.0116	1.0640	0.1513	-0.0925
16	-0.3942	-0.0806	0.0033	1.0884	-0.0806	0.0504
17	-0.3631	-0.0728	0.0027	1.0881	-0.0728	0.0443
18	-0.4110	-0.0839	0.0036	1.0875	-0.0839	0.0524
19	-0.4470	-0.0888	0.0040	1.0834	-0.0887	0.0530
20	-0.2877	-0.0546	0.0015	1.0865	-0.0543	0.0298
21	-0.4218	-0.0864	0.0038	1.0874	-0.0864	0.0543
22	1.3223	0.2486	0.0303	0.9967	0.0795	0.1328
23	0.1537	0.0284	0.0004	1.0880	0.0281	-0.0146
24	0.2802	0.0494	0.0012	1.0815	0.0210	0.0215
25	-0.0209	-0.0042	0.0000	1.0959	-0.0010	-0.0026
26	0.8837	0.3793	0.0723	* 1.1977	-0.1028	0.3483
27	* 3.2025	1.0982	0.4874	0.7300	-0.1957	0.9626
28	* 2.1516	0.3402	0.0529	0.8579	0.2620	0.0035
29	0.6092	0.2474	0.0311	* 1.2034	-0.0620	0.2251
30	1.1733	0.1870	0.0173	1.0059	0.1296	0.0230
31	-0.2063	-0.0330	0.0006	1.0779	-0.0221	-0.0052
32	-0.4857	-0.0791	0.0032	1.0680	-0.0716	0.0189
33	0.9509	0.1647	0.0136	1.0351	0.0752	0.0665
34	0.0713	0.0146	0.0001	1.0970	0.0146	-0.0091
35	-0.3599	-0.0725	0.0027	1.0886	-0.0725	0.0444
36	-0.4327	-0.0872	0.0039	1.0854	-0.0872	0.0534
37	-0.3529	-0.0683	0.0024	1.0857	-0.0681	0.0389
38	-0.1666	-0.0328	0.0006	1.0926	-0.0328	0.0193
39	-0.4777	-0.0963	0.0047	1.0831	-0.0963	0.0591
40	0.2491	0.0502	0.0013	1.0926	0.0502	-0.0308
41	-0.4582	-0.0937	0.0045	1.0853	-0.0937	0.0587
42	-0.5154	-0.1041	0.0055	1.0811	-0.1041	0.0640
43	-0.4849	-0.0983	0.0049	1.0832	-0.0983	0.0608
44	-0.4608	-0.0942	0.0045	1.0852	-0.0942	0.0590
45	-0.5340	-0.1094	0.0061	1.0812	-0.1094	0.0687
46	1.3451	0.2310	0.0261	0.9881	0.2216	-0.0890
47	1.5566	0.2477	0.0296	0.9544	0.1738	0.0276
48	0.4788	0.0759	0.0029	1.0669	0.0620	-0.0050
49	* -2.7596	-1.1576	* 0.5729	0.8596	0.3042	-1.0591
50	-0.0272	-0.0043	0.0000	1.0801	-0.0037	0.0006
51	0.2829	0.0604	0.0019	1.0967	0.0099	0.0401

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Outlier Detection Chart

Row	Vegetation (X)	Residual		Standardized Residual		RStudent	
10	31.6000	-20.1118	||||||||||||..	-2.7754	|||||||||||||.	* -3.0582	|||||||||||||.
11	17.5000	-9.7252	||||||.....	-1.2460	||||||.....	-1.2552	|||||.....
13	4.0800	-1.4519	|.....	-0.1838	|.....	-0.1815	|.....
14	14.1000	-8.7093	|||||.....	-1.1070	|||||.....	-1.1103	|||||.....
15	0.3700	5.9423	||||.....	0.7565	|||.....	0.7523	|||.....
16	0.0800	-3.1284	||.....	-0.3985	|.....	-0.3942	|.....
17	0.4300	-2.8845	|.....	-0.3672	|.....	-0.3631	|.....
18	0.1100	-3.2618	||.....	-0.4155	||.....	-0.4110	|.....
19	0.6200	-3.5492	||.....	-0.4516	||.....	-0.4470	||.....
20	1.5000	-2.2916	|.....	-0.2911	|.....	-0.2877	|.....
21	0.0300	-3.3462	||.....	-0.4263	||.....	-0.4218	|.....
22	13.6000	10.3136	|||||||.....	1.3098	||||||.....	1.3223	||||||.....
23	2.0200	1.2266	|.....	0.1557	|.....	0.1537	|.....
24	12.2000	2.2378	|.....	0.2836	|.....	0.2802	|.....
25	14.9000	-0.1660	|.....	-0.0211	|.....	-0.0209	|.....
26	29.5000	6.5245	||||.....	0.8862	||||.....	0.8837	||||.....
27	24.8000	21.8201	||||||||||||||	2.8790	||||||||||||||	* 3.2025	||||||||||||||
28	7.7400	16.2863	||||||||||....	2.0580	|||||||||.....	* 2.1516	|||||||||.....
29	28.3000	4.5596	|||.....	0.6142	|||.....	0.6092	||.....
30	8.8100	9.2393	||||||.....	1.1677	|||||.....	1.1733	|||||.....
31	9.1500	-1.6523	|.....	-0.2089	|.....	-0.2063	|.....
32	5.3300	-3.8792	||.....	-0.4905	||.....	-0.4857	||.....
33	11.8000	7.5161	|||||.....	0.9521	||||.....	0.9509	||||.....
34	0.0900	0.5671	|.....	0.0722	|.....	0.0713	|.....
35	0.3500	-2.8588	|.....	-0.3640	|.....	-0.3599	|.....
36	0.3400	-3.4344	||.....	-0.4373	||.....	-0.4327	|.....
37	1.1100	-2.8077	|.....	-0.3569	|.....	-0.3529	|.....
38	0.7700	-1.3261	|.....	-0.1687	|.....	-0.1666	|.....
39	0.3300	-3.7899	||.....	-0.4825	||.....	-0.4777	||.....
40	0.3300	1.9801	|.....	0.2521	|.....	0.2491	|.....
41	0.0700	-3.6340	||.....	-0.4629	||.....	-0.4582	||.....
42	0.3000	-4.0865	||.....	-0.5203	||.....	-0.5154	||.....
43	0.2300	-3.8453	||.....	-0.4897	||.....	-0.4849	||.....
44	0.0700	-3.6540	||.....	-0.4655	||.....	-0.4608	||.....
45	0.0400	-4.2306	||.....	-0.5390	||.....	-0.5340	||.....
46	3.7100	10.5131	|||||||.....	1.3313	|||||.....	1.3451	|||||.....
47	8.7000	12.0983	||||||||.....	1.5290	||||||.....	1.5566	||||||.....
48	7.0200	3.8273	||.....	0.4837	||.....	0.4788	||.....
49	29.0000	-18.8525	|||||||||||...	-2.5516	|||||||||||..	* -2.7596	|||||||||||...
50	6.3600	-0.2184	|.....	-0.0276	|.....	-0.0272	|.....
51	16.0000	2.2436	|.....	0.2863	|.....	0.2829	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Influence Detection Chart

Row	Vegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	31.6000	-1.4425	|||||||||||||||	* 0.8569	|||||||||||||||	-1.3424	|||||||||||||||
11	17.5000	-0.2912	||.....	0.0418	|.....	-0.2105	||.....
13	4.0800	-0.0307	|.....	0.0005	|.....	0.0109	|.....
14	14.1000	-0.2141	||.....	0.0228	|.....	-0.1210	|.....
15	0.3700	0.1514	|.....	0.0116	|.....	-0.0925	|.....
16	0.0800	-0.0806	|.....	0.0033	|.....	0.0504	|.....
17	0.4300	-0.0728	|.....	0.0027	|.....	0.0443	|.....
18	0.1100	-0.0839	|.....	0.0036	|.....	0.0524	|.....
19	0.6200	-0.0888	|.....	0.0040	|.....	0.0530	|.....
20	1.5000	-0.0546	|.....	0.0015	|.....	0.0298	|.....
21	0.0300	-0.0864	|.....	0.0038	|.....	0.0543	|.....
22	13.6000	0.2486	||.....	0.0303	|.....	0.1328	|.....
23	2.0200	0.0284	|.....	0.0004	|.....	-0.0146	|.....
24	12.2000	0.0494	|.....	0.0012	|.....	0.0215	|.....
25	14.9000	-0.0042	|.....	0.0000	|.....	-0.0026	|.....
26	29.5000	0.3793	|||.....	0.0723	|.....	0.3483	|||.....
27	24.8000	1.0982	|||||||||||....	0.4874	|||||||.....	0.9626	|||||||||.....
28	7.7400	0.3402	|||.....	0.0529	|.....	0.0035	|.....
29	28.3000	0.2474	||.....	0.0311	|.....	0.2251	||.....
30	8.8100	0.1870	|.....	0.0173	|.....	0.0230	|.....
31	9.1500	-0.0330	|.....	0.0006	|.....	-0.0052	|.....
32	5.3300	-0.0791	|.....	0.0032	|.....	0.0189	|.....
33	11.8000	0.1647	|.....	0.0136	|.....	0.0665	|.....
34	0.0900	0.0146	|.....	0.0001	|.....	-0.0091	|.....
35	0.3500	-0.0725	|.....	0.0027	|.....	0.0444	|.....
36	0.3400	-0.0872	|.....	0.0039	|.....	0.0534	|.....
37	1.1100	-0.0683	|.....	0.0024	|.....	0.0389	|.....
38	0.7700	-0.0328	|.....	0.0006	|.....	0.0193	|.....
39	0.3300	-0.0963	|.....	0.0047	|.....	0.0591	|.....
40	0.3300	0.0502	|.....	0.0013	|.....	-0.0308	|.....
41	0.0700	-0.0937	|.....	0.0045	|.....	0.0587	|.....
42	0.3000	-0.1041	|.....	0.0055	|.....	0.0640	|.....
43	0.2300	-0.0983	|.....	0.0049	|.....	0.0608	|.....
44	0.0700	-0.0942	|.....	0.0045	|.....	0.0590	|.....
45	0.0400	-0.1094	|.....	0.0061	|.....	0.0687	|.....
46	3.7100	0.2310	||.....	0.0261	|.....	-0.0890	|.....
47	8.7000	0.2477	||.....	0.0296	|.....	0.0276	|.....
48	7.0200	0.0759	|.....	0.0029	|.....	-0.0050	|.....
49	29.0000	-1.1576	|||||||||||...	* 0.5729	|||||||||.....	-1.0591	||||||||||....
50	6.3600	-0.0043	|.....	0.0000	|.....	0.0006	|.....
51	16.0000	0.0604	|.....	0.0019	|.....	0.0401	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Outlier & Influence Chart

Row	Vegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	31.6000	* -3.0582	||||||||||||||.	* 0.8569	||||||||||||||	0.1820	||||||||||||||
11	17.5000	-1.2552	|||||.....	0.0418	|.....	0.0511	||.....
13	4.0800	-0.1815	|.....	0.0005	|.....	0.0279	|.....
14	14.1000	-1.1103	|||||.....	0.0228	|.....	0.0358	|.....
15	0.3700	0.7523	|||.....	0.0116	|.....	0.0389	|.....
16	0.0800	-0.3942	|.....	0.0033	|.....	0.0401	|.....
17	0.4300	-0.3631	|.....	0.0027	|.....	0.0387	|.....
18	0.1100	-0.4110	|.....	0.0036	|.....	0.0400	|.....
19	0.6200	-0.4470	||.....	0.0040	|.....	0.0379	|.....
20	1.5000	-0.2877	|.....	0.0015	|.....	0.0348	|.....
21	0.0300	-0.4218	|.....	0.0038	|.....	0.0403	|.....
22	13.6000	1.3223	||||||.....	0.0303	|.....	0.0341	|.....
23	2.0200	0.1537	|.....	0.0004	|.....	0.0331	|.....
24	12.2000	0.2802	|.....	0.0012	|.....	0.0301	|.....
25	14.9000	-0.0209	|.....	0.0000	|.....	0.0389	|.....
26	29.5000	0.8837	||||.....	0.0723	|.....	0.1556	|||||||||||...
27	24.8000	* 3.2025	||||||||||||||	0.4874	|||||||.....	0.1052	||||||.....
28	7.7400	* 2.1516	|||||||||.....	0.0529	|.....	0.0244	|.....
29	28.3000	0.6092	||.....	0.0311	|.....	0.1416	||||||||||....
30	8.8100	1.1733	|||||.....	0.0173	|.....	0.0248	|.....
31	9.1500	-0.2063	|.....	0.0006	|.....	0.0250	|.....
32	5.3300	-0.4857	||.....	0.0032	|.....	0.0259	|.....
33	11.8000	0.9509	||||.....	0.0136	|.....	0.0291	|.....
34	0.0900	0.0713	|.....	0.0001	|.....	0.0401	|.....
35	0.3500	-0.3599	|.....	0.0027	|.....	0.0390	|.....
36	0.3400	-0.4327	|.....	0.0039	|.....	0.0390	|.....
37	1.1100	-0.3529	|.....	0.0024	|.....	0.0361	|.....
38	0.7700	-0.1666	|.....	0.0006	|.....	0.0374	|.....
39	0.3300	-0.4777	||.....	0.0047	|.....	0.0391	|.....
40	0.3300	0.2491	|.....	0.0013	|.....	0.0391	|.....
41	0.0700	-0.4582	||.....	0.0045	|.....	0.0401	|.....
42	0.3000	-0.5154	||.....	0.0055	|.....	0.0392	|.....
43	0.2300	-0.4849	||.....	0.0049	|.....	0.0395	|.....
44	0.0700	-0.4608	||.....	0.0045	|.....	0.0401	|.....
45	0.0400	-0.5340	||.....	0.0061	|.....	0.0403	|.....
46	3.7100	1.3451	||||||.....	0.0261	|.....	0.0286	|.....
47	8.7000	1.5566	|||||||.....	0.0296	|.....	0.0247	|.....
48	7.0200	0.4788	||.....	0.0029	|.....	0.0245	|.....
49	29.0000	* -2.7596	|||||||||||...	* 0.5729	|||||||||.....	0.1496	||||||||||....
50	6.3600	-0.0272	|.....	0.0000	|.....	0.0248	|.....
51	16.0000	0.2829	|.....	0.0019	|.....	0.0436	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Inverse Prediction of X Means

Row	Invert (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	30.2000	31.6000	17.6900	13.9100	15.4205	20.6776
11	20.2000	17.5000	10.7737	6.7263	9.0050	12.7661
13	9.0700	4.0800	3.0758	1.0042	0.9262	4.8991
14	16.3000	14.1000	8.0764	6.0236	6.3084	9.8753
15	11.1000	0.3700	4.4799	-4.1099	2.4842	6.2494
16	1.6100	0.0800	-2.0837	2.1637	-5.0151	0.1524
17	2.3600	0.4300	-1.5650	1.9950	-4.4065	0.6184
18	1.5200	0.1100	-2.1460	2.2560	-5.0883	0.0966
19	1.9700	0.6200	-1.8347	2.4547	-4.7227	0.3758
20	4.5000	1.5000	-0.0849	1.5849	-2.6815	1.9594
21	1.3200	0.0300	-2.2843	2.3143	-5.2509	-0.0272
22	34.6000	13.6000	20.7332	-7.1332	18.1163	24.2857
23	8.7700	2.0200	2.8684	-0.8484	0.6933	4.7021
24	24.5000	12.2000	13.7477	-1.5477	11.8321	16.0996
25	26.0000	14.9000	14.7852	0.1148	12.7906	17.2901
26	53.8000	29.5000	34.0126	-4.5126	29.5782	40.3316
27	62.3000	24.8000	39.8915	-15.0915	34.5891	47.4985
28	32.1000	7.7400	19.0042	-11.2642	16.5905	22.2298
29	50.1000	28.3000	31.4535	-3.1535	27.3895	37.2193
30	26.6000	8.8100	15.2002	-6.3902	13.1708	17.7696
31	16.2000	9.1500	8.0072	1.1428	6.2373	9.8031
32	8.4500	5.3300	2.6470	2.6830	0.4442	4.4928
33	29.2000	11.8000	16.9984	-5.1984	14.8004	19.8650
34	5.3200	0.0900	0.4822	-0.3922	-2.0258	2.4784
35	2.2700	0.3500	-1.6273	1.9773	-4.4794	0.5623
36	1.6800	0.3400	-2.0353	2.3753	-4.9582	0.1958
37	3.4200	1.1100	-0.8319	1.9419	-3.5498	1.2803
38	4.4100	0.7700	-0.1472	0.9172	-2.7537	1.9026
39	1.3100	0.3300	-2.2912	2.6212	-5.2591	-0.0334
40	7.0800	0.3300	1.6995	-1.3695	-0.6299	3.6040
41	1.0900	0.0700	-2.4434	2.5134	-5.4382	-0.1695
42	0.9700	0.3000	-2.5264	2.8264	-5.5359	-0.2437
43	1.1100	0.2300	-2.4296	2.6596	-5.4219	-0.1572
44	1.0700	0.0700	-2.4572	2.5272	-5.4545	-0.1819
45	0.4500	0.0400	-2.8860	2.9260	-5.9600	-0.5646
46	20.5000	3.7100	10.9812	-7.2712	9.2068	12.9942
47	29.3000	8.7000	17.0676	-8.3676	14.8625	19.9461
48	18.6000	7.0200	9.6671	-2.6471	7.9159	11.5630
49	27.7000	29.0000	15.9610	13.0390	13.8636	18.6528
50	13.6000	6.3600	6.2089	0.1511	4.3549	7.9604
51	30.0000	16.0000	17.5517	-1.5517	15.2967	20.5148

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Invert X = Vegetation

Inverse Prediction of X Individuals

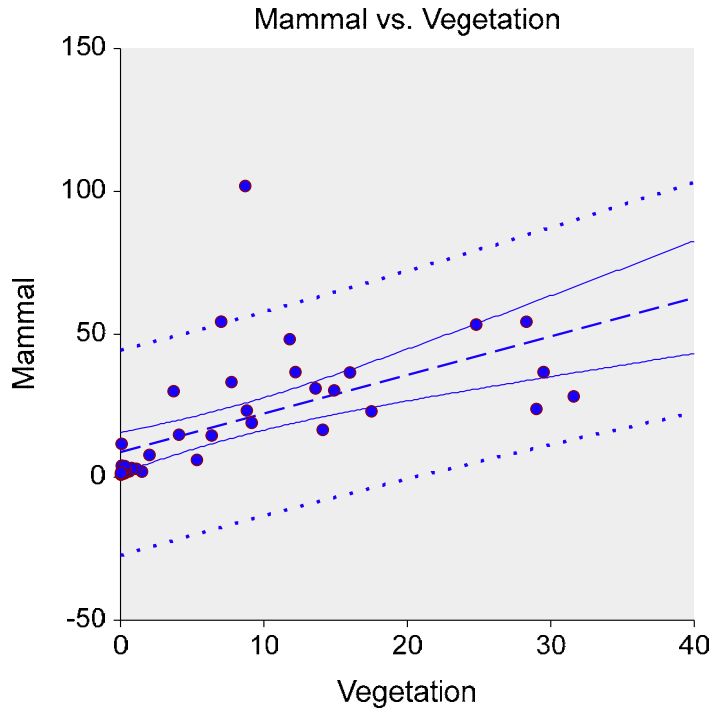
Row	Invert (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	30.2000	31.6000	17.6900	13.9100	6.3429	29.7552
11	20.2000	17.5000	10.7737	6.7263	-0.6756	22.4467
13	9.0700	4.0800	3.0758	1.0042	-8.6662	14.4915
14	16.3000	14.1000	8.0764	6.0236	-3.4539	19.6376
15	11.1000	0.3700	4.4799	-4.1099	-7.1947	15.9283
16	1.6100	0.0800	-2.0837	2.1637	-14.1275	9.2648
17	2.3600	0.4300	-1.5650	1.9950	-13.5747	9.7865
18	1.5200	0.1100	-2.1460	2.2560	-14.1939	9.2022
19	1.9700	0.6200	-1.8347	2.4547	-13.8620	9.5151
20	4.5000	1.5000	-0.0849	1.5849	-12.0019	11.2797
21	1.3200	0.0300	-2.2843	2.3143	-14.3415	9.0633
22	34.6000	13.6000	20.7332	-7.1332	9.3841	33.0179
23	8.7700	2.0200	2.8684	-0.8484	-8.8842	14.2797
24	24.5000	12.2000	13.7477	-1.5477	2.3608	25.5709
25	26.0000	14.9000	14.7852	0.1148	3.4135	26.6673
26	53.8000	29.5000	34.0126	-4.5126	22.3441	47.5657
27	62.3000	24.8000	39.8915	-15.0915	27.9371	54.1506
28	32.1000	7.7400	19.0042	-11.2642	7.6596	31.1606
29	50.1000	28.3000	31.4535	-3.1535	19.8834	44.7253
30	26.6000	8.8100	15.2002	-6.3902	3.8336	27.1068
31	16.2000	9.1500	8.0072	1.1428	-3.5255	19.5658
32	8.4500	5.3300	2.6470	2.6830	-9.1169	14.0539
33	29.2000	11.8000	16.9984	-5.1984	5.6478	29.0176
34	5.3200	0.0900	0.4822	-0.3922	-11.4011	11.8537
35	2.2700	0.3500	-1.6273	1.9773	-13.6410	9.7239
36	1.6800	0.3400	-2.0353	2.3753	-14.0759	9.3135
37	3.4200	1.1100	-0.8319	1.9419	-12.7948	10.5253
38	4.4100	0.7700	-0.1472	0.9172	-12.0679	11.2168
39	1.3100	0.3300	-2.2912	2.6212	-14.3488	9.0563
40	7.0800	0.3300	1.6995	-1.3695	-10.1149	13.0890
41	1.0900	0.0700	-2.4434	2.5134	-14.5113	8.9036
42	0.9700	0.3000	-2.5264	2.8264	-14.5999	8.8203
43	1.1100	0.2300	-2.4296	2.6596	-14.4965	8.9175
44	1.0700	0.0700	-2.4572	2.5272	-14.5260	8.8897
45	0.4500	0.0400	-2.8860	2.9260	-14.9841	8.4595
46	20.5000	3.7100	10.9812	-7.2712	-0.4628	22.6638
47	29.3000	8.7000	17.0676	-8.3676	5.7174	29.0913
48	18.6000	7.0200	9.6671	-2.6471	-1.8126	21.2914
49	27.7000	29.0000	15.9610	13.0390	4.6024	27.9140
50	13.6000	6.3600	6.2089	0.1511	-5.3911	17.7064
51	30.0000	16.0000	17.5517	-1.5517	6.2040	29.6075

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	Mammal	Rows Processed	58
Independent Variable	Vegetation	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	8.6050	Rows Prediction Only	0
Slope	1.3581	Sum of Frequencies	41
R-Squared	0.3622	Sum of Weights	41.0000
Correlation	0.6018	Coefficient of Variation	0.9172
Mean Square Error	303.2619	Square Root of MSE	17.41442

Linear Regression Report

Y = Mammal X = Vegetation

Summary Statement
The equation of the straight line relating Mammal and Vegetation is estimated as: Mammal = (8.6050) + (1.3581) Vegetation using the 41 observations in this dataset. The y-intercept, the estimated value of Mammal when Vegetation is zero, is 8.6050 with a standard error of 3.5018. The slope, the estimated change in Mammal per unit change in Vegetation, is 1.3581 with a standard error of 0.2886. The value of R-Squared, the proportion of the variation in Mammal that can be accounted for by variation in Vegetation, is 0.3622. The correlation between Mammal and Vegetation is 0.6018.

A significance test that the slope is zero resulted in a t-value of 4.7060. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 1.3581. The lower limit of the 95% confidence interval for the slope is 0.7744 and the upper limit is 1.9418. The estimated intercept is 8.6050. The lower limit of the 95% confidence interval for the intercept is 1.5220 and the upper limit is 15.6880.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	Mammal	Vegetation
Count	41	41
Mean	18.9857	7.6437
Standard Deviation	21.5309	9.5412
Minimum	0.8900	0.0300
Maximum	101.9000	31.6000

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	8.6050	1.3581
Lower 95% Confidence Limit	1.5220	0.7744
Upper 95% Confidence Limit	15.6880	1.9418
Standard Error	3.5018	0.2886
Standardized Coefficient	0.0000	0.6018
T Value	2.4573	4.7060
Prob Level (T Test)	0.0185	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	0.6688	0.9957
Regression of Y on X	8.6050	1.3581
Inverse Regression from X on Y	-9.6757	3.7497
Orthogonal Regression of Y and X	-6.3532	3.3150

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(8.60500894019781) + (1.35807237026885) * (Vegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Bootstrap Section

---------- Estimation Results	----------		Bootstrap Confidence Limits	----------
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	8.6050	0.9000	3.8584	12.6622
Bootstrap Mean	8.4467	0.9500	2.6455	13.2695
Bias (BM - OV)	-0.1583	0.9900	-0.0921	14.1003
Bias Corrected	8.7633			
Standard Error	2.7216			
Slope				
Original Value	1.3581	0.9000	0.8136	1.6920
Bootstrap Mean	1.4033	0.9500	0.6539	1.7482
Bias (BM - OV)	0.0453	0.9900	0.2861	1.8697
Bias Corrected	1.3128			
Standard Error	0.2864			
Correlation				
Original Value	0.6018	0.9000	0.3594	0.7574
Bootstrap Mean	0.6352	0.9500	0.3378	0.7883
Bias (BM - OV)	0.0333	0.9900	0.2925	0.8541
Bias Corrected	0.5685			
Standard Error	0.1235			
R-Squared				
Original Value	0.3622	0.9000	0.0117	0.5253
Bootstrap Mean	0.4187	0.9500	0.0000	0.5519
Bias (BM - OV)	0.0565	0.9900	0.0000	0.6022
Bias Corrected	0.3057			
Standard Error	0.1594			
Standard Error of Estimate				
Original Value	17.4144	0.9000	10.2188	26.0426
Bootstrap Mean	16.2243	0.9500	9.2485	26.9073
Bias (BM - OV)	-1.1901	0.9900	6.6040	28.2396
Bias Corrected	18.6045			
Standard Error	4.8762			
Orthogonal Intercept				
Original Value	-6.3532	0.9000	-15.0633	9.9329
Bootstrap Mean	-6.8905	0.9500	-15.4230	15.1807
Bias (BM - OV)	-0.5373	0.9900	-16.2848	32.6780
Bias Corrected	-5.8159			
Standard Error	9.3268			
Orthogonal Slope				
Original Value	3.3150	0.9000	0.4334	4.8959
Bootstrap Mean	3.4238	0.9500	-0.2073	5.0192
Bias (BM - OV)	0.1088	0.9900	-2.0134	5.2016
Bias Corrected	3.2062			
Standard Error	1.4440			

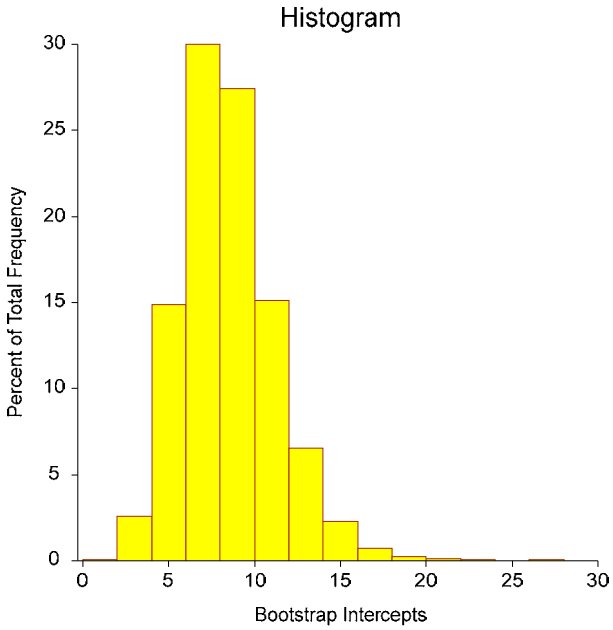
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

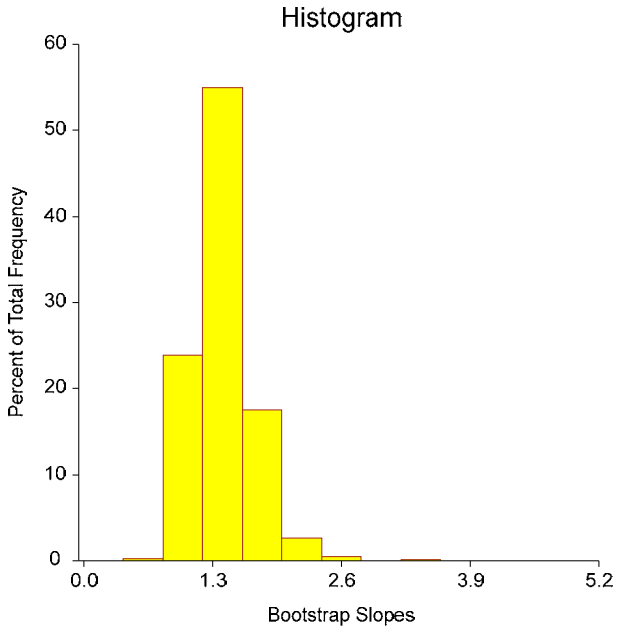
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

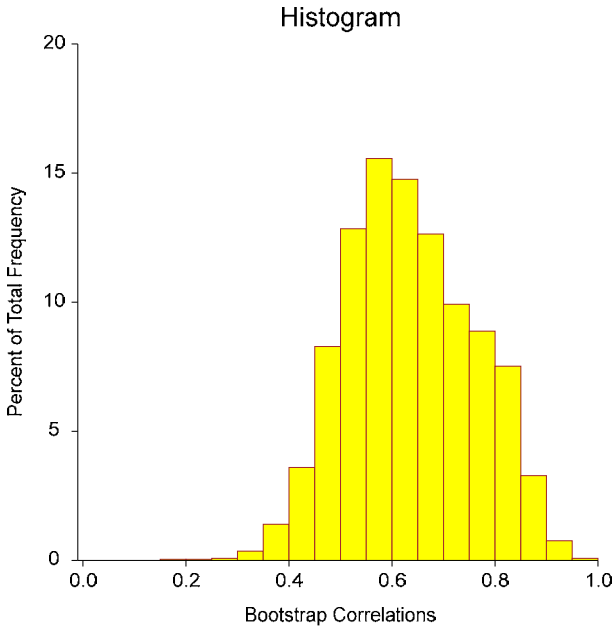
Linear Regression Report

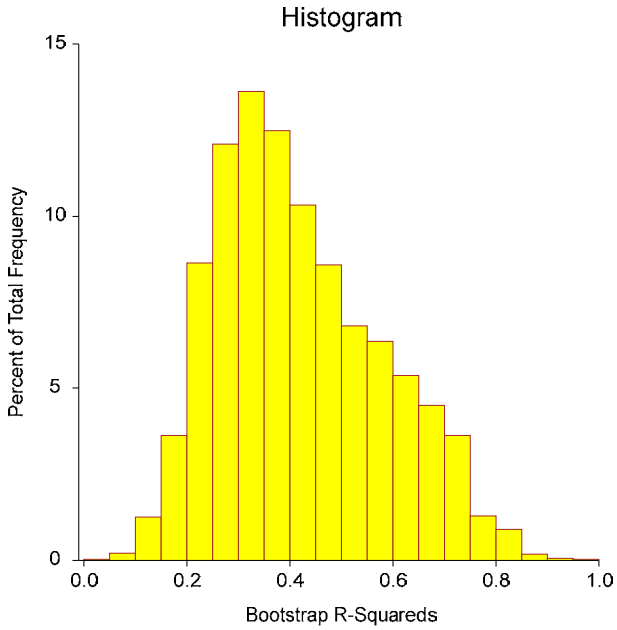
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Bootstrap Histograms Section



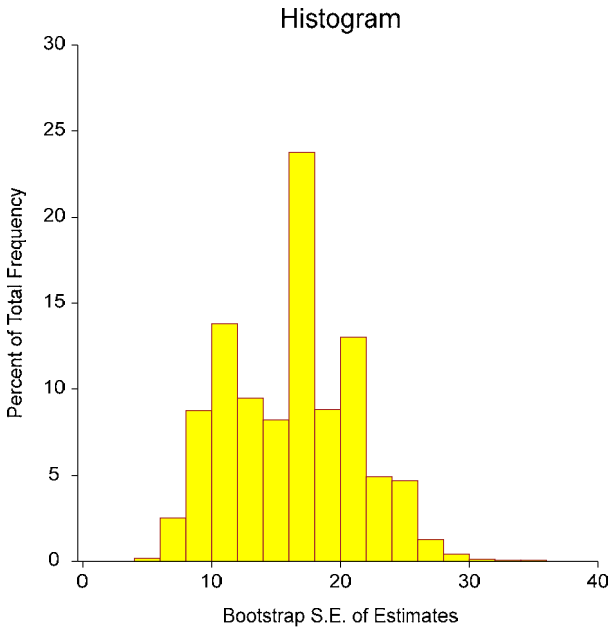


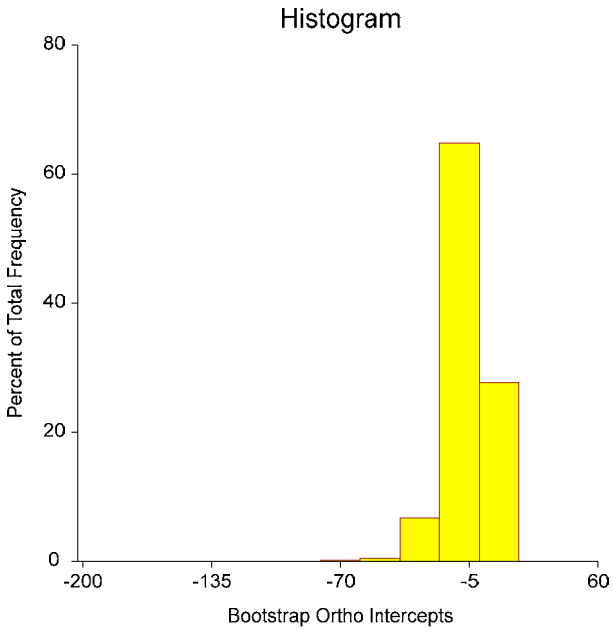


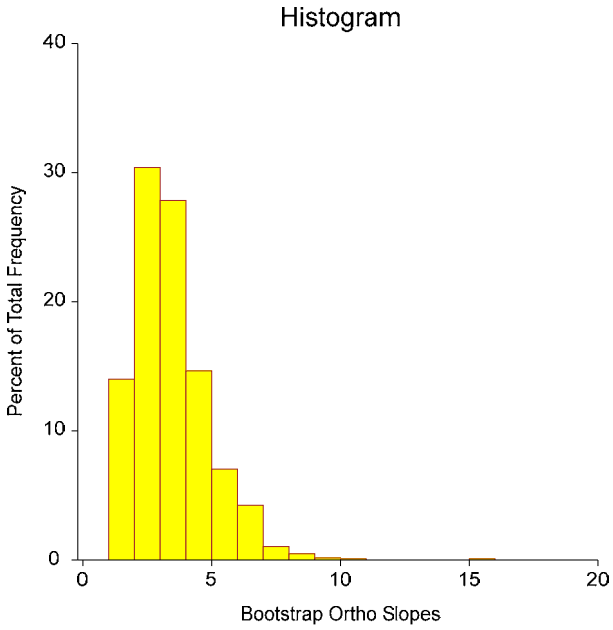


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.6018	0.3622	0.8290
Lower 95% Conf. Limit (r dist'n)	0.3567		
Upper 95% Conf. Limit (r dist'n)	0.7630		
Lower 95% Conf. Limit (Fisher's z)	0.3610		0.6999
Upper 95% Conf. Limit (Fisher's z)	0.7674		0.9057
Adjusted (Rbar)		0.3458	
T-Value for H0: Rho = 0	4.7060	4.7060	9.2583
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	14778.65	14778.65			
Slope	1	6716.034	6716.034	22.1460	0.0000	0.9957
Error	39	11827.21	303.2619			
Lack of Fit	37	11826.2	319.6271	632.0488	0.0016	
Pure Error	2	1.0114	0.5057			
Adj. Total	40	18543.25	463.5812			
Total	41	33321.9				

s = Square Root(303.2619) = 17.41442

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	313.39	778.4117	0.04043509	-0.002099105
1	313.39	6036.835	10895.18	-0.002099105	0.0002746205
2 (Y'Y)			33321.9		
Determinant		149296.9			6.698061E-06

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	12.26242	-0.6365786
1	-0.6365786	0.08328193

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.7027	0.000000	No
Anderson Darling	3.6474	0.000000	No
D'Agostino Skewness	5.3518	0.000000	No
D'Agostino Kurtosis	4.5656	0.000005	No
D'Agostino Omnibus	49.4869	0.000000	No
Constant Residual Variance?			
Modified Levene Test	8.8596	0.004988	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	632.0488	0.001581	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

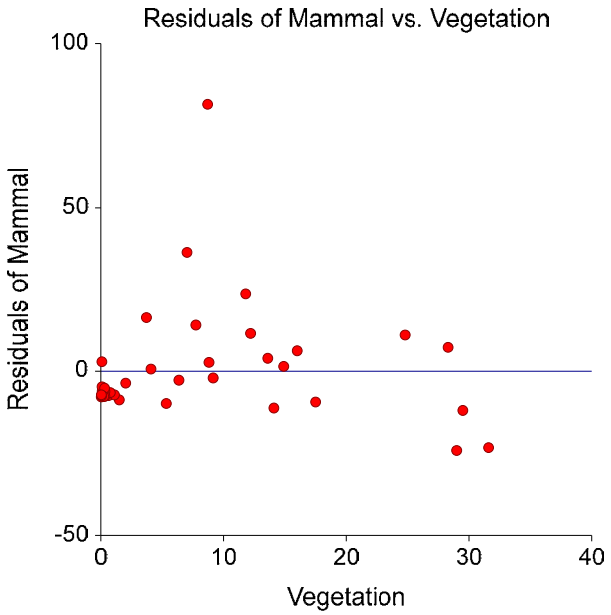
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

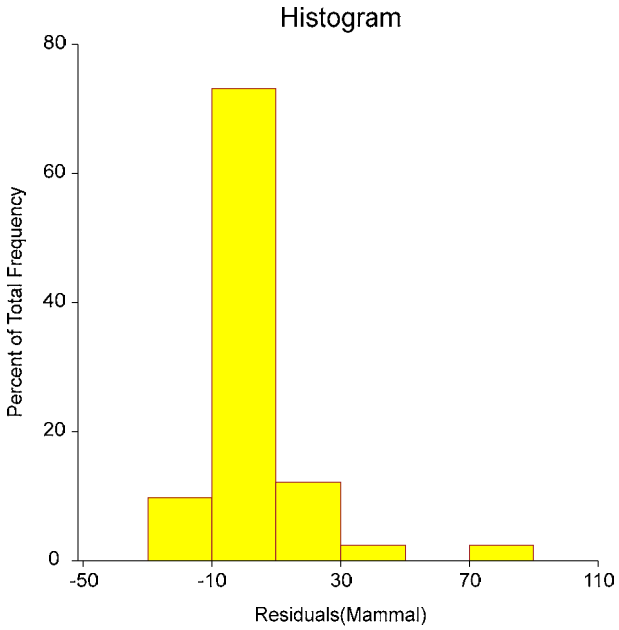
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

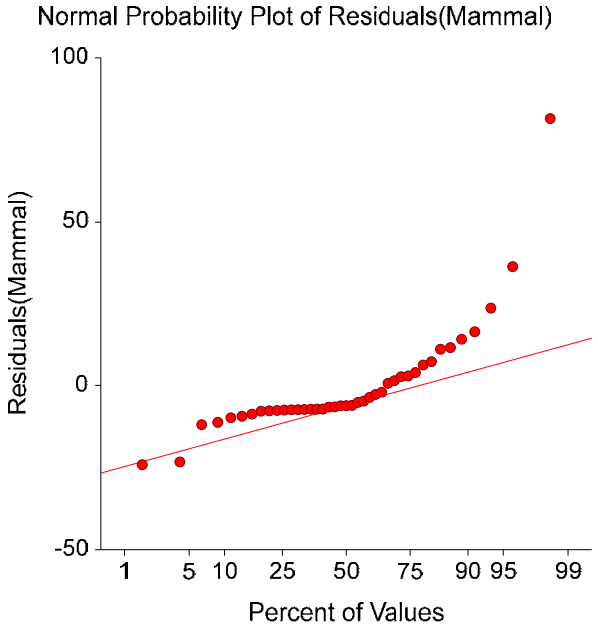
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Original Data Section

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual
10	31.6000	28.3000	51.5201	-23.2201
11	17.5000	23.0667	32.3713	-9.3046
13	4.0800	14.8900	14.1459	0.7441
14	14.1000	16.6000	27.7538	-11.1538
15	0.3700	2.6000	9.1075	-6.5075
16	0.0800	11.6950	8.7137	2.9813
17	0.4300	2.0767	9.1890	-7.1123
18	0.1100	2.7800	8.7544	-5.9744
19	0.6200	2.1100	9.4470	-7.3370
20	1.5000	1.9900	10.6421	-8.6521
21	0.0300	0.8900	8.6458	-7.7558
22	13.6000	31.1000	27.0748	4.0252
23	2.0200	7.8000	11.3483	-3.5483
24	12.2000	36.8000	25.1735	11.6265
25	14.9000	30.4000	28.8403	1.5597
26	29.5000	36.8000	48.6681	-11.8681
27	24.8000	53.4233	42.2852	11.1381
28	7.7400	33.3000	19.1165	14.1835
29	28.3000	54.4000	47.0385	7.3615
30	8.8100	23.3500	20.5696	2.7804
31	9.1500	19.0700	21.0314	-1.9614
32	5.3300	6.0800	15.8435	-9.7635
33	11.8000	48.3000	24.6303	23.6697
34	0.0900	4.0533	8.7272	-4.6739
35	0.3500	2.9867	9.0803	-6.0937
36	0.3400	1.8400	9.0668	-7.2268
37	1.1100	2.9700	10.1125	-7.1425
38	0.7700	3.2100	9.6507	-6.4407
39	0.3300	2.9400	9.0532	-6.1132
40	0.3300	1.5200	9.0532	-7.5332
41	0.0700	1.3900	8.7001	-7.3101
42	0.3000	3.9267	9.0124	-5.0858
43	0.2300	1.2767	8.9174	-7.6407
44	0.0700	1.3100	8.7001	-7.3901
45	0.0400	1.5500	8.6593	-7.1093
46	3.7100	30.1000	13.6435	16.4565
47	8.7000	101.9000	20.4202	81.4798
48	7.0200	54.4500	18.1387	36.3113
49	29.0000	23.9000	47.9891	-24.0891
50	6.3600	14.6000	17.2423	-2.6423
51	16.0000	36.6667	30.3342	6.3325

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Predicted Values and Confidence Limits of Means

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	31.6000	28.3000	51.5201	7.4292	36.4932	66.5470
11	17.5000	23.0667	32.3713	3.9354	24.4112	40.3313
13	4.0800	14.8900	14.1459	2.9076	8.2647	20.0272
14	14.1000	16.6000	27.7538	3.2967	21.0856	34.4220
15	0.3700	2.6000	9.1075	3.4355	2.1585	16.0565
16	0.0800	11.6950	8.7137	3.4873	1.6600	15.7673
17	0.4300	2.0767	9.1890	3.4250	2.2613	16.1166
18	0.1100	2.7800	8.7544	3.4819	1.7117	15.7971
19	0.6200	2.1100	9.4470	3.3919	2.5862	16.3078
20	1.5000	1.9900	10.6421	3.2465	4.0754	17.2089
21	0.0300	0.8900	8.6458	3.4963	1.5738	15.7177
22	13.6000	31.1000	27.0748	3.2173	20.5671	33.5825
23	2.0200	7.8000	11.3483	3.1671	4.9423	17.7544
24	12.2000	36.8000	25.1735	3.0209	19.0632	31.2838
25	14.9000	30.4000	28.8403	3.4325	21.8975	35.7831
26	29.5000	36.8000	48.6681	6.8688	34.7747	62.5616
27	24.8000	53.4233	42.2852	5.6489	30.8593	53.7111
28	7.7400	33.3000	19.1165	2.7198	13.6151	24.6178
29	28.3000	54.4000	47.0385	6.5522	33.7853	60.2916
30	8.8100	23.3500	20.5696	2.7404	15.0266	26.1127
31	9.1500	19.0700	21.0314	2.7542	15.4605	26.6023
32	5.3300	6.0800	15.8435	2.8004	10.1791	21.5080
33	11.8000	48.3000	24.6303	2.9724	18.6180	30.6426
34	0.0900	4.0533	8.7272	3.4855	1.6772	15.7773
35	0.3500	2.9867	9.0803	3.4390	2.1242	16.0365
36	0.3400	1.8400	9.0668	3.4408	2.1071	16.0264
37	1.1100	2.9700	10.1125	3.3094	3.4187	16.8063
38	0.7700	3.2100	9.6507	3.3662	2.8419	16.4596
39	0.3300	2.9400	9.0532	3.4426	2.0899	16.0164
40	0.3300	1.5200	9.0532	3.4426	2.0899	16.0164
41	0.0700	1.3900	8.7001	3.4891	1.6427	15.7574
42	0.3000	3.9267	9.0124	3.4479	2.0384	15.9865
43	0.2300	1.2767	8.9174	3.4603	1.9182	15.9166
44	0.0700	1.3100	8.7001	3.4891	1.6427	15.7574
45	0.0400	1.5500	8.6593	3.4945	1.5910	15.7277
46	3.7100	30.1000	13.6435	2.9471	7.6824	19.6045
47	8.7000	101.9000	20.4202	2.7367	14.8847	25.9557
48	7.0200	54.4500	18.1387	2.7256	12.6256	23.6518
49	29.0000	23.9000	47.9891	6.7365	34.3632	61.6150
50	6.3600	14.6000	17.2423	2.7448	11.6905	22.7942
51	16.0000	36.6667	30.3342	3.6348	22.9820	37.6863

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Predicted Values and Prediction Limits

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	31.6000	28.3000	51.5201	18.9329	13.2247	89.8155
11	17.5000	23.0667	32.3713	17.8535	-3.7409	68.4835
13	4.0800	14.8900	14.1459	17.6555	-21.5656	49.8575
14	14.1000	16.6000	27.7538	17.7237	-8.0958	63.6034
15	0.3700	2.6000	9.1075	17.7501	-26.7954	45.0104
16	0.0800	11.6950	8.7137	17.7602	-27.2096	44.6370
17	0.4300	2.0767	9.1890	17.7480	-26.7098	45.0877
18	0.1100	2.7800	8.7544	17.7591	-27.1668	44.6755
19	0.6200	2.1100	9.4470	17.7417	-26.4389	45.3329
20	1.5000	1.9900	10.6421	17.7145	-25.1888	46.4730
21	0.0300	0.8900	8.6458	17.7619	-27.2811	44.5726
22	13.6000	31.1000	27.0748	17.7091	-8.7453	62.8949
23	2.0200	7.8000	11.3483	17.7001	-24.4534	47.1501
24	12.2000	36.8000	25.1735	17.6745	-10.5765	60.9235
25	14.9000	30.4000	28.8403	17.7495	-7.0614	64.7420
26	29.5000	36.8000	48.6681	18.7201	10.8032	86.5331
27	24.8000	53.4233	42.2852	18.3077	5.2544	79.3160
28	7.7400	33.3000	19.1165	17.6255	-16.5345	54.7675
29	28.3000	54.4000	47.0385	18.6063	9.4037	84.6732
30	8.8100	23.3500	20.5696	17.6287	-15.0878	56.2271
31	9.1500	19.0700	21.0314	17.6309	-14.6304	56.6932
32	5.3300	6.0800	15.8435	17.6381	-19.8330	51.5201
33	11.8000	48.3000	24.6303	17.6663	-11.1031	60.3637
34	0.0900	4.0533	8.7272	17.7598	-27.1953	44.6498
35	0.3500	2.9867	9.0803	17.7507	-26.8239	44.9846
36	0.3400	1.8400	9.0668	17.7511	-26.8382	44.9717
37	1.1100	2.9700	10.1125	17.7261	-25.7419	45.9668
38	0.7700	3.2100	9.6507	17.7368	-26.2253	45.5267
39	0.3300	2.9400	9.0532	17.7514	-26.8525	44.9588
40	0.3300	1.5200	9.0532	17.7514	-26.8525	44.9588
41	0.0700	1.3900	8.7001	17.7605	-27.2239	44.6241
42	0.3000	3.9267	9.0124	17.7525	-26.8953	44.9202
43	0.2300	1.2767	8.9174	17.7549	-26.9953	44.8300
44	0.0700	1.3100	8.7001	17.7605	-27.2239	44.6241
45	0.0400	1.5500	8.6593	17.7616	-27.2668	44.5855
46	3.7100	30.1000	13.6435	17.6620	-22.0814	49.3683
47	8.7000	101.9000	20.4202	17.6281	-15.2360	56.0765
48	7.0200	54.4500	18.1387	17.6264	-17.5141	53.7915
49	29.0000	23.9000	47.9891	18.6720	10.2215	85.7568
50	6.3600	14.6000	17.2423	17.6294	-18.4165	52.9012
51	16.0000	36.6667	30.3342	17.7897	-5.6489	66.3173

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Working-Hotelling Simultaneous Confidence Band

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	31.6000	28.3000	51.5201	7.4292	30.3479	72.6923
11	17.5000	23.0667	32.3713	3.9354	21.1559	43.5866
13	4.0800	14.8900	14.1459	2.9076	5.8596	22.4323
14	14.1000	16.6000	27.7538	3.2967	18.3587	37.1490
15	0.3700	2.6000	9.1075	3.4355	-0.6833	18.8983
16	0.0800	11.6950	8.7137	3.4873	-1.2246	18.6519
17	0.4300	2.0767	9.1890	3.4250	-0.5717	18.9497
18	0.1100	2.7800	8.7544	3.4819	-1.1685	18.6773
19	0.6200	2.1100	9.4470	3.3919	-0.2195	19.1135
20	1.5000	1.9900	10.6421	3.2465	1.3899	19.8944
21	0.0300	0.8900	8.6458	3.4963	-1.3183	18.6098
22	13.6000	31.1000	27.0748	3.2173	17.9058	36.2438
23	2.0200	7.8000	11.3483	3.1671	2.3225	20.3741
24	12.2000	36.8000	25.1735	3.0209	16.5644	33.7825
25	14.9000	30.4000	28.8403	3.4325	19.0582	38.6224
26	29.5000	36.8000	48.6681	6.8688	29.0930	68.2433
27	24.8000	53.4233	42.2852	5.6489	26.1866	58.3838
28	7.7400	33.3000	19.1165	2.7198	11.3654	26.8676
29	28.3000	54.4000	47.0385	6.5522	28.3654	65.7115
30	8.8100	23.3500	20.5696	2.7404	12.7598	28.3795
31	9.1500	19.0700	21.0314	2.7542	13.1823	28.8805
32	5.3300	6.0800	15.8435	2.8004	7.8627	23.8244
33	11.8000	48.3000	24.6303	2.9724	16.1592	33.1013
34	0.0900	4.0533	8.7272	3.4855	-1.2059	18.6604
35	0.3500	2.9867	9.0803	3.4390	-0.7205	18.8812
36	0.3400	1.8400	9.0668	3.4408	-0.7391	18.8726
37	1.1100	2.9700	10.1125	3.3094	0.6812	19.5437
38	0.7700	3.2100	9.6507	3.3662	0.0574	19.2440
39	0.3300	2.9400	9.0532	3.4426	-0.7577	18.8641
40	0.3300	1.5200	9.0532	3.4426	-0.7577	18.8641
41	0.0700	1.3900	8.7001	3.4891	-1.2434	18.6435
42	0.3000	3.9267	9.0124	3.4479	-0.8136	18.8385
43	0.2300	1.2767	8.9174	3.4603	-0.9442	18.7789
44	0.0700	1.3100	8.7001	3.4891	-1.2434	18.6435
45	0.0400	1.5500	8.6593	3.4945	-1.2996	18.6182
46	3.7100	30.1000	13.6435	2.9471	5.2446	22.0423
47	8.7000	101.9000	20.4202	2.7367	12.6210	28.2195
48	7.0200	54.4500	18.1387	2.7256	10.3710	25.9064
49	29.0000	23.9000	47.9891	6.7365	28.7908	67.1874
50	6.3600	14.6000	17.2423	2.7448	9.4201	25.0646
51	16.0000	36.6667	30.3342	3.6348	19.9753	40.6930

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Section

Row	Vegetation (X)	Mammal (Y)	Predicted Mammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	31.6000	28.3000	51.5201	-23.2201	-1.4743	82.0498
11	17.5000	23.0667	32.3713	-9.3046	-0.5485	40.3379
13	4.0800	14.8900	14.1459	0.7441	0.0433	4.9970
14	14.1000	16.6000	27.7538	-11.1538	-0.6523	67.1917
15	0.3700	2.6000	9.1075	-6.5075	-0.3812	250.2883
16	0.0800	11.6950	8.7137	2.9813	0.1747	25.4925
17	0.4300	2.0767	9.1890	-7.1123	-0.4166	342.4870
18	0.1100	2.7800	8.7544	-5.9744	-0.3501	214.9064
19	0.6200	2.1100	9.4470	-7.3370	-0.4295	347.7258
20	1.5000	1.9900	10.6421	-8.6521	-0.5057	434.7798
21	0.0300	0.8900	8.6458	-7.7558	-0.4546	871.4327
22	13.6000	31.1000	27.0748	4.0252	0.2352	12.9428
23	2.0200	7.8000	11.3483	-3.5483	-0.2072	45.4912
24	12.2000	36.8000	25.1735	11.6265	0.6779	31.5938
25	14.9000	30.4000	28.8403	1.5597	0.0914	5.1306
26	29.5000	36.8000	48.6681	-11.8681	-0.7416	32.2504
27	24.8000	53.4233	42.2852	11.1381	0.6762	20.8488
28	7.7400	33.3000	19.1165	14.1835	0.8246	42.5931
29	28.3000	54.4000	47.0385	7.3615	0.4563	13.5322
30	8.8100	23.3500	20.5696	2.7804	0.1617	11.9074
31	9.1500	19.0700	21.0314	-1.9614	-0.1141	10.2851
32	5.3300	6.0800	15.8435	-9.7635	-0.5681	160.5845
33	11.8000	48.3000	24.6303	23.6697	1.3794	49.0057
34	0.0900	4.0533	8.7272	-4.6739	-0.2739	115.3101
35	0.3500	2.9867	9.0803	-6.0937	-0.3570	204.0290
36	0.3400	1.8400	9.0668	-7.2268	-0.4233	392.7583
37	1.1100	2.9700	10.1125	-7.1425	-0.4178	240.4872
38	0.7700	3.2100	9.6507	-6.4407	-0.3770	200.6456
39	0.3300	2.9400	9.0532	-6.1132	-0.3581	207.9310
40	0.3300	1.5200	9.0532	-7.5332	-0.4413	495.6035
41	0.0700	1.3900	8.7001	-7.3101	-0.4285	525.9046
42	0.3000	3.9267	9.0124	-5.0858	-0.2979	129.5186
43	0.2300	1.2767	8.9174	-7.6407	-0.4477	598.4882
44	0.0700	1.3100	8.7001	-7.3901	-0.4331	564.1278
45	0.0400	1.5500	8.6593	-7.1093	-0.4167	458.6666
46	3.7100	30.1000	13.6435	16.4565	0.9588	54.6729
47	8.7000	101.9000	20.4202	81.4798	4.7377	79.9605
48	7.0200	54.4500	18.1387	36.3113	2.1111	66.6875
49	29.0000	23.9000	47.9891	-24.0891	-1.5001	100.7912
50	6.3600	14.6000	17.2423	-2.6423	-0.1537	18.0983
51	16.0000	36.6667	30.3342	6.3325	0.3718	17.2705

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Residual Diagnostics Section

Row	Vegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	31.6000	-23.2201	*-1.4976	0.1820	0.2418	293.8968
11	17.5000	-9.3046	-0.5435	0.0511	0.0081	308.8415
13	4.0800	0.7441	0.0428	0.0279	0.0000	311.2275
14	14.1000	-11.1538	-0.6474	0.0358	0.0079	307.8469
15	0.3700	-6.5075	-0.3770	0.0389	0.0029	310.0829
16	0.0800	2.9813	0.1726	0.0401	0.0006	310.9988
17	0.4300	-7.1123	-0.4121	0.0387	0.0035	309.8577
18	0.1100	-5.9744	-0.3462	0.0400	0.0026	310.2640
19	0.6200	-7.3370	-0.4250	0.0379	0.0036	309.7700
20	1.5000	-8.6521	-0.5008	0.0348	0.0046	309.2015
21	0.0300	-7.7558	-0.4499	0.0403	0.0043	309.5930
22	13.6000	4.0252	0.2323	0.0341	0.0010	310.8010
23	2.0200	-3.5483	-0.2047	0.0331	0.0007	310.8998
24	12.2000	11.6265	0.6731	0.0301	0.0071	307.5748
25	14.9000	1.5597	0.0902	0.0389	0.0002	311.1758
26	29.5000	-11.8681	*-0.7373	0.1556	0.0507	306.8529
27	24.8000	11.1381	*0.6714	0.1052	0.0269	307.5938
28	7.7400	14.1835	0.8211	0.0244	0.0085	305.8161
29	28.3000	7.3615	*0.4516	0.1416	0.0172	309.5811
30	8.8100	2.7804	0.1596	0.0248	0.0003	311.0338
31	9.1500	-1.9614	-0.1126	0.0250	0.0002	311.1386
32	5.3300	-9.7635	-0.5631	0.0259	0.0043	308.6673
33	11.8000	23.6697	1.3961	0.0291	0.0286	296.0564
34	0.0900	-4.6739	-0.2707	0.0401	0.0016	310.6436
35	0.3500	-6.0937	-0.3529	0.0390	0.0026	310.2256
36	0.3400	-7.2268	-0.4188	0.0390	0.0036	309.8122
37	1.1100	-7.1425	-0.4133	0.0361	0.0033	309.8496
38	0.7700	-6.4407	-0.3728	0.0374	0.0028	310.1084
39	0.3300	-6.1132	-0.3541	0.0391	0.0026	310.2190
40	0.3300	-7.5332	-0.4367	0.0391	0.0040	309.6883
41	0.0700	-7.3101	-0.4239	0.0401	0.0038	309.7774
42	0.3000	-5.0858	-0.2944	0.0392	0.0018	310.5340
43	0.2300	-7.6407	-0.4430	0.0395	0.0041	309.6430
44	0.0700	-7.3901	-0.4286	0.0401	0.0039	309.7451
45	0.0400	-7.1093	-0.4123	0.0403	0.0036	309.8566
46	3.7100	16.4565	0.9578	0.0286	0.0136	303.9055
47	8.7000	81.4798	*7.1782	0.0247	0.2842	132.1092
48	7.0200	36.3113	*2.2143	0.0245	0.0560	275.6734
49	29.0000	-24.0891	*-1.5254	0.1496	0.1980	293.2845
50	6.3600	-2.6423	-0.1517	0.0248	0.0003	311.0540
51	16.0000	6.3325	0.3677	0.0436	0.0031	310.1391

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-1.4976	-0.7064	0.2418	* 1.1482	0.2132	-0.6574
11	-0.5435	-0.1261	0.0081	1.0930	-0.0103	-0.0911
13	0.0428	0.0072	0.0000	1.0834	0.0069	-0.0026
14	-0.6474	-0.1248	0.0079	1.0688	-0.0355	-0.0705
15	-0.3770	-0.0759	0.0029	1.0878	-0.0758	0.0463
16	0.1726	0.0353	0.0006	1.0956	0.0353	-0.0221
17	-0.4121	-0.0827	0.0035	1.0860	-0.0826	0.0502
18	-0.3462	-0.0706	0.0026	1.0903	-0.0706	0.0441
19	-0.4250	-0.0844	0.0036	1.0845	-0.0843	0.0504
20	-0.5008	-0.0950	0.0046	1.0770	-0.0945	0.0519
21	-0.4499	-0.0922	0.0043	1.0860	-0.0922	0.0580
22	0.2323	0.0437	0.0010	1.0875	0.0140	0.0233
23	-0.2047	-0.0379	0.0007	1.0870	-0.0375	0.0194
24	0.6731	0.1186	0.0071	1.0606	0.0504	0.0516
25	0.0902	0.0181	0.0002	1.0954	0.0042	0.0111
26	-0.7373	-0.3165	0.0507	* 1.2125	0.0857	-0.2906
27	0.6714	0.2302	0.0269	* 1.1498	-0.0410	0.2018
28	0.8211	0.1298	0.0085	1.0423	0.1000	0.0013
29	0.4516	0.1834	0.0172	* 1.2140	-0.0460	0.1668
30	0.1596	0.0254	0.0003	1.0786	0.0176	0.0031
31	-0.1126	-0.0180	0.0002	1.0796	-0.0120	-0.0028
32	-0.5631	-0.0917	0.0043	1.0635	-0.0830	0.0219
33	1.3961	0.2419	0.0286	0.9816	0.1104	0.0976
34	-0.2707	-0.0553	0.0016	1.0931	-0.0553	0.0346
35	-0.3529	-0.0711	0.0026	1.0889	-0.0711	0.0435
36	-0.4188	-0.0844	0.0036	1.0861	-0.0844	0.0517
37	-0.4133	-0.0800	0.0033	1.0830	-0.0798	0.0456
38	-0.3728	-0.0734	0.0028	1.0863	-0.0733	0.0433
39	-0.3541	-0.0714	0.0026	1.0890	-0.0714	0.0438
40	-0.4367	-0.0881	0.0040	1.0852	-0.0880	0.0540
41	-0.4239	-0.0867	0.0038	1.0871	-0.0867	0.0543
42	-0.2944	-0.0595	0.0018	1.0913	-0.0595	0.0366
43	-0.4430	-0.0898	0.0041	1.0854	-0.0898	0.0555
44	-0.4286	-0.0876	0.0039	1.0868	-0.0876	0.0549
45	-0.4123	-0.0844	0.0036	1.0878	-0.0844	0.0530
46	0.9578	0.1645	0.0136	1.0339	0.1578	-0.0634
47	* 7.1782	1.1423	0.2842	0.1946	0.8015	0.1272
48	* 2.2143	0.3509	0.0560	0.8471	0.2865	-0.0232
49	-1.5254	-0.6399	0.1980	1.0999	0.1681	-0.5854
50	-0.1517	-0.0242	0.0003	1.0789	-0.0207	0.0033
51	0.3677	0.0785	0.0031	1.0935	0.0128	0.0521

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Outlier Detection Chart

Row	Vegetation (X)	Residual		Standardized Residual		RStudent	
10	31.6000	-23.2201	||||.....	-1.4743	||||.....	-1.4976	|||.....
11	17.5000	-9.3046	|.....	-0.5485	|.....	-0.5435	|.....
13	4.0800	0.7441	|.....	0.0433	|.....	0.0428	|.....
14	14.1000	-11.1538	|.....	-0.6523	|.....	-0.6474	|.....
15	0.3700	-6.5075	|.....	-0.3812	|.....	-0.3770	|.....
16	0.0800	2.9813	|.....	0.1747	|.....	0.1726	|.....
17	0.4300	-7.1123	|.....	-0.4166	|.....	-0.4121	|.....
18	0.1100	-5.9744	|.....	-0.3501	|.....	-0.3462	|.....
19	0.6200	-7.3370	|.....	-0.4295	|.....	-0.4250	|.....
20	1.5000	-8.6521	|.....	-0.5057	|.....	-0.5008	|.....
21	0.0300	-7.7558	|.....	-0.4546	|.....	-0.4499	|.....
22	13.6000	4.0252	|.....	0.2352	|.....	0.2323	|.....
23	2.0200	-3.5483	|.....	-0.2072	|.....	-0.2047	|.....
24	12.2000	11.6265	||.....	0.6779	||.....	0.6731	|.....
25	14.9000	1.5597	|.....	0.0914	|.....	0.0902	|.....
26	29.5000	-11.8681	||.....	-0.7416	||.....	-0.7373	|.....
27	24.8000	11.1381	|.....	0.6762	||.....	0.6714	|.....
28	7.7400	14.1835	||.....	0.8246	||.....	0.8211	|.....
29	28.3000	7.3615	|.....	0.4563	|.....	0.4516	|.....
30	8.8100	2.7804	|.....	0.1617	|.....	0.1596	|.....
31	9.1500	-1.9614	|.....	-0.1141	|.....	-0.1126	|.....
32	5.3300	-9.7635	|.....	-0.5681	|.....	-0.5631	|.....
33	11.8000	23.6697	||||.....	1.3794	||||.....	1.3961	||.....
34	0.0900	-4.6739	|.....	-0.2739	|.....	-0.2707	|.....
35	0.3500	-6.0937	|.....	-0.3570	|.....	-0.3529	|.....
36	0.3400	-7.2268	|.....	-0.4233	|.....	-0.4188	|.....
37	1.1100	-7.1425	|.....	-0.4178	|.....	-0.4133	|.....
38	0.7700	-6.4407	|.....	-0.3770	|.....	-0.3728	|.....
39	0.3300	-6.1132	|.....	-0.3581	|.....	-0.3541	|.....
40	0.3300	-7.5332	|.....	-0.4413	|.....	-0.4367	|.....
41	0.0700	-7.3101	|.....	-0.4285	|.....	-0.4239	|.....
42	0.3000	-5.0858	|.....	-0.2979	|.....	-0.2944	|.....
43	0.2300	-7.6407	|.....	-0.4477	|.....	-0.4430	|.....
44	0.0700	-7.3901	|.....	-0.4331	|.....	-0.4286	|.....
45	0.0400	-7.1093	|.....	-0.4167	|.....	-0.4123	|.....
46	3.7100	16.4565	||.....	0.9588	||.....	0.9578	|.....
47	8.7000	81.4798	|||||||||||||||	4.7377	|||||||||||||||	* 7.1782	|||||||||||||||
48	7.0200	36.3113	||||||.....	2.1111	||||||.....	* 2.2143	||||.....
49	29.0000	-24.0891	||||.....	-1.5001	||||.....	-1.5254	|||.....
50	6.3600	-2.6423	|.....	-0.1537	|.....	-0.1517	|.....
51	16.0000	6.3325	|.....	0.3718	|.....	0.3677	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Influence Detection Chart

Row	Vegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	31.6000	-0.7064	|||||||||.....	0.2418	|||||||||||...	-0.6574	||||||||||||||
11	17.5000	-0.1261	|.....	0.0081	|.....	-0.0911	||.....
13	4.0800	0.0072	|.....	0.0000	|.....	-0.0026	|.....
14	14.1000	-0.1248	|.....	0.0079	|.....	-0.0705	|.....
15	0.3700	-0.0759	|.....	0.0029	|.....	0.0463	|.....
16	0.0800	0.0353	|.....	0.0006	|.....	-0.0221	|.....
17	0.4300	-0.0827	|.....	0.0035	|.....	0.0502	|.....
18	0.1100	-0.0706	|.....	0.0026	|.....	0.0441	|.....
19	0.6200	-0.0844	|.....	0.0036	|.....	0.0504	|.....
20	1.5000	-0.0950	|.....	0.0046	|.....	0.0519	|.....
21	0.0300	-0.0922	|.....	0.0043	|.....	0.0580	|.....
22	13.6000	0.0437	|.....	0.0010	|.....	0.0233	|.....
23	2.0200	-0.0379	|.....	0.0007	|.....	0.0194	|.....
24	12.2000	0.1186	|.....	0.0071	|.....	0.0516	|.....
25	14.9000	0.0181	|.....	0.0002	|.....	0.0111	|.....
26	29.5000	-0.3165	||||.....	0.0507	||.....	-0.2906	||||||.....
27	24.8000	0.2302	||.....	0.0269	|.....	0.2018	||||.....
28	7.7400	0.1298	|.....	0.0085	|.....	0.0013	|.....
29	28.3000	0.1834	||.....	0.0172	|.....	0.1668	|||.....
30	8.8100	0.0254	|.....	0.0003	|.....	0.0031	|.....
31	9.1500	-0.0180	|.....	0.0002	|.....	-0.0028	|.....
32	5.3300	-0.0917	|.....	0.0043	|.....	0.0219	|.....
33	11.8000	0.2419	|||.....	0.0286	|.....	0.0976	||.....
34	0.0900	-0.0553	|.....	0.0016	|.....	0.0346	|.....
35	0.3500	-0.0711	|.....	0.0026	|.....	0.0435	|.....
36	0.3400	-0.0844	|.....	0.0036	|.....	0.0517	|.....
37	1.1100	-0.0800	|.....	0.0033	|.....	0.0456	|.....
38	0.7700	-0.0734	|.....	0.0028	|.....	0.0433	|.....
39	0.3300	-0.0714	|.....	0.0026	|.....	0.0438	|.....
40	0.3300	-0.0881	|.....	0.0040	|.....	0.0540	|.....
41	0.0700	-0.0867	|.....	0.0038	|.....	0.0543	|.....
42	0.3000	-0.0595	|.....	0.0018	|.....	0.0366	|.....
43	0.2300	-0.0898	|.....	0.0041	|.....	0.0555	|.....
44	0.0700	-0.0876	|.....	0.0039	|.....	0.0549	|.....
45	0.0400	-0.0844	|.....	0.0036	|.....	0.0530	|.....
46	3.7100	0.1645	||.....	0.0136	|.....	-0.0634	|.....
47	8.7000	1.1423	|||||||||||||||	0.2842	||||||||||||||	0.1272	||.....
48	7.0200	0.3509	||||.....	0.0560	||.....	-0.0232	|.....
49	29.0000	-0.6399	||||||||.....	0.1980	|||||||||.....	-0.5854	||||||||||||..
50	6.3600	-0.0242	|.....	0.0003	|.....	0.0033	|.....
51	16.0000	0.0785	|.....	0.0031	|.....	0.0521	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Outlier & Influence Chart

Row	Vegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	31.6000	-1.4976	|||.....	0.2418	|||||||||||...	0.1820	||||||||||||||
11	17.5000	-0.5435	|.....	0.0081	|.....	0.0511	||.....
13	4.0800	0.0428	|.....	0.0000	|.....	0.0279	|.....
14	14.1000	-0.6474	|.....	0.0079	|.....	0.0358	|.....
15	0.3700	-0.3770	|.....	0.0029	|.....	0.0389	|.....
16	0.0800	0.1726	|.....	0.0006	|.....	0.0401	|.....
17	0.4300	-0.4121	|.....	0.0035	|.....	0.0387	|.....
18	0.1100	-0.3462	|.....	0.0026	|.....	0.0400	|.....
19	0.6200	-0.4250	|.....	0.0036	|.....	0.0379	|.....
20	1.5000	-0.5008	|.....	0.0046	|.....	0.0348	|.....
21	0.0300	-0.4499	|.....	0.0043	|.....	0.0403	|.....
22	13.6000	0.2323	|.....	0.0010	|.....	0.0341	|.....
23	2.0200	-0.2047	|.....	0.0007	|.....	0.0331	|.....
24	12.2000	0.6731	|.....	0.0071	|.....	0.0301	|.....
25	14.9000	0.0902	|.....	0.0002	|.....	0.0389	|.....
26	29.5000	-0.7373	|.....	0.0507	||.....	0.1556	|||||||||||...
27	24.8000	0.6714	|.....	0.0269	|.....	0.1052	||||||.....
28	7.7400	0.8211	|.....	0.0085	|.....	0.0244	|.....
29	28.3000	0.4516	|.....	0.0172	|.....	0.1416	||||||||||....
30	8.8100	0.1596	|.....	0.0003	|.....	0.0248	|.....
31	9.1500	-0.1126	|.....	0.0002	|.....	0.0250	|.....
32	5.3300	-0.5631	|.....	0.0043	|.....	0.0259	|.....
33	11.8000	1.3961	||.....	0.0286	|.....	0.0291	|.....
34	0.0900	-0.2707	|.....	0.0016	|.....	0.0401	|.....
35	0.3500	-0.3529	|.....	0.0026	|.....	0.0390	|.....
36	0.3400	-0.4188	|.....	0.0036	|.....	0.0390	|.....
37	1.1100	-0.4133	|.....	0.0033	|.....	0.0361	|.....
38	0.7700	-0.3728	|.....	0.0028	|.....	0.0374	|.....
39	0.3300	-0.3541	|.....	0.0026	|.....	0.0391	|.....
40	0.3300	-0.4367	|.....	0.0040	|.....	0.0391	|.....
41	0.0700	-0.4239	|.....	0.0038	|.....	0.0401	|.....
42	0.3000	-0.2944	|.....	0.0018	|.....	0.0392	|.....
43	0.2300	-0.4430	|.....	0.0041	|.....	0.0395	|.....
44	0.0700	-0.4286	|.....	0.0039	|.....	0.0401	|.....
45	0.0400	-0.4123	|.....	0.0036	|.....	0.0403	|.....
46	3.7100	0.9578	|.....	0.0136	|.....	0.0286	|.....
47	8.7000	* 7.1782	|||||||||||||||	0.2842	||||||||||||||	0.0247	|.....
48	7.0200	* 2.2143	||||.....	0.0560	||.....	0.0245	|.....
49	29.0000	-1.5254	|||.....	0.1980	|||||||||.....	0.1496	||||||||||....
50	6.3600	-0.1517	|.....	0.0003	|.....	0.0248	|.....
51	16.0000	0.3677	|.....	0.0031	|.....	0.0436	|.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Inverse Prediction of X Means

Row	Mammal (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	28.3000	31.6000	14.5022	17.0978	10.2944	21.8183
11	23.0667	17.5000	10.6487	6.8513	6.5719	16.0873
13	14.8900	4.0800	4.6279	-0.5479	-0.8151	8.7041
14	16.6000	14.1000	5.8870	8.2130	0.9082	10.0697
15	2.6000	0.3700	-4.4217	4.7917	-14.9396	0.6281
16	11.6950	0.0800	2.2753	-2.1953	-4.2456	6.3631
17	2.0767	0.4300	-4.8071	5.2371	-15.5792	0.3223
18	2.7800	0.1100	-4.2892	4.3992	-14.7201	0.7336
19	2.1100	0.6200	-4.7825	5.4025	-15.5384	0.3417
20	1.9900	1.5000	-4.8709	6.3709	-15.6853	0.2718
21	0.8900	0.0300	-5.6809	5.7109	-17.0354	-0.3651
22	31.1000	13.6000	16.5639	-2.9639	12.0858	25.0847
23	7.8000	2.0200	-0.5928	2.6128	-8.7027	3.7844
24	36.8000	12.2000	20.7610	-8.5610	15.4902	31.9768
25	30.4000	14.9000	16.0485	-1.1485	11.6474	24.2587
26	36.8000	29.5000	20.7610	8.7390	15.4902	31.9768
27	53.4233	24.8000	33.0014	-8.2014	24.6460	52.8492
28	33.3000	7.7400	18.1839	-10.4439	13.4305	27.7141
29	54.4000	28.3000	33.7206	-5.4206	25.1682	54.0913
30	23.3500	8.8100	10.8573	-2.0473	6.7901	16.3810
31	19.0700	9.1500	7.7058	1.4442	3.2336	12.2061
32	6.0800	5.3300	-1.8593	7.1893	-10.7377	2.7124
33	48.3000	11.8000	29.2289	-17.4289	21.8879	46.3526
34	4.0533	0.0900	-3.3516	3.4416	-13.1731	1.4869
35	2.9867	0.3500	-4.1370	4.4870	-14.4682	0.8551
36	1.8400	0.3400	-4.9813	5.3213	-15.8690	0.1846
37	2.9700	1.1100	-4.1493	5.2593	-14.4885	0.8453
38	3.2100	0.7700	-3.9725	4.7425	-14.1964	0.9867
39	2.9400	0.3300	-4.1714	4.5014	-14.5251	0.8277
40	1.5200	0.3300	-5.2170	5.5470	-16.2613	-0.0012
41	1.3900	0.0700	-5.3127	5.3827	-16.4209	-0.0764
42	3.9267	0.3000	-3.4448	3.7448	-13.3265	1.4114
43	1.2767	0.2300	-5.3961	5.6261	-16.5600	-0.1420
44	1.3100	0.0700	-5.3716	5.4416	-16.5191	-0.1227
45	1.5500	0.0400	-5.1949	5.2349	-16.2245	0.0162
46	30.1000	3.7100	15.8276	-12.1176	11.4578	23.9064
47	101.9000	8.7000	68.6966	-59.9966	50.0324	115.0306
48	54.4500	7.0200	33.7574	-26.7374	25.1949	54.1549
49	23.9000	29.0000	11.2623	17.7377	7.2073	16.9573
50	14.6000	6.3600	4.4143	1.9457	-1.1158	8.4809
51	36.6667	16.0000	20.6629	-4.6629	15.4131	31.8130

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = Mammal X = Vegetation

Inverse Prediction of X Individuals

Row	Mammal (Y)	Vegetation (X)	Predicted Vegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	28.3000	31.6000	14.5022	17.0978	-13.2414	45.3540
11	23.0667	17.5000	10.6487	6.8513	-17.7872	40.4465
13	14.8900	4.0800	4.6279	-0.5479	-25.1727	33.0616
14	16.6000	14.1000	5.8870	8.2130	-23.5995	34.5774
15	2.6000	0.3700	-4.4217	4.7917	-36.9172	22.6057
16	11.6950	0.0800	2.2753	-2.1953	-28.1524	30.2699
17	2.0767	0.4300	-4.8071	5.2371	-37.4340	22.1771
18	2.7800	0.1100	-4.2892	4.3992	-36.7398	22.7534
19	2.1100	0.6200	-4.7825	5.4025	-37.4010	22.2043
20	1.9900	1.5000	-4.8709	6.3709	-37.5197	22.1062
21	0.8900	0.0300	-5.6809	5.7109	-38.6106	21.2101
22	31.1000	13.6000	16.5639	-2.9639	-10.8663	48.0369
23	7.8000	2.0200	-0.5928	2.6128	-31.8554	26.9370
24	36.8000	12.2000	20.7610	-8.5610	-6.1514	53.6184
25	30.4000	14.9000	16.0485	-1.1485	-11.4564	47.3625
26	36.8000	29.5000	20.7610	8.7390	-6.1514	53.6184
27	53.4233	24.8000	33.0014	-8.2014	6.7475	70.7478
28	33.3000	7.7400	18.1839	-10.4439	-9.0277	50.1723
29	54.4000	28.3000	33.7206	-5.4206	7.4693	71.7901
30	23.3500	8.8100	10.8573	-2.0473	-17.5375	40.7086
31	19.0700	9.1500	7.7058	1.4442	-21.3539	36.7936
32	6.0800	5.3300	-1.8593	7.1893	-33.5149	25.4896
33	48.3000	11.8000	29.2289	-17.4289	2.8987	65.3418
34	4.0533	0.0900	-3.3516	3.4416	-35.4891	23.8028
35	2.9867	0.3500	-4.1370	4.4870	-36.5363	22.9232
36	1.8400	0.3400	-4.9813	5.3213	-37.6681	21.9837
37	2.9700	1.1100	-4.1493	5.2593	-36.5527	22.9095
38	3.2100	0.7700	-3.9725	4.7425	-36.3166	23.1069
39	2.9400	0.3300	-4.1714	4.5014	-36.5822	22.8848
40	1.5200	0.3300	-5.2170	5.5470	-37.9851	21.7226
41	1.3900	0.0700	-5.3127	5.3827	-38.1140	21.6167
42	3.9267	0.3000	-3.4448	3.7448	-35.6132	23.6981
43	1.2767	0.2300	-5.3961	5.6261	-38.2265	21.5244
44	1.3100	0.0700	-5.3716	5.4416	-38.1934	21.5516
45	1.5500	0.0400	-5.1949	5.2349	-37.9554	21.7471
46	30.1000	3.7100	15.8276	-12.1176	-11.7100	47.0742
47	101.9000	8.7000	68.6966	-59.9966	39.1570	125.9060
48	54.4500	7.0200	33.7574	-26.7374	7.5062	71.8436
49	23.9000	29.0000	11.2623	17.7377	-17.0540	41.2185
50	14.6000	6.3600	4.4143	1.9457	-25.4410	32.8061
51	36.6667	16.0000	20.6629	-4.6629	-6.2599	53.4860

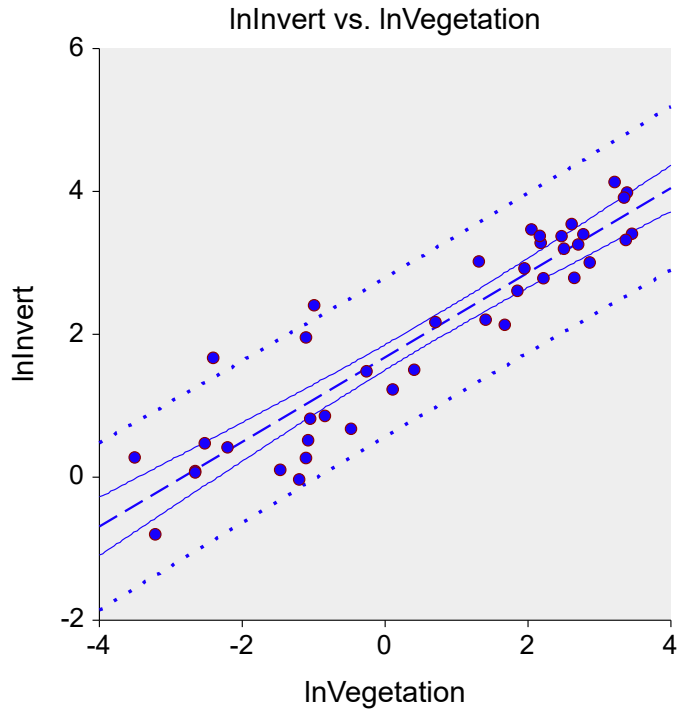
This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Vegetation to Prey Tissue Linear Regressions
In Transformation – APL10 and PCO06 (SM Only) Removed

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnInvert	Rows Processed	58
Independent Variable	lnVegetation	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.6782	Rows Prediction Only	0
Slope	0.5910	Sum of Frequencies	41
R-Squared	0.8508	Sum of Weights	41.0000
Correlation	0.9224	Coefficient of Variation	0.2673
Mean Square Error	0.295112	Square Root of MSE	0.5432421

Linear Regression Report

Y = lnInvert X = lnVegetation

Summary Statement

The equation of the straight line relating lnInvert and lnVegetation is estimated as: lnInvert = (1.6782) + (0.5910) lnVegetation using the 41 observations in this dataset. The y-intercept, the estimated value of lnInvert when lnVegetation is zero, is 1.6782 with a standard error of 0.0881. The slope, the estimated change in lnInvert per unit change in lnVegetation, is 0.5910 with a standard error of 0.0396. The value of R-Squared, the proportion of the variation in lnInvert that can be accounted for by variation in lnVegetation, is 0.8508. The correlation between lnInvert and lnVegetation is 0.9224.

A significance test that the slope is zero resulted in a t-value of 14.9129. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5910. The lower limit of the 95% confidence interval for the slope is 0.5108 and the upper limit is 0.6711. The estimated intercept is 1.6782. The lower limit of the 95% confidence interval for the intercept is 1.5001 and the upper limit is 1.8564.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnInvert	lnVegetation
Count	41	41
Mean	2.0320	0.5985
Standard Deviation	1.3887	2.1675
Minimum	-0.7985	-3.5066
Maximum	4.1320	3.4532

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.6782	0.5910
Lower 95% Confidence Limit	1.5001	0.5108
Upper 95% Confidence Limit	1.8564	0.6711
Standard Error	0.0881	0.0396
Standardized Coefficient	0.0000	0.9224
T Value	19.0507	14.9129
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	1.0000
Regression of Y on X	1.6782	0.5910
Inverse Regression from X on Y	1.6162	0.6946
Orthogonal Regression of Y and X	1.6616	0.6187

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.67824307965955) + (0.590967387917872) * (lnVegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.6782	0.9000	1.5109	1.8444
Bootstrap Mean	1.6742	0.9500	1.4799	1.8779
Bias (BM - OV)	-0.0041	0.9900	1.4118	1.9425
Bias Corrected	1.6823			
Standard Error	0.1016			
Slope				
Original Value	0.5910	0.9000	0.5189	0.6567
Bootstrap Mean	0.5921	0.9500	0.5065	0.6709
Bias (BM - OV)	0.0012	0.9900	0.4798	0.6970
Bias Corrected	0.5898			
Standard Error	0.0419			
Correlation				
Original Value	0.9224	0.9000	0.8870	0.9668
Bootstrap Mean	0.9218	0.9500	0.8820	0.9777
Bias (BM - OV)	-0.0006	0.9900	0.8761	0.9985
Bias Corrected	0.9230			
Standard Error	0.0243			
R-Squared				
Original Value	0.8508	0.9000	0.7843	0.9308
Bootstrap Mean	0.8503	0.9500	0.7746	0.9497
Bias (BM - OV)	-0.0005	0.9900	0.7633	0.9854
Bias Corrected	0.8513			
Standard Error	0.0444			
Standard Error of Estimate				
Original Value	0.5432	0.9000	0.4572	0.6726
Bootstrap Mean	0.5256	0.9500	0.4387	0.6928
Bias (BM - OV)	-0.0177	0.9900	0.4057	0.7269
Bias Corrected	0.5609			
Standard Error	0.0653			
Orthogonal Intercept				
Original Value	1.6616	0.9000	1.4971	1.8269
Bootstrap Mean	1.6579	0.9500	1.4650	1.8612
Bias (BM - OV)	-0.0037	0.9900	1.3934	1.9274
Bias Corrected	1.6654			
Standard Error	0.1011			
Orthogonal Slope				
Original Value	0.6187	0.9000	0.5497	0.6832
Bootstrap Mean	0.6198	0.9500	0.5355	0.6964
Bias (BM - OV)	0.0011	0.9900	0.5112	0.7276
Bias Corrected	0.6176			
Standard Error	0.0409			

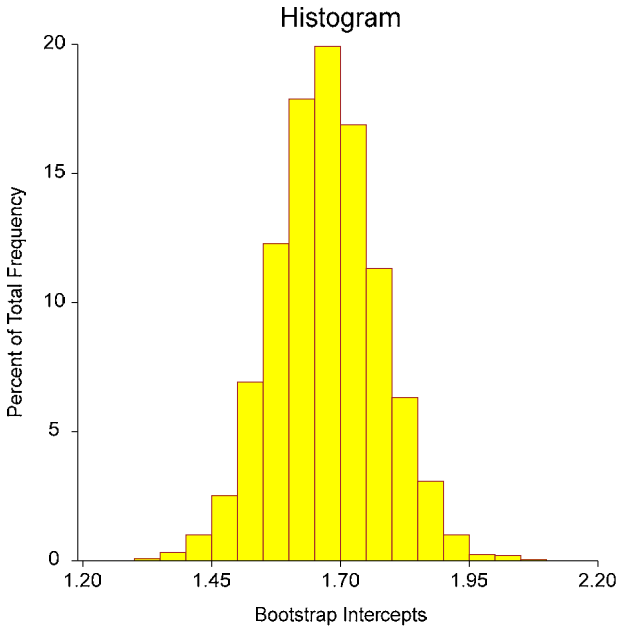
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

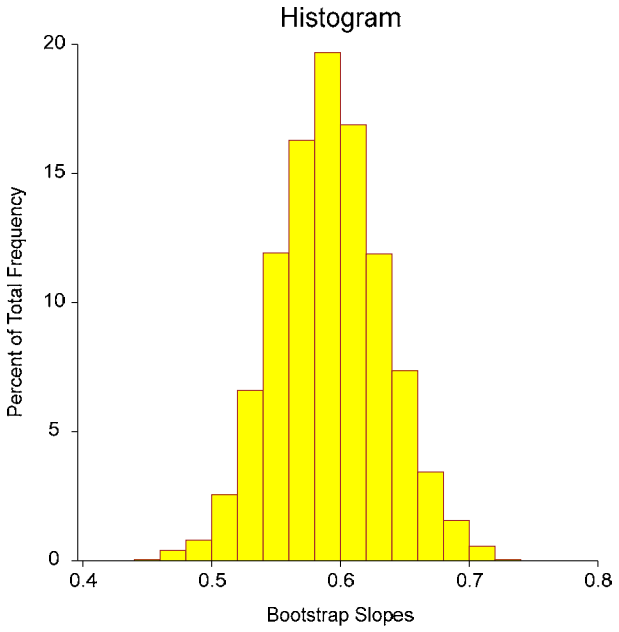
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

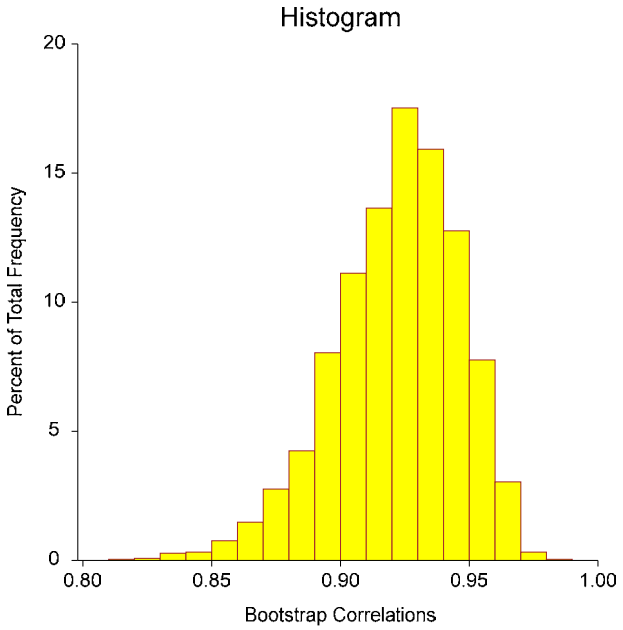
Linear Regression Report

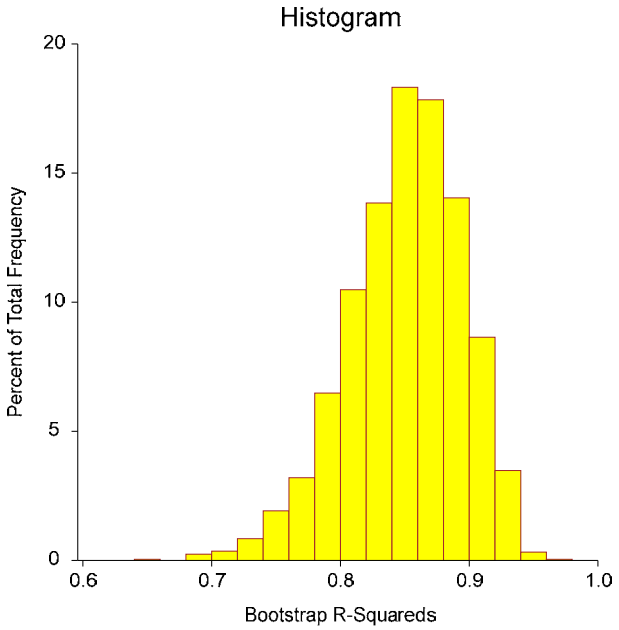
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Bootstrap Histograms Section



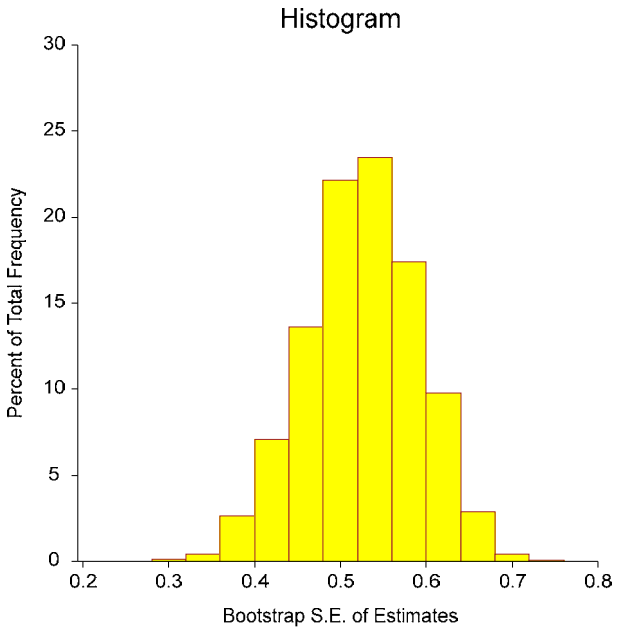


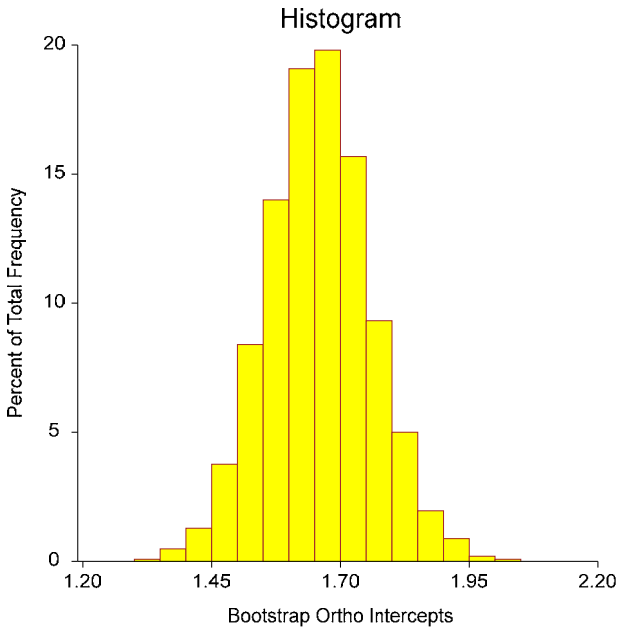


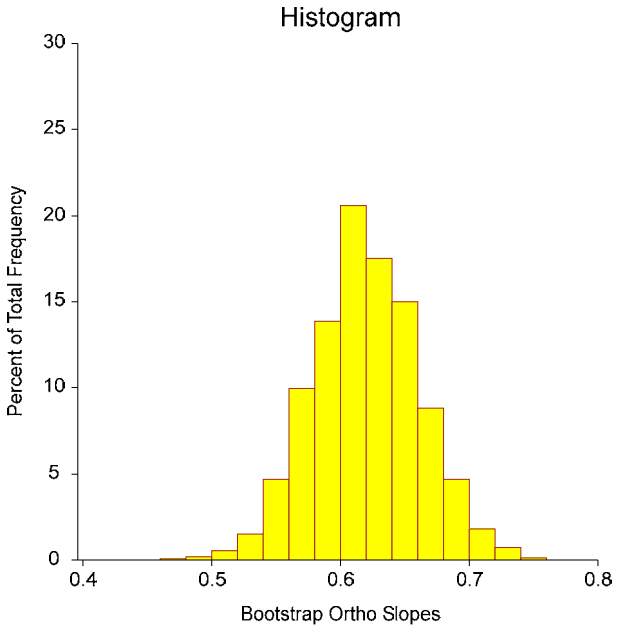


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.9224	0.8508	0.9120
Lower 95% Conf. Limit (r dist'n)	0.8556		
Upper 95% Conf. Limit (r dist'n)	0.9570		
Lower 95% Conf. Limit (Fisher's z)	0.8583		0.8401
Upper 95% Conf. Limit (Fisher's z)	0.9581		0.9524
Adjusted (Rbar)		0.8470	
T-Value for H0: Rho = 0	14.9129	14.9129	13.8861
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	169.2829	169.2829			
Slope	1	65.63096	65.63096	222.3934	0.0000	1.0000
Error	39	11.50937	0.295112			
Lack of Fit	37	10.08579	0.272589	0.3830	0.9131	
Pure Error	2	1.423572	0.7117862			
Adj. Total	40	77.14033	1.928508			
Total	41	246.4232				

s = Square Root(0.295112) = 0.5432421

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	24.53991	83.31025	0.02629657	-0.003184985
1	24.53991	202.6118	160.9209	-0.003184985	0.005321307
2 (Y'Y)			246.4232		
Determinant		7704.875			0.000129788

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.007760431	-0.0009399271
1	-0.0009399271	0.001570381

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9658	0.249391	Yes
Anderson Darling	0.3817	0.399878	Yes
D'Agostino Skewness	1.7901	0.073444	No
D'Agostino Kurtosis	0.8743	0.381936	Yes
D'Agostino Omnibus	3.9688	0.137464	No
Constant Residual Variance?			
Modified Levene Test	5.3674	0.025859	No
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	0.3830	0.913067	Yes

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

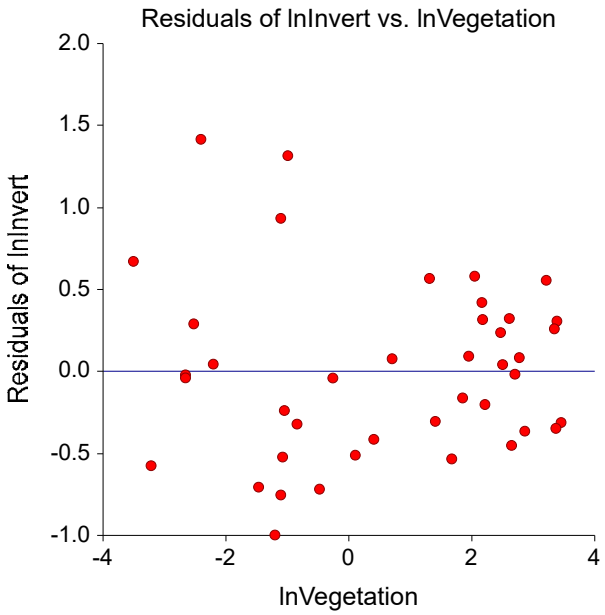
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

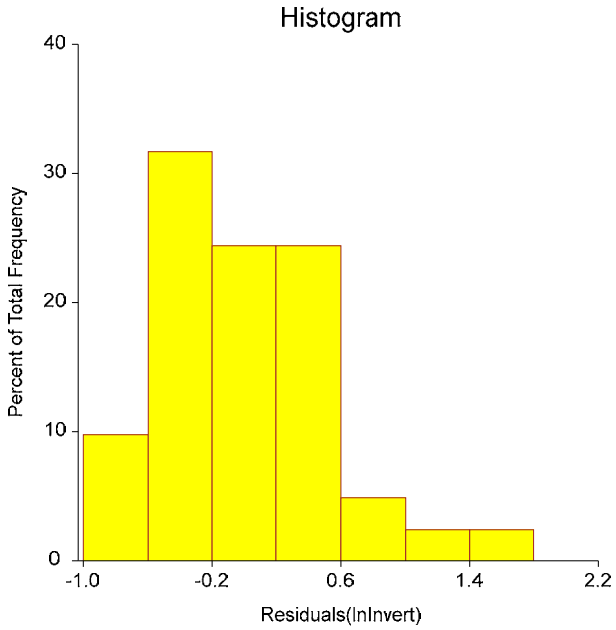
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

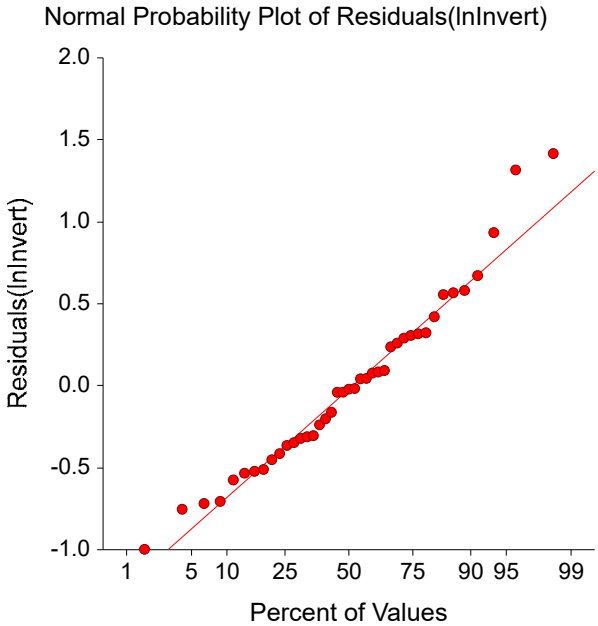
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Original Data Section

Row	lnVegetation (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual
10	3.4532	3.4078	3.7189	-0.3111
11	2.8622	3.0057	3.3697	-0.3640
13	1.4061	2.2050	2.5092	-0.3042
14	2.6462	2.7912	3.2420	-0.4509
15	-0.9943	2.4069	1.0907	1.3163
16	-2.5257	0.4762	0.1856	0.2906
17	-0.8440	0.8587	1.1795	-0.3208
18	-2.2073	0.4187	0.3738	0.0449
19	-0.4780	0.6780	1.3957	-0.7177
20	0.4055	1.5041	1.9179	-0.4138
21	-3.5066	0.2776	-0.3940	0.6717
22	2.6101	3.5439	3.2207	0.3231
23	0.7031	2.1713	2.0938	0.0776
24	2.5014	3.1987	3.1565	0.0422
25	2.7014	3.2581	3.2747	-0.0166
26	3.3844	3.9853	3.6783	0.3070
27	3.2108	4.1320	3.5757	0.5562
28	2.0464	3.4689	2.8876	0.5813
29	3.3429	3.9140	3.6538	0.2603
30	2.1759	3.2809	2.9641	0.3168
31	2.2138	2.7850	2.9865	-0.2015
32	1.6734	2.1342	2.6671	-0.5330
33	2.4681	3.3742	3.1368	0.2374
34	-2.4079	1.6715	0.2552	1.4162
35	-1.0498	0.8198	1.0578	-0.2381
36	-1.0788	0.5188	1.0407	-0.5219
37	0.1044	1.2296	1.7399	-0.5103
38	-0.2614	1.4839	1.5238	-0.0399
39	-1.1087	0.2700	1.0231	-0.7530
40	-1.1087	1.9573	1.0231	0.9342
41	-2.6593	0.0862	0.1067	-0.0205
42	-1.2040	-0.0305	0.9667	-0.9972
43	-1.4697	0.1044	0.8097	-0.7054
44	-2.6593	0.0677	0.1067	-0.0390
45	-3.2189	-0.7985	-0.2240	-0.5745
46	1.3110	3.0204	2.4530	0.5674
47	2.1633	3.3776	2.9567	0.4209
48	1.9488	2.9232	2.8299	0.0933
49	3.3673	3.3214	3.6682	-0.3468
50	1.8500	2.6101	2.7715	-0.1615
51	2.7726	3.4012	3.3168	0.0844

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Predicted Values and Confidence Limits of Means

Row	lnVegetation (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	3.4532	3.4078	3.7189	0.1414	3.4329	4.0050
11	2.8622	3.0057	3.3697	0.1235	3.1200	3.6195
13	1.4061	2.2050	2.5092	0.0907	2.3258	2.6926
14	2.6462	2.7912	3.2420	0.1174	3.0046	3.4795
15	-0.9943	2.4069	1.0907	0.1057	0.8768	1.3046
16	-2.5257	0.4762	0.1856	0.1501	-0.1180	0.4892
17	-0.8440	0.8587	1.1795	0.1023	0.9726	1.3864
18	-2.2073	0.4187	0.3738	0.1399	0.0909	0.6567
19	-0.4780	0.6780	1.3957	0.0950	1.2037	1.5878
20	0.4055	1.5041	1.9179	0.0852	1.7456	2.0902
21	-3.5066	0.2776	-0.3940	0.1835	-0.7651	-0.0229
22	2.6101	3.5439	3.2207	0.1164	2.9852	3.4562
23	0.7031	2.1713	2.0938	0.0849	1.9219	2.2656
24	2.5014	3.1987	3.1565	0.1135	2.9269	3.3861
25	2.7014	3.2581	3.2747	0.1189	3.0341	3.5152
26	3.3844	3.9853	3.6783	0.1392	3.3967	3.9599
27	3.2108	4.1320	3.5757	0.1338	3.3050	3.8465
28	2.0464	3.4689	2.8876	0.1024	2.6804	3.0948
29	3.3429	3.9140	3.6538	0.1379	3.3748	3.9328
30	2.1759	3.2809	2.9641	0.1054	2.7510	3.1773
31	2.2138	2.7850	2.9865	0.1063	2.7715	3.2015
32	1.6734	2.1342	2.6671	0.0949	2.4751	2.8592
33	2.4681	3.3742	3.1368	0.1126	2.9090	3.3646
34	-2.4079	1.6715	0.2552	0.1463	-0.0406	0.5511
35	-1.0498	0.8198	1.0578	0.1071	0.8413	1.2744
36	-1.0788	0.5188	1.0407	0.1078	0.8227	1.2587
37	0.1044	1.2296	1.7399	0.0871	1.5638	1.9160
38	-0.2614	1.4839	1.5238	0.0914	1.3389	1.7087
39	-1.1087	0.2700	1.0231	0.1085	0.8036	1.2425
40	-1.1087	1.9573	1.0231	0.1085	0.8036	1.2425
41	-2.6593	0.0862	0.1067	0.1545	-0.2058	0.4192
42	-1.2040	-0.0305	0.9667	0.1109	0.7424	1.1911
43	-1.4697	0.1044	0.8097	0.1180	0.5711	1.0483
44	-2.6593	0.0677	0.1067	0.1545	-0.2058	0.4192
45	-3.2189	-0.7985	-0.2240	0.1734	-0.5748	0.1268
46	1.3110	3.0204	2.4530	0.0894	2.2722	2.6339
47	2.1633	3.3776	2.9567	0.1051	2.7441	3.1693
48	1.9488	2.9232	2.8299	0.1003	2.6270	3.0328
49	3.3673	3.3214	3.6682	0.1387	3.3877	3.9487
50	1.8500	2.6101	2.7715	0.0983	2.5728	2.9703
51	2.7726	3.4012	3.3168	0.1209	3.0722	3.5613

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Predicted Values and Prediction Limits

Row	lnVegetation (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	3.4532	3.4078	3.7189	0.5613	2.5835	4.8544
11	2.8622	3.0057	3.3697	0.5571	2.2429	4.4965
13	1.4061	2.2050	2.5092	0.5508	1.3952	3.6232
14	2.6462	2.7912	3.2420	0.5558	2.1179	4.3662
15	-0.9943	2.4069	1.0907	0.5534	-0.0288	2.2101
16	-2.5257	0.4762	0.1856	0.5636	-0.9544	1.3256
17	-0.8440	0.8587	1.1795	0.5528	0.0614	2.2976
18	-2.2073	0.4187	0.3738	0.5610	-0.7608	1.5085
19	-0.4780	0.6780	1.3957	0.5515	0.2803	2.5112
20	0.4055	1.5041	1.9179	0.5499	0.8056	3.0301
21	-3.5066	0.2776	-0.3940	0.5734	-1.5538	0.7658
22	2.6101	3.5439	3.2207	0.5556	2.0970	4.3445
23	0.7031	2.1713	2.0938	0.5498	0.9816	3.2059
24	2.5014	3.1987	3.1565	0.5550	2.0340	4.2791
25	2.7014	3.2581	3.2747	0.5561	2.1498	4.3995
26	3.3844	3.9853	3.6783	0.5608	2.5440	4.8126
27	3.2108	4.1320	3.5757	0.5595	2.4441	4.7074
28	2.0464	3.4689	2.8876	0.5528	1.7694	4.0058
29	3.3429	3.9140	3.6538	0.5605	2.5201	4.7874
30	2.1759	3.2809	2.9641	0.5534	1.8448	4.0834
31	2.2138	2.7850	2.9865	0.5535	1.8669	4.1061
32	1.6734	2.1342	2.6671	0.5515	1.5517	3.7826
33	2.4681	3.3742	3.1368	0.5548	2.0146	4.2590
34	-2.4079	1.6715	0.2552	0.5626	-0.8827	1.3932
35	-1.0498	0.8198	1.0578	0.5537	-0.0621	2.1778
36	-1.0788	0.5188	1.0407	0.5538	-0.0795	2.1609
37	0.1044	1.2296	1.7399	0.5502	0.6271	2.8528
38	-0.2614	1.4839	1.5238	0.5509	0.4095	2.6380
39	-1.1087	0.2700	1.0231	0.5540	-0.0975	2.1436
40	-1.1087	1.9573	1.0231	0.5540	-0.0975	2.1436
41	-2.6593	0.0862	0.1067	0.5648	-1.0357	1.2491
42	-1.2040	-0.0305	0.9667	0.5544	-0.1547	2.0882
43	-1.4697	0.1044	0.8097	0.5559	-0.3147	1.9341
44	-2.6593	0.0677	0.1067	0.5648	-1.0357	1.2491
45	-3.2189	-0.7985	-0.2240	0.5703	-1.3775	0.9294
46	1.3110	3.0204	2.4530	0.5506	1.3394	3.5666
47	2.1633	3.3776	2.9567	0.5533	1.8375	4.0759
48	1.9488	2.9232	2.8299	0.5524	1.7125	3.9473
49	3.3673	3.3214	3.6682	0.5607	2.5341	4.8023
50	1.8500	2.6101	2.7715	0.5521	1.6549	3.8882
51	2.7726	3.4012	3.3168	0.5565	2.1911	4.4425

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Working-Hotelling Simultaneous Confidence Band

Row	lnVegetation (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	3.4532	3.4078	3.7189	0.1414	3.3160	4.1219
11	2.8622	3.0057	3.3697	0.1235	3.0178	3.7216
13	1.4061	2.2050	2.5092	0.0907	2.2508	2.7676
14	2.6462	2.7912	3.2420	0.1174	2.9075	3.5766
15	-0.9943	2.4069	1.0907	0.1057	0.7893	1.3920
16	-2.5257	0.4762	0.1856	0.1501	-0.2421	0.6134
17	-0.8440	0.8587	1.1795	0.1023	0.8879	1.4710
18	-2.2073	0.4187	0.3738	0.1399	-0.0248	0.7724
19	-0.4780	0.6780	1.3957	0.0950	1.1251	1.6664
20	0.4055	1.5041	1.9179	0.0852	1.6751	2.1606
21	-3.5066	0.2776	-0.3940	0.1835	-0.9169	0.1289
22	2.6101	3.5439	3.2207	0.1164	2.8889	3.5525
23	0.7031	2.1713	2.0938	0.0849	1.8517	2.3358
24	2.5014	3.1987	3.1565	0.1135	2.8330	3.4800
25	2.7014	3.2581	3.2747	0.1189	2.9358	3.6136
26	3.3844	3.9853	3.6783	0.1392	3.2815	4.0751
27	3.2108	4.1320	3.5757	0.1338	3.1943	3.9572
28	2.0464	3.4689	2.8876	0.1024	2.5957	3.1795
29	3.3429	3.9140	3.6538	0.1379	3.2607	4.0469
30	2.1759	3.2809	2.9641	0.1054	2.6638	3.2644
31	2.2138	2.7850	2.9865	0.1063	2.6836	3.2894
32	1.6734	2.1342	2.6671	0.0949	2.3966	2.9377
33	2.4681	3.3742	3.1368	0.1126	2.8158	3.4578
34	-2.4079	1.6715	0.2552	0.1463	-0.1616	0.6721
35	-1.0498	0.8198	1.0578	0.1071	0.7527	1.3630
36	-1.0788	0.5188	1.0407	0.1078	0.7335	1.3479
37	0.1044	1.2296	1.7399	0.0871	1.4918	1.9881
38	-0.2614	1.4839	1.5238	0.0914	1.2632	1.7843
39	-1.1087	0.2700	1.0231	0.1085	0.7138	1.3323
40	-1.1087	1.9573	1.0231	0.1085	0.7138	1.3323
41	-2.6593	0.0862	0.1067	0.1545	-0.3335	0.5470
42	-1.2040	-0.0305	0.9667	0.1109	0.6507	1.2828
43	-1.4697	0.1044	0.8097	0.1180	0.4735	1.1459
44	-2.6593	0.0677	0.1067	0.1545	-0.3335	0.5470
45	-3.2189	-0.7985	-0.2240	0.1734	-0.7183	0.2703
46	1.3110	3.0204	2.4530	0.0894	2.1982	2.7078
47	2.1633	3.3776	2.9567	0.1051	2.6572	3.2562
48	1.9488	2.9232	2.8299	0.1003	2.5440	3.1158
49	3.3673	3.3214	3.6682	0.1387	3.2729	4.0635
50	1.8500	2.6101	2.7715	0.0983	2.4915	3.0516
51	2.7726	3.4012	3.3168	0.1209	2.9722	3.6613

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Residual Section

Row	lnVegetation (X)	lnInvert (Y)	Predicted lnInvert (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	3.4532	3.4078	3.7189	-0.3111	-0.5931	9.1291
11	2.8622	3.0057	3.3697	-0.3640	-0.6881	12.1113
13	1.4061	2.2050	2.5092	-0.3042	-0.5680	13.7974
14	2.6462	2.7912	3.2420	-0.4509	-0.8501	16.1539
15	-0.9943	2.4069	1.0907	1.3163	2.4702	54.6864
16	-2.5257	0.4762	0.1856	0.2906	0.5566	61.0234
17	-0.8440	0.8587	1.1795	-0.3208	-0.6013	37.3631
18	-2.2073	0.4187	0.3738	0.0449	0.0855	10.7221
19	-0.4780	0.6780	1.3957	-0.7177	-1.3418	105.8511
20	0.4055	1.5041	1.9179	-0.4138	-0.7712	27.5107
21	-3.5066	0.2776	-0.3940	0.6717	1.3136	241.9212
22	2.6101	3.5439	3.2207	0.3231	0.6090	9.1184
23	0.7031	2.1713	2.0938	0.0776	0.1446	3.5732
24	2.5014	3.1987	3.1565	0.0422	0.0794	1.3181
25	2.7014	3.2581	3.2747	-0.0166	-0.0312	0.5084
26	3.3844	3.9853	3.6783	0.3070	0.5846	7.7025
27	3.2108	4.1320	3.5757	0.5562	1.0564	13.4613
28	2.0464	3.4689	2.8876	0.5813	1.0895	16.7564
29	3.3429	3.9140	3.6538	0.2603	0.4953	6.6493
30	2.1759	3.2809	2.9641	0.3168	0.5944	9.6555
31	2.2138	2.7850	2.9865	-0.2015	-0.3782	7.2347
32	1.6734	2.1342	2.6671	-0.5330	-0.9964	24.9733
33	2.4681	3.3742	3.1368	0.2374	0.4466	7.0346
34	-2.4079	1.6715	0.2552	1.4162	2.7070	84.7305
35	-1.0498	0.8198	1.0578	-0.2381	-0.4470	29.0386
36	-1.0788	0.5188	1.0407	-0.5219	-0.9802	100.6003
37	0.1044	1.2296	1.7399	-0.5103	-0.9516	41.4980
38	-0.2614	1.4839	1.5238	-0.0399	-0.0745	2.6896
39	-1.1087	0.2700	1.0231	-0.7530	-1.4147	278.8729
40	-1.1087	1.9573	1.0231	0.9342	1.7551	47.7304
41	-2.6593	0.0862	0.1067	-0.0205	-0.0394	23.8222
42	-1.2040	-0.0305	0.9667	-0.9972	-1.8751	3273.8660
43	-1.4697	0.1044	0.8097	-0.7054	-1.3302	675.8839
44	-2.6593	0.0677	0.1067	-0.0390	-0.0750	57.7139
45	-3.2189	-0.7985	-0.2240	-0.5745	-1.1159	71.9467
46	1.3110	3.0204	2.4530	0.5674	1.0589	18.7856
47	2.1633	3.3776	2.9567	0.4209	0.7897	12.4613
48	1.9488	2.9232	2.8299	0.0933	0.1747	3.1905
49	3.3673	3.3214	3.6682	-0.3468	-0.6602	10.4405
50	1.8500	2.6101	2.7715	-0.1615	-0.3022	6.1868
51	2.7726	3.4012	3.3168	0.0844	0.1594	2.4828

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Residual Diagnostics Section

Row	lnVegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	3.4532	-0.3111	-0.5881	0.0678	0.0128	0.3001
11	2.8622	-0.3640	-0.6834	0.0517	0.0129	0.2992
13	1.4061	-0.3042	-0.5630	0.0279	0.0046	0.3004
14	2.6462	-0.4509	-0.8470	0.0467	0.0177	0.2973
15	-0.9943	1.3163	*2.6549	0.0379	0.1202	0.2555
16	-2.5257	0.2906	0.5516	0.0763	0.0128	0.3005
17	-0.8440	-0.3208	-0.5963	0.0355	0.0066	0.3001
18	-2.2073	0.0449	0.0844	0.0663	0.0003	0.3028
19	-0.4780	-0.7177	-1.3562	0.0306	0.0284	0.2889
20	0.4055	-0.4138	-0.7672	0.0246	0.0075	0.2983
21	-3.5066	0.6717	*1.3263	0.1141	0.1111	0.2895
22	2.6101	0.3231	0.6040	0.0459	0.0089	0.3000
23	0.7031	0.0776	0.1428	0.0244	0.0003	0.3027
24	2.5014	0.0422	0.0783	0.0437	0.0001	0.3028
25	2.7014	-0.0166	-0.0308	0.0479	0.0000	0.3029
26	3.3844	0.3070	0.5796	0.0657	0.0120	0.3002
27	3.2108	0.5562	1.0581	0.0607	0.0361	0.2942
28	2.0464	0.5813	1.0922	0.0355	0.0219	0.2937
29	3.3429	0.2603	0.4905	0.0645	0.0085	0.3010
30	2.1759	0.3168	0.5894	0.0376	0.0069	0.3001
31	2.2138	-0.2015	-0.3740	0.0383	0.0028	0.3018
32	1.6734	-0.5330	-0.9963	0.0305	0.0156	0.2952
33	2.4681	0.2374	0.4420	0.0430	0.0045	0.3013
34	-2.4079	1.4162	*2.9651	0.0725	0.2863	0.2460
35	-1.0498	-0.2381	-0.4423	0.0388	0.0040	0.3013
36	-1.0788	-0.5219	-0.9797	0.0394	0.0197	0.2954
37	0.1044	-0.5103	-0.9504	0.0257	0.0119	0.2958
38	-0.2614	-0.0399	-0.0736	0.0283	0.0001	0.3028
39	-1.1087	-0.7530	-1.4337	0.0399	0.0416	0.2873
40	-1.1087	0.9342	1.8052	0.0399	0.0640	0.2790
41	-2.6593	-0.0205	-0.0389	0.0809	0.0001	0.3029
42	-1.2040	-0.9972	-1.9405	0.0417	0.0765	0.2756
43	-1.4697	-0.7054	-1.3438	0.0472	0.0438	0.2891
44	-2.6593	-0.0390	-0.0740	0.0809	0.0002	0.3028
45	-3.2189	-0.5745	*-1.1196	0.1019	0.0707	0.2932
46	1.3110	0.5674	1.0606	0.0271	0.0156	0.2942
47	2.1633	0.4209	0.7858	0.0374	0.0121	0.2980
48	1.9488	0.0933	0.1725	0.0341	0.0005	0.3026
49	3.3673	-0.3468	-0.6554	0.0652	0.0152	0.2995
50	1.8500	-0.1615	-0.2987	0.0327	0.0015	0.3022
51	2.7726	0.0844	0.1574	0.0495	0.0007	0.3027

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.5881	-0.1586	0.0128	1.1096	-0.0575	-0.1268
11	-0.6834	-0.1595	0.0129	1.0839	-0.0743	-0.1159
13	-0.5630	-0.0953	0.0046	1.0657	-0.0768	-0.0336
14	-0.8470	-0.1875	0.0177	1.0644	-0.0956	-0.1296
15	* 2.6549	0.5269	0.1202	0.7790	0.4918	-0.3145
16	0.5516	0.1586	0.0128	1.1223	0.1216	-0.1308
17	-0.5963	-0.1143	0.0066	1.0719	-0.1085	0.0639
18	0.0844	0.0225	0.0003	1.1277	0.0180	-0.0179
19	-1.3562	-0.2408	0.0284	0.9885	-0.2363	0.1082
20	-0.7672	-0.1218	0.0075	1.0472	-0.1198	0.0109
21	1.3263	0.4759	0.1111	1.0861	0.3255	-0.4220
22	0.6040	0.1325	0.0089	1.0831	0.0686	0.0907
23	0.1428	0.0226	0.0003	1.0786	0.0214	0.0011
24	0.0783	0.0167	0.0001	1.1011	0.0091	0.0111
25	-0.0308	-0.0069	0.0000	1.1063	-0.0034	-0.0048
26	0.5796	0.1537	0.0120	1.1077	0.0574	0.1219
27	1.0581	0.2690	0.0361	1.0581	0.1082	0.2080
28	1.0922	0.2097	0.0219	1.0267	0.1356	0.1175
29	0.4905	0.1287	0.0085	1.1118	0.0489	0.1015
30	0.5894	0.1166	0.0069	1.0748	0.0718	0.0691
31	-0.3740	-0.0746	0.0028	1.0872	-0.0453	-0.0449
32	-0.9963	-0.1768	0.0156	1.0319	-0.1308	-0.0793
33	0.4420	0.0937	0.0045	1.0894	0.0514	0.0616
34	* 2.9651	0.8289	0.2863	0.7490	0.6449	-0.6752
35	-0.4423	-0.0889	0.0040	1.0847	-0.0825	0.0543
36	-0.9797	-0.1983	0.0197	1.0431	-0.1833	0.1223
37	-0.9504	-0.1543	0.0119	1.0315	-0.1542	0.0347
38	-0.0736	-0.0126	0.0001	1.0837	-0.0125	0.0047
39	-1.4337	-0.2923	0.0416	0.9874	-0.2691	0.1822
40	1.8052	0.3680	0.0640	0.9306	0.3389	-0.2294
41	-0.0389	-0.0115	0.0001	1.1459	-0.0087	0.0096
42	-1.9405	-0.4047	0.0765	0.9099	-0.3683	0.2606
43	-1.3438	-0.2989	0.0438	1.0074	-0.2630	0.2077
44	-0.0740	-0.0220	0.0002	1.1457	-0.0166	0.0183
45	-1.1196	-0.3772	0.0707	1.0992	-0.2663	0.3290
46	1.0606	0.1770	0.0156	1.0213	0.1467	0.0559
47	0.7858	0.1549	0.0121	1.0596	0.0959	0.0914
48	0.1725	0.0324	0.0005	1.0888	0.0217	0.0173
49	-0.6554	-0.1731	0.0152	1.1017	-0.0651	-0.1369
50	-0.2987	-0.0549	0.0015	1.0839	-0.0382	-0.0277
51	0.1574	0.0359	0.0007	1.1068	0.0174	0.0256

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Outlier Detection Chart

Row	lnVegetation (X)	Residual		Standardized Residual		RStudent	
10	3.4532	-0.3111	|||.....	-0.5931	|||.....	-0.5881	||.....
11	2.8622	-0.3640	|||.....	-0.6881	|||.....	-0.6834	|||.....
13	1.4061	-0.3042	|||.....	-0.5680	|||.....	-0.5630	||.....
14	2.6462	-0.4509	||||.....	-0.8501	||||.....	-0.8470	||||.....
15	-0.9943	1.3163	||||||||||||..	2.4702	||||||||||||..	* 2.6549	||||||||||||..
16	-2.5257	0.2906	||.....	0.5566	||.....	0.5516	||.....
17	-0.8440	-0.3208	|||.....	-0.6013	|||.....	-0.5963	||.....
18	-2.2073	0.0449	|.....	0.0855	|.....	0.0844	|.....
19	-0.4780	-0.7177	|||||||.....	-1.3418	|||||||.....	-1.3562	||||||.....
20	0.4055	-0.4138	||||.....	-0.7712	||||.....	-0.7672	|||.....
21	-3.5066	0.6717	|||||||.....	1.3136	|||||||.....	1.3263	||||||.....
22	2.6101	0.3231	|||.....	0.6090	|||.....	0.6040	||.....
23	0.7031	0.0776	|.....	0.1446	|.....	0.1428	|.....
24	2.5014	0.0422	|.....	0.0794	|.....	0.0783	|.....
25	2.7014	-0.0166	|.....	-0.0312	|.....	-0.0308	|.....
26	3.3844	0.3070	|||.....	0.5846	|||.....	0.5796	||.....
27	3.2108	0.5562	|||||.....	1.0564	|||||.....	1.0581	|||||.....
28	2.0464	0.5813	||||||.....	1.0895	|||||.....	1.0922	|||||.....
29	3.3429	0.2603	||.....	0.4953	||.....	0.4905	||.....
30	2.1759	0.3168	|||.....	0.5944	|||.....	0.5894	||.....
31	2.2138	-0.2015	|.....	-0.3782	|.....	-0.3740	|.....
32	1.6734	-0.5330	|||||.....	-0.9964	|||||.....	-0.9963	||||.....
33	2.4681	0.2374	||.....	0.4466	||.....	0.4420	||.....
34	-2.4079	1.4162	||||||||||||||	2.7070	||||||||||||||	* 2.9651	||||||||||||||
35	-1.0498	-0.2381	||.....	-0.4470	||.....	-0.4423	||.....
36	-1.0788	-0.5219	|||||.....	-0.9802	|||||.....	-0.9797	||||.....
37	0.1044	-0.5103	|||||.....	-0.9516	|||||.....	-0.9504	||||.....
38	-0.2614	-0.0399	|.....	-0.0745	|.....	-0.0736	|.....
39	-1.1087	-0.7530	|||||||.....	-1.4147	|||||||.....	-1.4337	|||||||.....
40	-1.1087	0.9342	||||||||.....	1.7551	||||||||.....	1.8052	||||||||.....
41	-2.6593	-0.0205	|.....	-0.0394	|.....	-0.0389	|.....
42	-1.2040	-0.9972	|||||||||.....	-1.8751	|||||||||.....	-1.9405	||||||||.....
43	-1.4697	-0.7054	|||||||.....	-1.3302	|||||||.....	-1.3438	||||||.....
44	-2.6593	-0.0390	|.....	-0.0750	|.....	-0.0740	|.....
45	-3.2189	-0.5745	|||||.....	-1.1159	||||||.....	-1.1196	|||||.....
46	1.3110	0.5674	|||||.....	1.0589	|||||.....	1.0606	|||||.....
47	2.1633	0.4209	||||.....	0.7897	||||.....	0.7858	|||.....
48	1.9488	0.0933	|.....	0.1747	|.....	0.1725	|.....
49	3.3673	-0.3468	|||.....	-0.6602	|||.....	-0.6554	|||.....
50	1.8500	-0.1615	|.....	-0.3022	|.....	-0.2987	|.....
51	2.7726	0.0844	|.....	0.1594	|.....	0.1574	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Influence Detection Chart

Row	lnVegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	3.4532	-0.1586	||.....	0.0128	|.....	-0.1268	||.....
11	2.8622	-0.1595	||.....	0.0129	|.....	-0.1159	||.....
13	1.4061	-0.0953	|.....	0.0046	|.....	-0.0336	|.....
14	2.6462	-0.1875	|||.....	0.0177	|.....	-0.1296	||.....
15	-0.9943	0.5269	|||||||||.....	0.1202	||||||.....	-0.3145	||||||.....
16	-2.5257	0.1586	||.....	0.0128	|.....	-0.1308	||.....
17	-0.8440	-0.1143	|.....	0.0066	|.....	0.0639	|.....
18	-2.2073	0.0225	|.....	0.0003	|.....	-0.0179	|.....
19	-0.4780	-0.2408	||||.....	0.0284	|.....	0.1082	||.....
20	0.4055	-0.1218	||.....	0.0075	|.....	0.0109	|.....
21	-3.5066	0.4759	||||||||.....	0.1111	|||||.....	-0.4220	|||||||||.....
22	2.6101	0.1325	||.....	0.0089	|.....	0.0907	|.....
23	0.7031	0.0226	|.....	0.0003	|.....	0.0011	|.....
24	2.5014	0.0167	|.....	0.0001	|.....	0.0111	|.....
25	2.7014	-0.0069	|.....	0.0000	|.....	-0.0048	|.....
26	3.3844	0.1537	||.....	0.0120	|.....	0.1219	||.....
27	3.2108	0.2690	||||.....	0.0361	|.....	0.2080	||||.....
28	2.0464	0.2097	|||.....	0.0219	|.....	0.1175	||.....
29	3.3429	0.1287	||.....	0.0085	|.....	0.1015	||.....
30	2.1759	0.1166	||.....	0.0069	|.....	0.0691	|.....
31	2.2138	-0.0746	|.....	0.0028	|.....	-0.0449	|.....
32	1.6734	-0.1768	|||.....	0.0156	|.....	-0.0793	|.....
33	2.4681	0.0937	|.....	0.0045	|.....	0.0616	|.....
34	-2.4079	0.8289	||||||||||||||||	0.2863	||||||||||||||||	-0.6752	||||||||||||||||
35	-1.0498	-0.0889	|.....	0.0040	|.....	0.0543	|.....
36	-1.0788	-0.1983	|||.....	0.0197	|.....	0.1223	||.....
37	0.1044	-0.1543	||.....	0.0119	|.....	0.0347	|.....
38	-0.2614	-0.0126	|.....	0.0001	|.....	0.0047	|.....
39	-1.1087	-0.2923	|||||.....	0.0416	||.....	0.1822	||||.....
40	-1.1087	0.3680	||||||.....	0.0640	|||.....	-0.2294	|||||.....
41	-2.6593	-0.0115	|.....	0.0001	|.....	0.0096	|.....
42	-1.2040	-0.4047	|||||||.....	0.0765	||||.....	0.2606	|||||.....
43	-1.4697	-0.2989	|||||.....	0.0438	||.....	0.2077	||||.....
44	-2.6593	-0.0220	|.....	0.0002	|.....	0.0183	|.....
45	-3.2189	-0.3772	||||||.....	0.0707	|||.....	0.3290	|||||||.....
46	1.3110	0.1770	|||.....	0.0156	|.....	0.0559	|.....
47	2.1633	0.1549	||.....	0.0121	|.....	0.0914	||.....
48	1.9488	0.0324	|.....	0.0005	|.....	0.0173	|.....
49	3.3673	-0.1731	|||.....	0.0152	|.....	-0.1369	|||.....
50	1.8500	-0.0549	|.....	0.0015	|.....	-0.0277	|.....
51	2.7726	0.0359	|.....	0.0007	|.....	0.0256	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Outlier & Influence Chart

Row	lnVegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	3.4532	-0.5881	||.....	0.0128	|.....	0.0678	|||||||.....
11	2.8622	-0.6834	|||.....	0.0129	|.....	0.0517	||||.....
13	1.4061	-0.5630	||.....	0.0046	|.....	0.0279	|.....
14	2.6462	-0.8470	||||.....	0.0177	|.....	0.0467	|||.....
15	-0.9943	* 2.6549	||||||||||||..	0.1202	||||||.....	0.0379	||.....
16	-2.5257	0.5516	||.....	0.0128	|.....	0.0763	||||||||.....
17	-0.8440	-0.5963	||.....	0.0066	|.....	0.0355	|.....
18	-2.2073	0.0844	|.....	0.0003	|.....	0.0663	||||||.....
19	-0.4780	-1.3562	||||||.....	0.0284	|.....	0.0306	|.....
20	0.4055	-0.7672	|||.....	0.0075	|.....	0.0246	|.....
21	-3.5066	1.3263	||||||.....	0.1111	|||||.....	0.1141	|||||||||||||||
22	2.6101	0.6040	||.....	0.0089	|.....	0.0459	|||.....
23	0.7031	0.1428	|.....	0.0003	|.....	0.0244	|.....
24	2.5014	0.0783	|.....	0.0001	|.....	0.0437	|||.....
25	2.7014	-0.0308	|.....	0.0000	|.....	0.0479	|||.....
26	3.3844	0.5796	||.....	0.0120	|.....	0.0657	||||||.....
27	3.2108	1.0581	|||||.....	0.0361	|.....	0.0607	||||||.....
28	2.0464	1.0922	|||||.....	0.0219	|.....	0.0355	|.....
29	3.3429	0.4905	||.....	0.0085	|.....	0.0645	||||||.....
30	2.1759	0.5894	||.....	0.0069	|.....	0.0376	||.....
31	2.2138	-0.3740	|.....	0.0028	|.....	0.0383	||.....
32	1.6734	-0.9963	||||.....	0.0156	|.....	0.0305	|.....
33	2.4681	0.4420	||.....	0.0045	|.....	0.0430	|||.....
34	-2.4079	* 2.9651	|||||||||||||||	0.2863	|||||||||||||||	0.0725	|||||||.....
35	-1.0498	-0.4423	||.....	0.0040	|.....	0.0388	||.....
36	-1.0788	-0.9797	||||.....	0.0197	|.....	0.0394	||.....
37	0.1044	-0.9504	||||.....	0.0119	|.....	0.0257	|.....
38	-0.2614	-0.0736	|.....	0.0001	|.....	0.0283	|.....
39	-1.1087	-1.4337	|||||||.....	0.0416	||.....	0.0399	||.....
40	-1.1087	1.8052	|||||||||.....	0.0640	|||.....	0.0399	||.....
41	-2.6593	-0.0389	|.....	0.0001	|.....	0.0809	|||||||||.....
42	-1.2040	-1.9405	|||||||||.....	0.0765	||||.....	0.0417	||.....
43	-1.4697	-1.3438	||||||.....	0.0438	||.....	0.0472	|||.....
44	-2.6593	-0.0740	|.....	0.0002	|.....	0.0809	|||||||||.....
45	-3.2189	-1.1196	|||||.....	0.0707	|||.....	0.1019	||||||||||||...
46	1.3110	1.0606	|||||.....	0.0156	|.....	0.0271	|.....
47	2.1633	0.7858	|||.....	0.0121	|.....	0.0374	||.....
48	1.9488	0.1725	|.....	0.0005	|.....	0.0341	|.....
49	3.3673	-0.6554	|||.....	0.0152	|.....	0.0652	||||||.....
50	1.8500	-0.2987	|.....	0.0015	|.....	0.0327	|.....
51	2.7726	0.1574	|.....	0.0007	|.....	0.0495	||||.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Inverse Prediction of X Means

Row	lnInvert (Y)	lnVegetation (X)	Predicted lnVegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.4078	3.4532	2.9267	0.5264	2.5352	3.4056
11	3.0057	2.8622	2.2462	0.6160	1.9060	2.6482
13	2.2050	1.4061	0.8913	0.5148	0.6009	1.1927
14	2.7912	2.6462	1.8832	0.7630	1.5646	2.2500
15	2.4069	-0.9943	1.2331	-2.2273	0.9390	1.5509
16	0.4762	-2.5257	-2.0340	-0.4918	-2.5504	-1.6162
17	0.8587	-0.8440	-1.3868	0.5429	-1.8255	-1.0226
18	0.4187	-2.2073	-2.1313	-0.0760	-2.6601	-1.7048
19	0.6780	-0.4780	-1.6925	1.2145	-2.1668	-1.3040
20	1.5041	0.4055	-0.2947	0.7002	-0.6295	0.0066
21	0.2776	-3.5066	-2.3700	-1.1365	-2.9298	-1.9215
22	3.5439	2.6101	3.1569	-0.5468	2.7456	3.6640
23	2.1713	0.7031	0.8344	-0.1313	0.5439	1.1337
24	3.1987	2.5014	2.5728	-0.0713	2.2094	3.0102
25	3.2581	2.7014	2.6733	0.0280	2.3022	3.1222
26	3.9853	3.3844	3.9038	-0.5194	3.4231	4.5084
27	4.1320	3.2108	4.1520	-0.9412	3.6468	4.7905
28	3.4689	2.0464	3.0300	-0.9836	2.6297	3.5214
29	3.9140	3.3429	3.7833	-0.4404	3.3142	4.3717
30	3.2809	2.1759	2.7119	-0.5361	2.3378	3.1653
31	2.7850	2.2138	1.8728	0.3409	1.5548	2.2386
32	2.1342	1.6734	0.7715	0.9019	0.4807	1.0688
33	3.3742	2.4681	2.8697	-0.4016	2.4829	3.3417
34	1.6715	-2.4079	-0.0115	-2.3965	-0.3279	0.2821
35	0.8198	-1.0498	-1.4526	0.4028	-1.8988	-1.0834
36	0.5188	-1.0788	-1.9620	0.8831	-2.4694	-1.5505
37	1.2296	0.1044	-0.7591	0.8635	-1.1325	-0.4366
38	1.4839	-0.2614	-0.3289	0.0675	-0.6662	-0.0264
39	0.2700	-1.1087	-2.3829	1.2742	-2.9444	-1.9332
40	1.9573	-1.1087	0.4722	-1.5808	0.1762	0.7634
41	0.0862	-2.6593	-2.6940	0.0347	-3.2969	-2.2145
42	-0.0305	-1.2040	-2.8914	1.6874	-3.5211	-2.3925
43	0.1044	-1.4697	-2.6632	1.1936	-3.2620	-2.1867
44	0.0677	-2.6593	-2.7253	0.0661	-3.3325	-2.2428
45	-0.7985	-3.2189	-4.1910	0.9721	-5.0046	-3.5570
46	3.0204	1.3110	2.2712	-0.9601	1.9293	2.6758
47	3.3776	2.1633	2.8755	-0.7122	2.4882	3.3482
48	2.9232	1.9488	2.1066	-0.1578	1.7752	2.4945
49	3.3214	3.3673	2.7805	0.5868	2.4009	3.2419
50	2.6101	1.8500	1.5768	0.2732	1.2724	1.9179
51	3.4012	2.7726	2.9155	-0.1429	2.5249	3.3929

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnInvert X = lnVegetation

Inverse Prediction of X Individuals

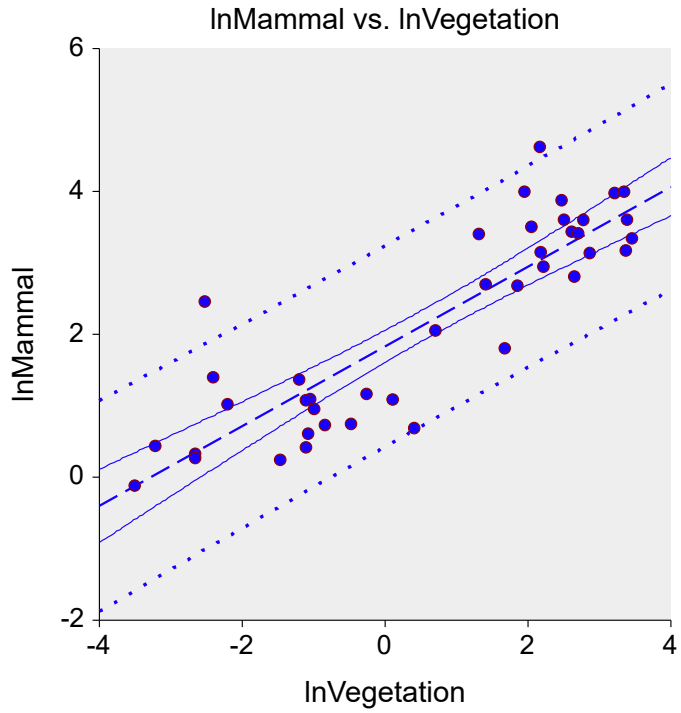
Row	lnInvert (Y)	lnVegetation (X)	Predicted lnVegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.4078	3.4532	2.9267	0.5264	1.0439	4.8968
11	3.0057	2.8622	2.2462	0.6160	0.3641	4.1901
13	2.2050	1.4061	0.8913	0.5148	-1.0031	2.7967
14	2.7912	2.6462	1.8832	0.7630	-0.0004	3.8150
15	2.4069	-0.9943	1.2331	-2.2273	-0.6565	3.1464
16	0.4762	-2.5257	-2.0340	-0.4918	-4.0173	-0.1494
17	0.8587	-0.8440	-1.3868	0.5429	-3.3432	0.4951
18	0.4187	-2.2073	-2.1313	-0.0760	-4.1190	-0.2459
19	0.6780	-0.4780	-1.6925	1.2145	-3.6611	0.1902
20	1.5041	0.4055	-0.2947	0.7002	-2.2149	1.5920
21	0.2776	-3.5066	-2.3700	-1.1365	-4.3689	-0.4824
22	3.5439	2.6101	3.1569	-0.5468	1.2728	5.1369
23	2.1713	0.7031	0.8344	-0.1313	-1.0609	2.7385
24	3.1987	2.5014	2.5728	-0.0713	0.6909	4.5287
25	3.2581	2.7014	2.6733	0.0280	0.7913	4.6332
26	3.9853	3.3844	3.9038	-0.5194	2.0122	5.9193
27	4.1320	3.2108	4.1520	-0.9412	2.2568	6.1805
28	3.4689	2.0464	3.0300	-0.9836	1.1466	5.0045
29	3.9140	3.3429	3.7833	-0.4404	1.8932	5.7927
30	3.2809	2.1759	2.7119	-0.5361	0.8298	4.6733
31	2.7850	2.2138	1.8728	0.3409	-0.0109	3.8043
32	2.1342	1.6734	0.7715	0.9019	-1.1249	2.6743
33	3.3742	2.4681	2.8697	-0.4016	0.9871	4.8375
34	1.6715	-2.4079	-0.0115	-2.3965	-1.9242	1.8784
35	0.8198	-1.0498	-1.4526	0.4028	-3.4115	0.4294
36	0.5188	-1.0788	-1.9620	0.8831	-3.9420	-0.0778
37	1.2296	0.1044	-0.7591	0.8635	-2.6932	1.1241
38	1.4839	-0.2614	-0.3289	0.0675	-2.2500	1.5575
39	0.2700	-1.1087	-2.3829	1.2742	-4.3824	-0.4952
40	1.9573	-1.1087	0.4722	-1.5808	-1.4297	2.3693
41	0.0862	-2.6593	-2.6940	0.0347	-4.7089	-0.8025
42	-0.0305	-1.2040	-2.8914	1.6874	-4.9165	-0.9971
43	0.1044	-1.4697	-2.6632	1.1936	-4.6765	-0.7722
44	0.0677	-2.6593	-2.7253	0.0661	-4.7418	-0.8335
45	-0.7985	-3.2189	-4.1910	0.9721	-6.2922	-2.2693
46	3.0204	1.3110	2.2712	-0.9601	0.3891	4.2160
47	3.3776	2.1633	2.8755	-0.7122	0.9929	4.8435
48	2.9232	1.9488	2.1066	-0.1578	0.2240	4.0457
49	3.3214	3.3673	2.7805	0.5868	0.8982	4.7446
50	2.6101	1.8500	1.5768	0.2732	-0.3091	3.4994
51	3.4012	2.7726	2.9155	-0.1429	1.0327	4.8851

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Linear Regression Plot Section



Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	lnMammal	Rows Processed	58
Independent Variable	lnVegetation	Rows Used in Estimation	41
Frequency Variable	None	Rows with X Missing	0
Weight Variable	None	Rows with Freq Missing	0
Intercept	1.8329	Rows Prediction Only	0
Slope	0.5580	Sum of Frequencies	41
R-Squared	0.7613	Sum of Weights	41.0000
Correlation	0.8725	Coefficient of Variation	0.3165
Mean Square Error	0.4704242	Square Root of MSE	0.6858748

Linear Regression Report

Y = lnMammal X = lnVegetation

Summary Statement

The equation of the straight line relating lnMammal and lnVegetation is estimated as: lnMammal = (1.8329) + (0.5580) lnVegetation using the 41 observations in this dataset. The y-intercept, the estimated value of lnMammal when lnVegetation is zero, is 1.8329 with a standard error of 0.1112. The slope, the estimated change in lnMammal per unit change in lnVegetation, is 0.5580 with a standard error of 0.0500. The value of R-Squared, the proportion of the variation in lnMammal that can be accounted for by variation in lnVegetation, is 0.7613. The correlation between lnMammal and lnVegetation is 0.8725.

A significance test that the slope is zero resulted in a t-value of 11.1536. The significance level of this t-test is 0.0000. Since 0.0000 < 0.0500, the hypothesis that the slope is zero is rejected.

The estimated slope is 0.5580. The lower limit of the 95% confidence interval for the slope is 0.4568 and the upper limit is 0.6592. The estimated intercept is 1.8329. The lower limit of the 95% confidence interval for the intercept is 1.6079 and the upper limit is 2.0579.

Descriptive Statistics Section

Parameter	Dependent	Independent
Variable	lnMammal	lnVegetation
Count	41	41
Mean	2.1669	0.5985
Standard Deviation	1.3863	2.1675
Minimum	-0.1165	-3.5066
Maximum	4.6240	3.4532

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Regression Estimation Section

Parameter	**Intercept B(0)**	**Slope B(1)**
Regression Coefficients	1.8329	0.5580
Lower 95% Confidence Limit	1.6079	0.4568
Upper 95% Confidence Limit	2.0579	0.6592
Standard Error	0.1112	0.0500
Standardized Coefficient	0.0000	0.8725
T Value	16.4795	11.1536
Prob Level (T Test)	0.0000	0.0000
Prob Level (Randomization Test N =1000)		0.0010
Reject H0 (Alpha = 0.0500)	Yes	Yes
Power (Alpha = 0.0500)	1.0000	1.0000
Regression of Y on X	1.8329	0.5580
Inverse Regression from X on Y	1.7282	0.7330
Orthogonal Regression of Y and X	1.8066	0.6020

Notes:
The above report shows the least-squares estimates of the intercept and slope followed by the corresponding standard errors, confidence intervals, and hypothesis tests. Note that these results are based on several assumptions that should be validated before they are used.

Estimated Model
(1.83289957235926) + (0.558043604714138) * (lnVegetation)

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Bootstrap Section

---------- Estimation Results----------		---------- Bootstrap Confidence Limits----------		
Parameter	**Estimate**	**Conf. Level**	**Lower**	**Upper**
Intercept				
Original Value	1.8329	0.9000	1.6403	2.0257
Bootstrap Mean	1.8291	0.9500	1.5994	2.0631
Bias (BM - OV)	-0.0038	0.9900	1.5070	2.1355
Bias Corrected	1.8367			
Standard Error	0.1173			
Slope				
Original Value	0.5580	0.9000	0.4751	0.6374
Bootstrap Mean	0.5606	0.9500	0.4607	0.6564
Bias (BM - OV)	0.0026	0.9900	0.4191	0.6857
Bias Corrected	0.5554			
Standard Error	0.0492			
Correlation				
Original Value	0.8725	0.9000	0.8147	0.9443
Bootstrap Mean	0.8735	0.9500	0.8078	0.9586
Bias (BM - OV)	0.0010	0.9900	0.7944	0.9929
Bias Corrected	0.8716			
Standard Error	0.0394			
R-Squared				
Original Value	0.7613	0.9000	0.6571	0.8814
Bootstrap Mean	0.7645	0.9500	0.6442	0.9041
Bias (BM - OV)	0.0032	0.9900	0.6188	0.9569
Bias Corrected	0.7581			
Standard Error	0.0680			
Standard Error of Estimate				
Original Value	0.6859	0.9000	0.5590	0.8652
Bootstrap Mean	0.6628	0.9500	0.5316	0.8937
Bias (BM - OV)	-0.0231	0.9900	0.4842	0.9352
Bias Corrected	0.7090			
Standard Error	0.0930			
Orthogonal Intercept				
Original Value	1.8066	0.9000	1.6143	2.0026
Bootstrap Mean	1.8027	0.9500	1.5723	2.0441
Bias (BM - OV)	-0.0038	0.9900	1.4933	2.1071
Bias Corrected	1.8104			
Standard Error	0.1179			
Orthogonal Slope				
Original Value	0.6020	0.9000	0.5125	0.6827
Bootstrap Mean	0.6046	0.9500	0.4938	0.6985
Bias (BM - OV)	0.0025	0.9900	0.4484	0.7306
Bias Corrected	0.5995			
Standard Error	0.0519			

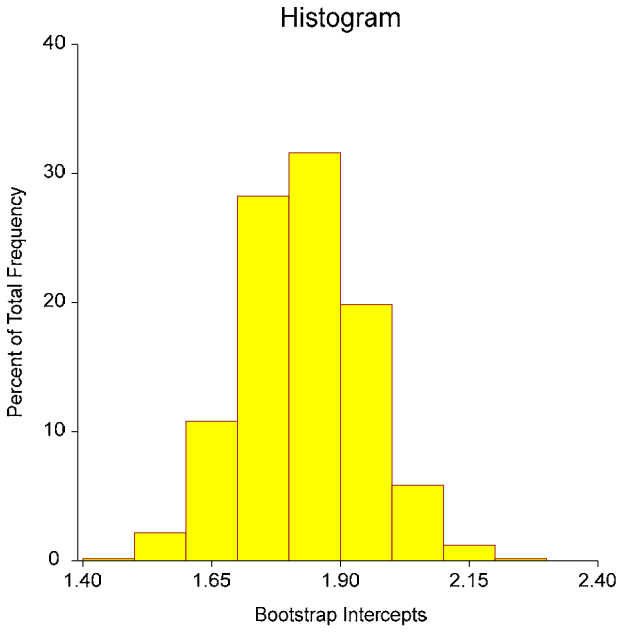
Sampling Method = Observation, Confidence Limit Type = Reflection, Number of Samples = 3000.

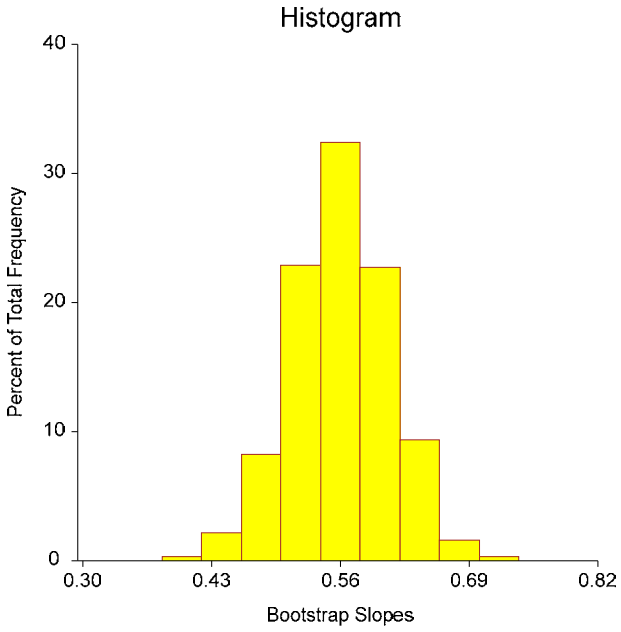
Notes:
The main purpose of this report is to present the bootstrap confidence intervals of various parameters. All gross outliers should have been removed. The sample size should be at least 50 and the sample should be 'representative' of the population it was drawn from.

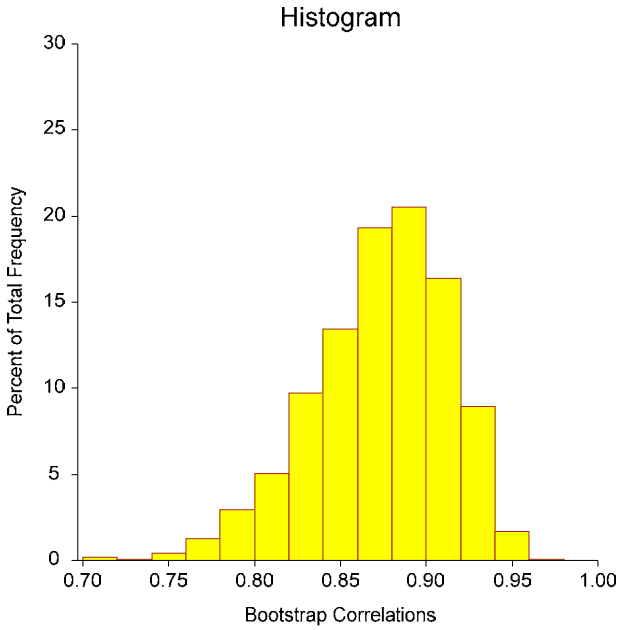
Linear Regression Report

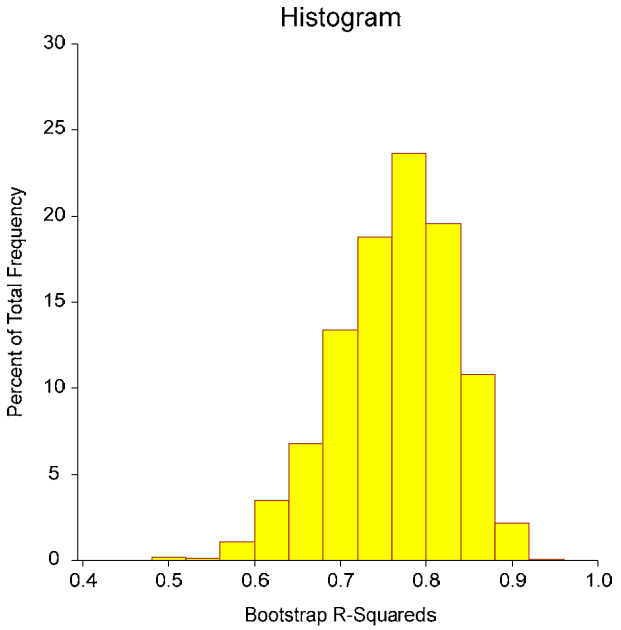
Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Bootstrap Histograms Section



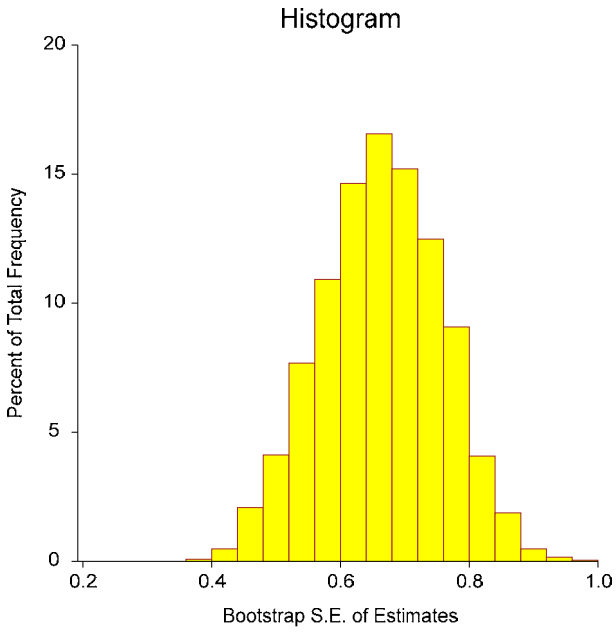


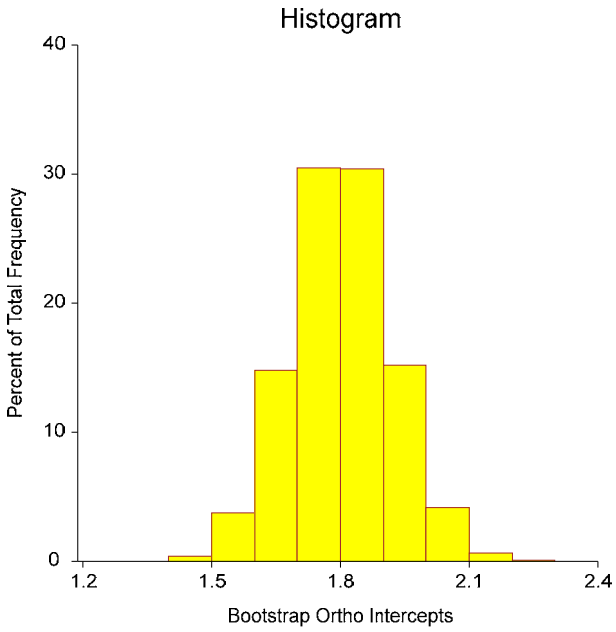


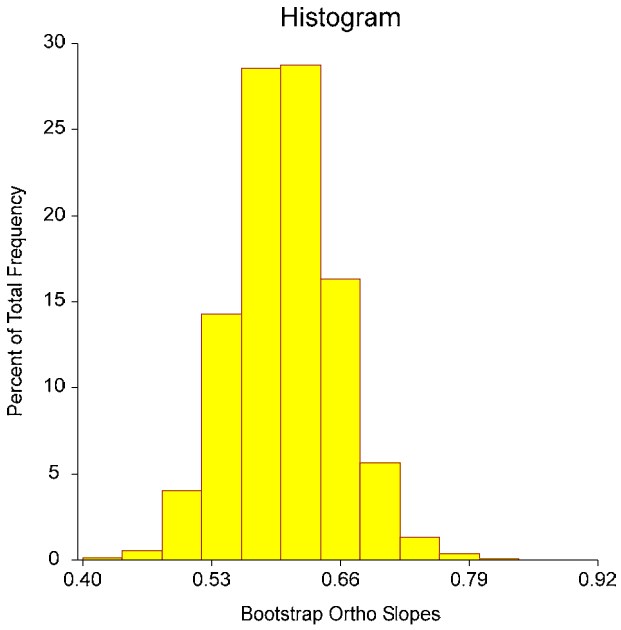


Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Correlation and R-Squared Section

Parameter	Pearson Correlation Coefficient	R-Squared	Spearman Rank Correlation Coefficient
Estimated Value	0.8725	0.7613	0.8290
Lower 95% Conf. Limit (r dist'n)	0.7683		
Upper 95% Conf. Limit (r dist'n)	0.9286		
Lower 95% Conf. Limit (Fisher's z)	0.7722		0.6999
Upper 95% Conf. Limit (Fisher's z)	0.9304		0.9057
Adjusted (Rbar)		0.7552	
T-Value for H0: Rho = 0	11.1536	11.1536	9.2583
Prob Level for H0: Rho = 0	0.0000	0.0000	0.0000
Prob Level (Randomization Test N =1000)	0.0010		

Notes:
The confidence interval for the Pearson correlation assumes that X and Y follow the bivariate normal distribution. This is a different assumption from linear regression which assumes that X is fixed and Y is normally distributed.

Two confidence intervals are given. The first is based on the exact distribution of Pearson's correlation. The second is based on Fisher's z transformation which approximates the exact distribution using the normal distribution. Why are both provided? Because most books only mention Fisher's approximate method, it will often be needed to do homework. However, the exact methods should be used whenever possible.

The confidence limits can be used to test hypotheses about the correlation. To test the hypothesis that rho is a specific value, say r0, check to see if r0 is between the confidence limits. If it is, the null hypothesis that rho = r0 is not rejected. If r0 is outside the limits, the null hypothesis is rejected.

Spearman's Rank correlation is calculated by replacing the orginal data with their ranks. This correlation is used when some of the assumptions may be invalid.

Analysis of Variance Section

Source	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1	192.5151	192.5151			
Slope	1	58.52184	58.52184	124.4023	0.0000	1.0000
Error	39	18.34654	0.4704242			
Lack of Fit	37	18.12719	0.4899239	4.4669	0.1995	
Pure Error	2	0.2193584	0.1096792			
Adj. Total	40	76.86839	1.92171			
Total	41	269.3835				

s = Square Root(0.4704242) = 0.6858748

Notes:
The above report shows the F-Ratio for testing whether the slope is zero, the degrees of freedom, and the mean square error. The mean square error, which estimates the variance of the residuals, is used extensively in the calculation of hypothesis tests and confidence intervals.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Summary Matrices

Index	X'X 0	X'X 1	X'Y 2	X'X Inverse 0	X'X Inverse 1
0	41	24.53991	88.84322	0.02629657	-0.003184985
1	24.53991	202.6118	158.0454	-0.003184985	0.005321307
2 (Y'Y)			269.3835		
Determinant		7704.875			0.000129788

Variance - Covariance Matrix of Regression Coefficients

Index	VC(b) 0	VC(b) 1
0	0.01237054	-0.001498294
1	-0.001498294	0.002503271

Tests of Assumptions Section

Assumption/Test	Test Value	Prob Level	Is the Assumption Reasonable at the 0.2000 Level of Significance?
Residuals follow Normal Distribution?			
Shapiro Wilk	0.9623	0.189822	No
Anderson Darling	0.4418	0.288827	Yes
D'Agostino Skewness	2.0614	0.039262	No
D'Agostino Kurtosis	1.6157	0.106165	No
D'Agostino Omnibus	6.8599	0.032389	No
Constant Residual Variance?			
Modified Levene Test	0.7878	0.380222	Yes
Relationship is a Straight Line?			
Lack of Linear Fit F(37, 2) Test	4.4669	0.199506	No

No Serial Correlation?
Evaluate the Serial-Correlation report and the Durbin-Watson test if you have equal-spaced, time series data.

Notes:
A 'Yes' means there is not enough evidence to make this assumption seem unreasonable. This lack of evidence may be because the sample size is too small, the assumptions of the test itself are not met, or the assumption is valid.
A 'No' means the that the assumption is not reasonable. However, since these tests are related to sample size, you should assess the role of sample size in the tests by also evaluating the appropriate plots and graphs. A large dataset (say N > 500) will often fail at least one of the normality tests because it is hard to find a large dataset that is perfectly normal.

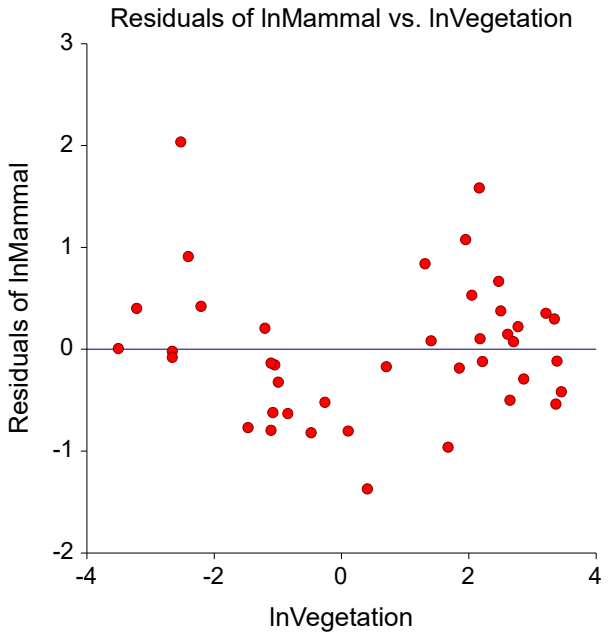
Normality and Constant Residual Variance:
Possible remedies for the failure of these assumptions include using a transformation of Y such as the log or square root, correcting data-recording errors found by looking into outliers, adding additional independent variables, using robust regression, or using bootstrap methods.

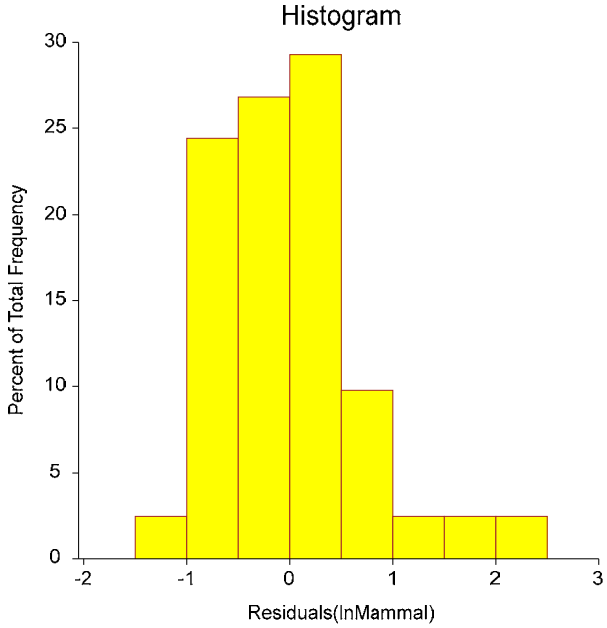
Straight-Line:
Possible remedies for the failure of this assumption include using nonlinear regression or polynomial regression.

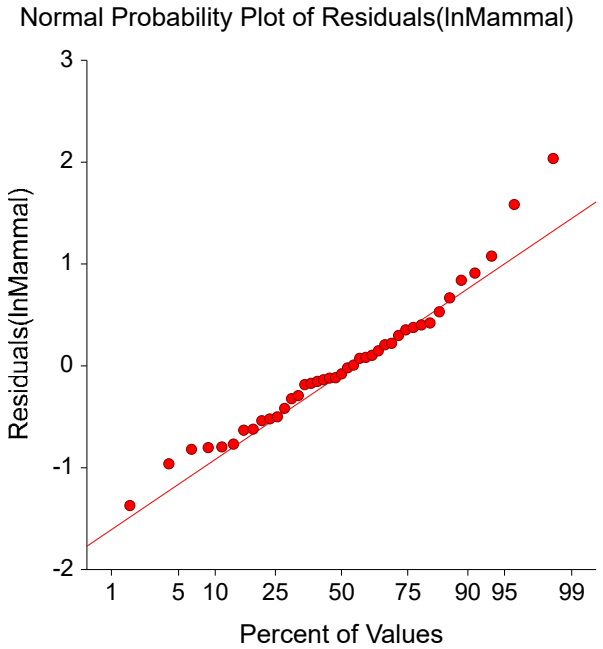
Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Residual Plots Section







Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Original Data Section

Row	lnVegetation (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual
10	3.4532	3.3429	3.7599	-0.4171
11	2.8622	3.1384	3.4301	-0.2917
13	1.4061	2.7007	2.6176	0.0831
14	2.6462	2.8094	3.3096	-0.5002
15	-0.9943	0.9555	1.2781	-0.3226
16	-2.5257	2.4592	0.4234	2.0357
17	-0.8440	0.7308	1.3619	-0.6312
18	-2.2073	1.0225	0.6011	0.4213
19	-0.4780	0.7467	1.5661	-0.8194
20	0.4055	0.6881	2.0592	-1.3710
21	-3.5066	-0.1165	-0.1239	0.0074
22	2.6101	3.4372	3.2894	0.1478
23	0.7031	2.0541	2.2253	-0.1711
24	2.5014	3.6055	3.2288	0.3767
25	2.7014	3.4144	3.3404	0.0741
26	3.3844	3.6055	3.7215	-0.1160
27	3.2108	3.9782	3.6247	0.3536
28	2.0464	3.5056	2.9749	0.5307
29	3.3429	3.9964	3.6984	0.2980
30	2.1759	3.1506	3.0471	0.1035
31	2.2138	2.9481	3.0683	-0.1202
32	1.6734	1.8050	2.7667	-0.9617
33	2.4681	3.8774	3.2102	0.6672
34	-2.4079	1.3995	0.4892	0.9104
35	-1.0498	1.0942	1.2471	-0.1529
36	-1.0788	0.6098	1.2309	-0.6211
37	0.1044	1.0886	1.8911	-0.8026
38	-0.2614	1.1663	1.6870	-0.5208
39	-1.1087	1.0784	1.2142	-0.1358
40	-1.1087	0.4187	1.2142	-0.7955
41	-2.6593	0.3293	0.3489	-0.0196
42	-1.2040	1.3678	1.1610	0.2068
43	-1.4697	0.2443	1.0128	-0.7685
44	-2.6593	0.2700	0.3489	-0.0789
45	-3.2189	0.4383	0.0366	0.4016
46	1.3110	3.4045	2.5645	0.8400
47	2.1633	4.6240	3.0401	1.5839
48	1.9488	3.9973	2.9204	1.0769
49	3.3673	3.1739	3.7120	-0.5381
50	1.8500	2.6810	2.8653	-0.1843
51	2.7726	3.6019	3.3801	0.2217

This report provides a data list that may be used to verify whether the correct variables were selected.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Predicted Values and Confidence Limits of Means

Row	lnVegetation (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Limit of Y Mean|X	Upper 95% Conf. Limit of Y Mean|X
10	3.4532	3.3429	3.7599	0.1785	3.3988	4.1210
11	2.8622	3.1384	3.4301	0.1559	3.1148	3.7454
13	1.4061	2.7007	2.6176	0.1145	2.3860	2.8491
14	2.6462	2.8094	3.3096	0.1482	3.0098	3.6094
15	-0.9943	0.9555	1.2781	0.1335	1.0080	1.5481
16	-2.5257	2.4592	0.4234	0.1895	0.0401	0.8067
17	-0.8440	0.7308	1.3619	0.1292	1.1007	1.6232
18	-2.2073	1.0225	0.6011	0.1766	0.2440	0.9583
19	-0.4780	0.7467	1.5661	0.1199	1.3236	1.8086
20	0.4055	0.6881	2.0592	0.1076	1.8416	2.2767
21	-3.5066	-0.1165	-0.1239	0.2316	-0.5925	0.3446
22	2.6101	3.4372	3.2894	0.1470	2.9921	3.5867
23	0.7031	2.0541	2.2253	0.1072	2.0083	2.4422
24	2.5014	3.6055	3.2288	0.1433	2.9389	3.5187
25	2.7014	3.4144	3.3404	0.1501	3.0367	3.6441
26	3.3844	3.6055	3.7215	0.1758	3.3660	4.0771
27	3.2108	3.9782	3.6247	0.1690	3.2829	3.9665
28	2.0464	3.5056	2.9749	0.1293	2.7133	3.2364
29	3.3429	3.9964	3.6984	0.1741	3.3461	4.0506
30	2.1759	3.1506	3.0471	0.1330	2.7780	3.3163
31	2.2138	2.9481	3.0683	0.1342	2.7969	3.3397
32	1.6734	1.8050	2.7667	0.1199	2.5243	3.0091
33	2.4681	3.8774	3.2102	0.1422	2.9226	3.4979
34	-2.4079	1.3995	0.4892	0.1847	0.1156	0.8627
35	-1.0498	1.0942	1.2471	0.1352	0.9736	1.5205
36	-1.0788	0.6098	1.2309	0.1361	0.9556	1.5061
37	0.1044	1.0886	1.8911	0.1099	1.6688	2.1135
38	-0.2614	1.1663	1.6870	0.1154	1.4536	1.9205
39	-1.1087	1.0784	1.2142	0.1370	0.9371	1.4913
40	-1.1087	0.4187	1.2142	0.1370	0.9371	1.4913
41	-2.6593	0.3293	0.3489	0.1950	-0.0456	0.7434
42	-1.2040	1.3678	1.1610	0.1400	0.8778	1.4443
43	-1.4697	0.2443	1.0128	0.1489	0.7115	1.3140
44	-2.6593	0.2700	0.3489	0.1950	-0.0456	0.7434
45	-3.2189	0.4383	0.0366	0.2190	-0.4063	0.4796
46	1.3110	3.4045	2.5645	0.1129	2.3362	2.7929
47	2.1633	4.6240	3.0401	0.1327	2.7718	3.3085
48	1.9488	3.9973	2.9204	0.1266	2.6642	3.1765
49	3.3673	3.1739	3.7120	0.1751	3.3578	4.0662
50	1.8500	2.6810	2.8653	0.1241	2.6143	3.1163
51	2.7726	3.6019	3.3801	0.1527	3.0713	3.6889

The confidence interval estimates the mean of the Y values in a large sample of individuals with this value of X. The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Predicted Values and Prediction Limits

Row	lnVegetation (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Prediction Limit of Y|X	Upper 95% Prediction Limit of Y|X
10	3.4532	3.3429	3.7599	0.7087	2.3264	5.1935
11	2.8622	3.1384	3.4301	0.7034	2.0074	4.8528
13	1.4061	2.7007	2.6176	0.6954	1.2111	4.0241
14	2.6462	2.8094	3.3096	0.7017	1.8902	4.7289
15	-0.9943	0.9555	1.2781	0.6987	-0.1353	2.6914
16	-2.5257	2.4592	0.4234	0.7116	-1.0159	1.8627
17	-0.8440	0.7308	1.3619	0.6979	-0.0498	2.7736
18	-2.2073	1.0225	0.6011	0.7082	-0.8314	2.0337
19	-0.4780	0.7467	1.5661	0.6963	0.1578	2.9745
20	0.4055	0.6881	2.0592	0.6943	0.6549	3.4634
21	-3.5066	-0.1165	-0.1239	0.7239	-1.5882	1.3404
22	2.6101	3.4372	3.2894	0.7014	1.8706	4.7082
23	0.7031	2.0541	2.2253	0.6942	0.8211	3.6294
24	2.5014	3.6055	3.2288	0.7007	1.8115	4.6461
25	2.7014	3.4144	3.3404	0.7021	1.9202	4.7605
26	3.3844	3.6055	3.7215	0.7080	2.2894	5.1537
27	3.2108	3.9782	3.6247	0.7064	2.1959	5.0535
28	2.0464	3.5056	2.9749	0.6980	1.5631	4.3866
29	3.3429	3.9964	3.6984	0.7076	2.2670	5.1297
30	2.1759	3.1506	3.0471	0.6987	1.6340	4.4603
31	2.2138	2.9481	3.0683	0.6989	1.6547	4.4819
32	1.6734	1.8050	2.7667	0.6963	1.3584	4.1750
33	2.4681	3.8774	3.2102	0.7005	1.7934	4.6270
34	-2.4079	1.3995	0.4892	0.7103	-0.9476	1.9259
35	-1.0498	1.0942	1.2471	0.6991	-0.1670	2.6611
36	-1.0788	0.6098	1.2309	0.6992	-0.1835	2.6452
37	0.1044	1.0886	1.8911	0.6946	0.4861	3.2962
38	-0.2614	1.1663	1.6870	0.6955	0.2802	3.0939
39	-1.1087	1.0784	1.2142	0.6994	-0.2005	2.6289
40	-1.1087	0.4187	1.2142	0.6994	-0.2005	2.6289
41	-2.6593	0.3293	0.3489	0.7131	-1.0934	1.7912
42	-1.2040	1.3678	1.1610	0.7000	-0.2549	2.5770
43	-1.4697	0.2443	1.0128	0.7019	-0.4069	2.4324
44	-2.6593	0.2700	0.3489	0.7131	-1.0934	1.7912
45	-3.2189	0.4383	0.0366	0.7200	-1.4197	1.4929
46	1.3110	3.4045	2.5645	0.6951	1.1585	3.9705
47	2.1633	4.6240	3.0401	0.6986	1.6271	4.4532
48	1.9488	3.9973	2.9204	0.6975	1.5096	4.3312
49	3.3673	3.1739	3.7120	0.7079	2.2802	5.1438
50	1.8500	2.6810	2.8653	0.6970	1.4555	4.2751
51	2.7726	3.6019	3.3801	0.7027	1.9589	4.8014

The prediction interval estimates the predicted value of Y for a single individual with this value of X.
The interval is only accurate if all of the linear regression assumptions are valid.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Working-Hotelling Simultaneous Confidence Band

Row	lnVegetation (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Standard Error of Yhat	Lower 95% Conf. Band of Y Mean|X	Upper 95% Conf. Band of Y Mean|X
10	3.4532	3.3429	3.7599	0.1785	3.2511	4.2687
11	2.8622	3.1384	3.4301	0.1559	2.9859	3.8744
13	1.4061	2.7007	2.6176	0.1145	2.2913	2.9438
14	2.6462	2.8094	3.3096	0.1482	2.8872	3.7320
15	-0.9943	0.9555	1.2781	0.1335	0.8976	1.6585
16	-2.5257	2.4592	0.4234	0.1895	-0.1166	0.9635
17	-0.8440	0.7308	1.3619	0.1292	0.9938	1.7300
18	-2.2073	1.0225	0.6011	0.1766	0.0979	1.1044
19	-0.4780	0.7467	1.5661	0.1199	1.2244	1.9078
20	0.4055	0.6881	2.0592	0.1076	1.7527	2.3657
21	-3.5066	-0.1165	-0.1239	0.2316	-0.7841	0.5362
22	2.6101	3.4372	3.2894	0.1470	2.8706	3.7083
23	0.7031	2.0541	2.2253	0.1072	1.9196	2.5309
24	2.5014	3.6055	3.2288	0.1433	2.8204	3.6372
25	2.7014	3.4144	3.3404	0.1501	2.9125	3.7683
26	3.3844	3.6055	3.7215	0.1758	3.2206	4.2225
27	3.2108	3.9782	3.6247	0.1690	3.1431	4.1063
28	2.0464	3.5056	2.9749	0.1293	2.6064	3.3434
29	3.3429	3.9964	3.6984	0.1741	3.2021	4.1947
30	2.1759	3.1506	3.0471	0.1330	2.6680	3.4263
31	2.2138	2.9481	3.0683	0.1342	2.6859	3.4507
32	1.6734	1.8050	2.7667	0.1199	2.4251	3.1083
33	2.4681	3.8774	3.2102	0.1422	2.8049	3.6155
34	-2.4079	1.3995	0.4892	0.1847	-0.0371	1.0154
35	-1.0498	1.0942	1.2471	0.1352	0.8618	1.6323
36	-1.0788	0.6098	1.2309	0.1361	0.8431	1.6187
37	0.1044	1.0886	1.8911	0.1099	1.5778	2.2044
38	-0.2614	1.1663	1.6870	0.1154	1.3581	2.0160
39	-1.1087	1.0784	1.2142	0.1370	0.8238	1.6047
40	-1.1087	0.4187	1.2142	0.1370	0.8238	1.6047
41	-2.6593	0.3293	0.3489	0.1950	-0.2069	0.9048
42	-1.2040	1.3678	1.1610	0.1400	0.7620	1.5601
43	-1.4697	0.2443	1.0128	0.1489	0.5883	1.4372
44	-2.6593	0.2700	0.3489	0.1950	-0.2069	0.9048
45	-3.2189	0.4383	0.0366	0.2190	-0.5874	0.6607
46	1.3110	3.4045	2.5645	0.1129	2.2428	2.8862
47	2.1633	4.6240	3.0401	0.1327	2.6620	3.4182
48	1.9488	3.9973	2.9204	0.1266	2.5595	3.2813
49	3.3673	3.1739	3.7120	0.1751	3.2130	4.2110
50	1.8500	2.6810	2.8653	0.1241	2.5117	3.2189
51	2.7726	3.6019	3.3801	0.1527	2.9451	3.8152

This is a confidence band for the regression line for all possible values of X from -infinity to + infinity. The confidence coefficient is the proportion of time that this procedure yields a band the includes the true regression line when a large number of samples are taken using the same X values as in this sample.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Residual Section

Row	lnVegetation (X)	lnMammal (Y)	Predicted lnMammal (Yhat|X)	Residual	Standardized Residual	Percent Absolute Error
10	3.4532	3.3429	3.7599	-0.4171	-0.6298	12.4758
11	2.8622	3.1384	3.4301	-0.2917	-0.4368	9.2960
13	1.4061	2.7007	2.6176	0.0831	0.1229	3.0780
14	2.6462	2.8094	3.3096	-0.5002	-0.7469	17.8037
15	-0.9943	0.9555	1.2781	-0.3226	-0.4794	33.7570
16	-2.5257	2.4592	0.4234	2.0357	3.0883	82.7814
17	-0.8440	0.7308	1.3619	-0.6312	-0.9370	86.3703
18	-2.2073	1.0225	0.6011	0.4213	0.6357	41.2056
19	-0.4780	0.7467	1.5661	-0.8194	-1.2134	109.7442
20	0.4055	0.6881	2.0592	-1.3710	-2.0240	199.2389
21	-3.5066	-0.1165	-0.1239	0.0074	0.0114	6.3319
22	2.6101	3.4372	3.2894	0.1478	0.2206	4.2993
23	0.7031	2.0541	2.2253	-0.1711	-0.2526	8.3313
24	2.5014	3.6055	3.2288	0.3767	0.5616	10.4476
25	2.7014	3.4144	3.3404	0.0741	0.1107	2.1692
26	3.3844	3.6055	3.7215	-0.1160	-0.1750	3.2184
27	3.2108	3.9782	3.6247	0.3536	0.5319	8.8873
28	2.0464	3.5056	2.9749	0.5307	0.7879	15.1381
29	3.3429	3.9964	3.6984	0.2980	0.4492	7.4568
30	2.1759	3.1506	3.0471	0.1035	0.1538	3.2837
31	2.2138	2.9481	3.0683	-0.1202	-0.1786	4.0756
32	1.6734	1.8050	2.7667	-0.9617	-1.4241	53.2795
33	2.4681	3.8774	3.2102	0.6672	0.9944	17.2079
34	-2.4079	1.3995	0.4892	0.9104	1.3782	65.0484
35	-1.0498	1.0942	1.2471	-0.1529	-0.2274	13.9738
36	-1.0788	0.6098	1.2309	-0.6211	-0.9239	101.8606
37	0.1044	1.0886	1.8911	-0.8026	-1.1855	73.7280
38	-0.2614	1.1663	1.6870	-0.5208	-0.7703	44.6531
39	-1.1087	1.0784	1.2142	-0.1358	-0.2021	12.5934
40	-1.1087	0.4187	1.2142	-0.7955	-1.1837	189.9899
41	-2.6593	0.3293	0.3489	-0.0196	-0.0298	5.9558
42	-1.2040	1.3678	1.1610	0.2068	0.3079	15.1164
43	-1.4697	0.2443	1.0128	-0.7685	-1.1479	314.6350
44	-2.6593	0.2700	0.3489	-0.0789	-0.1200	29.2154
45	-3.2189	0.4383	0.0366	0.4016	0.6179	91.6426
46	1.3110	3.4045	2.5645	0.8400	1.2417	24.6734
47	2.1633	4.6240	3.0401	1.5839	2.3537	34.2532
48	1.9488	3.9973	2.9204	1.0769	1.5976	26.9405
49	3.3673	3.1739	3.7120	-0.5381	-0.8115	16.9546
50	1.8500	2.6810	2.8653	-0.1843	-0.2732	6.8733
51	2.7726	3.6019	3.3801	0.2217	0.3316	6.1563

The residual is the difference between the actual and the predicted Y values. The formula is Residual = Y - Yhat. The Percent Absolute Error is the 100 |Residual| / Y.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Residual Diagnostics Section

Row	lnVegetation (X)	Residual	RStudent	Hat Diagonal	Cook's D	MSEi
10	3.4532	-0.4171	-0.6248	0.0678	0.0144	0.4779
11	2.8622	-0.2917	-0.4322	0.0517	0.0052	0.4804
13	1.4061	0.0831	0.1214	0.0279	0.0002	0.4826
14	2.6462	-0.5002	-0.7426	0.0467	0.0137	0.4759
15	-0.9943	-0.3226	-0.4747	0.0379	0.0045	0.4800
16	-2.5257	2.0357	*3.5073	0.0763	0.3941	0.3647
17	-0.8440	-0.6312	-0.9355	0.0355	0.0161	0.4719
18	-2.2073	0.4213	0.6308	0.0663	0.0143	0.4778
19	-0.4780	-0.8194	-1.2210	0.0306	0.0232	0.4646
20	0.4055	-1.3710	*-2.1119	0.0246	0.0516	0.4321
21	-3.5066	0.0074	*0.0113	0.1141	0.0000	0.4828
22	2.6101	0.1478	0.2179	0.0459	0.0012	0.4822
23	0.7031	-0.1711	-0.2496	0.0244	0.0008	0.4820
24	2.5014	0.3767	0.5566	0.0437	0.0072	0.4789
25	2.7014	0.0741	0.1093	0.0479	0.0003	0.4827
26	3.3844	-0.1160	-0.1728	0.0657	0.0011	0.4824
27	3.2108	0.3536	0.5269	0.0607	0.0091	0.4793
28	2.0464	0.5307	0.7839	0.0355	0.0114	0.4751
29	3.3429	0.2980	0.4446	0.0645	0.0070	0.4803
30	2.1759	0.1035	0.1518	0.0376	0.0005	0.4825
31	2.2138	-0.1202	-0.1764	0.0383	0.0006	0.4824
32	1.6734	-0.9617	-1.4437	0.0305	0.0319	0.4577
33	2.4681	0.6672	0.9943	0.0430	0.0222	0.4706
34	-2.4079	0.9104	1.3948	0.0725	0.0742	0.4593
35	-1.0498	-0.1529	-0.2246	0.0388	0.0010	0.4822
36	-1.0788	-0.6211	-0.9222	0.0394	0.0175	0.4722
37	0.1044	-0.8026	-1.1918	0.0257	0.0185	0.4654
38	-0.2614	-0.5208	-0.7662	0.0283	0.0086	0.4755
39	-1.1087	-0.1358	-0.1996	0.0399	0.0008	0.4823
40	-1.1087	-0.7955	-1.1900	0.0399	0.0291	0.4655
41	-2.6593	-0.0196	-0.0294	0.0809	0.0000	0.4828
42	-1.2040	0.2068	0.3043	0.0417	0.0021	0.4816
43	-1.4697	-0.7685	-1.1527	0.0472	0.0326	0.4665
44	-2.6593	-0.0789	-0.1184	0.0809	0.0006	0.4826
45	-3.2189	0.4016	*0.6129	0.1019	0.0217	0.4781
46	1.3110	0.8400	1.2506	0.0271	0.0215	0.4637
47	2.1633	1.5839	*2.5083	0.0374	0.1077	0.4142
48	1.9488	1.0769	1.6312	0.0341	0.0450	0.4512
49	3.3673	-0.5381	-0.8078	0.0652	0.0230	0.4747
50	1.8500	-0.1843	-0.2699	0.0327	0.0013	0.4819
51	2.7726	0.2217	0.3278	0.0495	0.0029	0.4814

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

MSEi is the value of the Mean Square Error (the average of the sum of squared residuals) calculated with each row omitted.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Leave One Row Out Section

Row	RStudent	DFFITS	Cook's D	CovRatio	DFBETAS(0)	DFBETAS(1)
10	-0.6248	-0.1684	0.0144	1.1070	-0.0610	-0.1348
11	-0.4322	-0.1009	0.0052	1.0999	-0.0470	-0.0733
13	0.1214	0.0205	0.0002	1.0827	0.0166	0.0073
14	-0.7426	-0.1644	0.0137	1.0735	-0.0838	-0.1136
15	-0.4747	-0.0942	0.0045	1.0819	-0.0879	0.0562
16	* 3.5073	1.0082	0.3941	0.6508	0.7728	-0.8317
17	-0.9355	-0.1794	0.0161	1.0434	-0.1703	0.1002
18	0.6308	0.1681	0.0143	1.1048	0.1342	-0.1336
19	-1.2210	-0.2168	0.0232	1.0060	-0.2127	0.0974
20	* -2.1119	-0.3353	0.0516	0.8649	-0.3297	0.0301
21	0.0113	0.0040	0.0000	* 1.1889	0.0028	-0.0036
22	0.2179	0.0478	0.0012	1.1013	0.0247	0.0327
23	-0.2496	-0.0395	0.0008	1.0762	-0.0375	-0.0019
24	0.5566	0.1189	0.0072	1.0837	0.0643	0.0790
25	0.1093	0.0245	0.0003	1.1056	0.0122	0.0172
26	-0.1728	-0.0458	0.0011	1.1256	-0.0171	-0.0363
27	0.5269	0.1340	0.0091	1.1052	0.0539	0.1036
28	0.7839	0.1505	0.0114	1.0577	0.0974	0.0843
29	0.4446	0.1167	0.0070	1.1143	0.0444	0.0920
30	0.1518	0.0300	0.0005	1.0932	0.0185	0.0178
31	-0.1764	-0.0352	0.0006	1.0935	-0.0213	-0.0212
32	-1.4437	-0.2562	0.0319	0.9764	-0.1896	-0.1150
33	0.9943	0.2107	0.0222	1.0455	0.1155	0.1386
34	1.3948	0.3899	0.0742	1.0277	0.3034	-0.3176
35	-0.2246	-0.0452	0.0010	1.0930	-0.0419	0.0275
36	-0.9222	-0.1867	0.0175	1.0490	-0.1725	0.1151
37	-1.1918	-0.1935	0.0185	1.0046	-0.1933	0.0435
38	-0.7662	-0.1308	0.0086	1.0513	-0.1300	0.0488
39	-0.1996	-0.0407	0.0008	1.0948	-0.0375	0.0254
40	-1.1900	-0.2426	0.0291	1.0197	-0.2234	0.1512
41	-0.0294	-0.0087	0.0000	1.1459	-0.0066	0.0073
42	0.3043	0.0635	0.0021	1.0938	0.0578	-0.0409
43	-1.1527	-0.2564	0.0326	1.0320	-0.2256	0.1782
44	-0.1184	-0.0351	0.0006	1.1452	-0.0265	0.0294
45	0.6129	0.2065	0.0217	* 1.1500	0.1458	-0.1801
46	1.2506	0.2087	0.0215	0.9987	0.1730	0.0659
47	* 2.5083	0.4946	0.1077	0.8055	0.3060	0.2918
48	1.6312	0.3065	0.0450	0.9524	0.2056	0.1635
49	-0.8078	-0.2133	0.0230	1.0890	-0.0802	-0.1688
50	-0.2699	-0.0496	0.0013	1.0848	-0.0345	-0.0251
51	0.3278	0.0748	0.0029	1.1020	0.0362	0.0533

Each column gives the impact on some aspect of the linear regression of omitting that row.

RStudent represents the size of the residual. DFFITS represents the change in the fitted value of a row. Cook's D summarizes the change in the fitted values of all rows. CovRatio represents the amount of change in the determinant of the covariance matrix. DFBETAS(0) and DFBETAS(1) give the amount of change in the intercept and slope.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Outlier Detection Chart

Row	lnVegetation (X)	Residual		Standardized Residual		RStudent	
10	3.4532	-0.4171	|||.....	-0.6298	|||.....	-0.6248	||.....
11	2.8622	-0.2917	||.....	-0.4368	||.....	-0.4322	|.....
13	1.4061	0.0831	|.....	0.1229	|.....	0.1214	|.....
14	2.6462	-0.5002	|||.....	-0.7469	|||.....	-0.7426	|||.....
15	-0.9943	-0.3226	||.....	-0.4794	||.....	-0.4747	|.....
16	-2.5257	2.0357	||||||||||||||	3.0883	||||||||||||||	* 3.5073	||||||||||||||
17	-0.8440	-0.6312	||||.....	-0.9370	||||.....	-0.9355	|||.....
18	-2.2073	0.4213	|||.....	0.6357	|||.....	0.6308	||.....
19	-0.4780	-0.8194	||||||.....	-1.2134	|||||.....	-1.2210	|||||.....
20	0.4055	-1.3710	||||||||||.....	-2.0240	||||||||.....	* -2.1119	||||||||.....
21	-3.5066	0.0074	|.....	0.0114	|.....	0.0113	|.....
22	2.6101	0.1478	|.....	0.2206	|.....	0.2179	|.....
23	0.7031	-0.1711	|.....	-0.2526	|.....	-0.2496	|.....
24	2.5014	0.3767	||.....	0.5616	||.....	0.5566	||.....
25	2.7014	0.0741	|.....	0.1107	|.....	0.1093	|.....
26	3.3844	-0.1160	|.....	-0.1750	|.....	-0.1728	|.....
27	3.2108	0.3536	||.....	0.5319	||.....	0.5269	||.....
28	2.0464	0.5307	|||.....	0.7879	|||.....	0.7839	|||.....
29	3.3429	0.2980	||.....	0.4492	||.....	0.4446	|.....
30	2.1759	0.1035	|.....	0.1538	|.....	0.1518	|.....
31	2.2138	-0.1202	|.....	-0.1786	|.....	-0.1764	|.....
32	1.6734	-0.9617	|||||||.....	-1.4241	||||||.....	-1.4437	||||||.....
33	2.4681	0.6672	||||.....	0.9944	||||.....	0.9943	||||.....
34	-2.4079	0.9104	||||||.....	1.3782	||||||.....	1.3948	|||||.....
35	-1.0498	-0.1529	|.....	-0.2274	|.....	-0.2246	|.....
36	-1.0788	-0.6211	||||.....	-0.9239	||||.....	-0.9222	|||.....
37	0.1044	-0.8026	|||||.....	-1.1855	|||||.....	-1.1918	|||||.....
38	-0.2614	-0.5208	|||.....	-0.7703	|||.....	-0.7662	|||.....
39	-1.1087	-0.1358	|.....	-0.2021	|.....	-0.1996	|.....
40	-1.1087	-0.7955	|||||.....	-1.1837	|||||.....	-1.1900	|||||.....
41	-2.6593	-0.0196	|.....	-0.0298	|.....	-0.0294	|.....
42	-1.2040	0.2068	|.....	0.3079	|.....	0.3043	|.....
43	-1.4697	-0.7685	|||||.....	-1.1479	|||||.....	-1.1527	||||.....
44	-2.6593	-0.0789	|.....	-0.1200	|.....	-0.1184	|.....
45	-3.2189	0.4016	||.....	0.6179	||.....	0.6129	||.....
46	1.3110	0.8400	||||||.....	1.2417	|||||.....	1.2506	|||||.....
47	2.1633	1.5839	||||||||||....	2.3537	||||||||||....	* 2.5083	|||||||||.....
48	1.9488	1.0769	|||||||.....	1.5976	|||||||.....	1.6312	||||||.....
49	3.3673	-0.5381	|||.....	-0.8115	|||.....	-0.8078	|||.....
50	1.8500	-0.1843	|.....	-0.2732	|.....	-0.2699	|.....
51	2.7726	0.2217	|.....	0.3316	|.....	0.3278	|.....

Outliers are rows that are separated from the rest of the data. Since outliers can have dramatic effects on the results, corrective action, such as elimination, must be carefully considered. Outlying rows should not be automatically be removed unless a good reason for their removal can be given.

An outlier may be defined as a row in which |RStudent| > 2. Rows with this characteristic have been starred.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Influence Detection Chart

Row	lnVegetation (X)	DFFITS		Cook's D		DFBETAS(1)	
10	3.4532	-0.1684	||.....	0.0144	|.....	-0.1348	||.....
11	2.8622	-0.1009	|.....	0.0052	|.....	-0.0733	|.....
13	1.4061	0.0205	|.....	0.0002	|.....	0.0073	|.....
14	2.6462	-0.1644	||.....	0.0137	|.....	-0.1136	||.....
15	-0.9943	-0.0942	|.....	0.0045	|.....	0.0562	|.....
16	-2.5257	1.0082	|||||||||||||||	0.3941	|||||||||||||||	-0.8317	|||||||||||||||
17	-0.8440	-0.1794	||.....	0.0161	|.....	0.1002	|.....
18	-2.2073	0.1681	||.....	0.0143	|.....	-0.1336	||.....
19	-0.4780	-0.2168	|||.....	0.0232	|.....	0.0974	|.....
20	0.4055	-0.3353	||||.....	0.0516	|.....	0.0301	|.....
21	-3.5066	0.0040	|.....	0.0000	|.....	-0.0036	|.....
22	2.6101	0.0478	|.....	0.0012	|.....	0.0327	|.....
23	0.7031	-0.0395	|.....	0.0008	|.....	-0.0019	|.....
24	2.5014	0.1189	|.....	0.0072	|.....	0.0790	|.....
25	2.7014	0.0245	|.....	0.0003	|.....	0.0172	|.....
26	3.3844	-0.0458	|.....	0.0011	|.....	-0.0363	|.....
27	3.2108	0.1340	|.....	0.0091	|.....	0.1036	|.....
28	2.0464	0.1505	||.....	0.0114	|.....	0.0843	|.....
29	3.3429	0.1167	|.....	0.0070	|.....	0.0920	|.....
30	2.1759	0.0300	|.....	0.0005	|.....	0.0178	|.....
31	2.2138	-0.0352	|.....	0.0006	|.....	-0.0212	|.....
32	1.6734	-0.2562	|||.....	0.0319	|.....	-0.1150	||.....
33	2.4681	0.2107	|||.....	0.0222	|.....	0.1386	||.....
34	-2.4079	0.3899	|||||.....	0.0742	||.....	-0.3176	|||||.....
35	-1.0498	-0.0452	|.....	0.0010	|.....	0.0275	|.....
36	-1.0788	-0.1867	||.....	0.0175	|.....	0.1151	||.....
37	0.1044	-0.1935	||.....	0.0185	|.....	0.0435	|.....
38	-0.2614	-0.1308	|.....	0.0086	|.....	0.0488	|.....
39	-1.1087	-0.0407	|.....	0.0008	|.....	0.0254	|.....
40	-1.1087	-0.2426	|||.....	0.0291	|.....	0.1512	||.....
41	-2.6593	-0.0087	|.....	0.0000	|.....	0.0073	|.....
42	-1.2040	0.0635	|.....	0.0021	|.....	-0.0409	|.....
43	-1.4697	-0.2564	|||.....	0.0326	|.....	0.1782	|||.....
44	-2.6593	-0.0351	|.....	0.0006	|.....	0.0294	|.....
45	-3.2189	0.2065	|||.....	0.0217	|.....	-0.1801	|||.....
46	1.3110	0.2087	|||.....	0.0215	|.....	0.0659	|.....
47	2.1633	0.4946	|||||||.....	0.1077	||||.....	0.2918	|||||.....
48	1.9488	0.3065	||||.....	0.0450	|.....	0.1635	||.....
49	3.3673	-0.2133	|||.....	0.0230	|.....	-0.1688	|||.....
50	1.8500	-0.0496	|.....	0.0013	|.....	-0.0251	|.....
51	2.7726	0.0748	|.....	0.0029	|.....	0.0533	|.....

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Influential rows are those whose omission results in a relatively large change in the results. They are not necessarily harmful. However, they will distort the results if they are also outliers. The impact of influential rows should be studied very carefully. Their accuracy should be double-checked.
DFFITS is the standardized change in Yhat when the row is omitted. A row is influential when DFFITS > 1 for small datasets (N < 30) or when DFFITS > 2*SQR(1/N) for medium to large datasets.

Cook's D gives the influence of each row on the Yhats of all the rows. Cook suggests investigating all rows having a Cook's D > 0.5. Rows in which Cook's D > 1.0 are very influential.

DFBETAS(1) is the standardized change in the slope when this row is omitted. DFBETAS(1) > 1 for small datasets (N < 30) and DFBETAS(1) > 2/SQR(N) for medium and large datasets are indicative of influential rows.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Outlier & Influence Chart

Row	lnVegetation (X)	RStudent (Outlier)		Cooks D (Influence)		Hat Diagonal (Leverage)	
10	3.4532	-0.6248	||.....	0.0144	|.....	0.0678	|||||||.....
11	2.8622	-0.4322	|.....	0.0052	|.....	0.0517	||||.....
13	1.4061	0.1214	|.....	0.0002	|.....	0.0279	|.....
14	2.6462	-0.7426	|||.....	0.0137	|.....	0.0467	|||.....
15	-0.9943	-0.4747	|.....	0.0045	|.....	0.0379	||.....
16	-2.5257	* 3.5073	|||||||||||||||	0.3941	|||||||||||||||	0.0763	||||||||.....
17	-0.8440	-0.9355	|||.....	0.0161	|.....	0.0355	|.....
18	-2.2073	0.6308	||.....	0.0143	|.....	0.0663	||||||.....
19	-0.4780	-1.2210	|||||.....	0.0232	|.....	0.0306	|.....
20	0.4055	* -2.1119	|||||||||.....	0.0516	|.....	0.0246	|.....
21	-3.5066	0.0113	|.....	0.0000	|.....	0.1141	|||||||||||||||
22	2.6101	0.2179	|.....	0.0012	|.....	0.0459	|||.....
23	0.7031	-0.2496	|.....	0.0008	|.....	0.0244	|.....
24	2.5014	0.5566	||.....	0.0072	|.....	0.0437	|||.....
25	2.7014	0.1093	|.....	0.0003	|.....	0.0479	|||.....
26	3.3844	-0.1728	|.....	0.0011	|.....	0.0657	||||||.....
27	3.2108	0.5269	||.....	0.0091	|.....	0.0607	||||||.....
28	2.0464	0.7839	|||.....	0.0114	|.....	0.0355	|.....
29	3.3429	0.4446	|.....	0.0070	|.....	0.0645	||||||.....
30	2.1759	0.1518	|.....	0.0005	|.....	0.0376	||.....
31	2.2138	-0.1764	|.....	0.0006	|.....	0.0383	||.....
32	1.6734	-1.4437	||||||.....	0.0319	|.....	0.0305	|.....
33	2.4681	0.9943	||||.....	0.0222	|.....	0.0430	|||.....
34	-2.4079	1.3948	|||||.....	0.0742	||.....	0.0725	|||||||.....
35	-1.0498	-0.2246	|.....	0.0010	|.....	0.0388	||.....
36	-1.0788	-0.9222	|||.....	0.0175	|.....	0.0394	||.....
37	0.1044	-1.1918	|||||.....	0.0185	|.....	0.0257	|.....
38	-0.2614	-0.7662	|||.....	0.0086	|.....	0.0283	|.....
39	-1.1087	-0.1996	|.....	0.0008	|.....	0.0399	||.....
40	-1.1087	-1.1900	|||||.....	0.0291	|.....	0.0399	||.....
41	-2.6593	-0.0294	|.....	0.0000	|.....	0.0809	|||||||||.....
42	-1.2040	0.3043	|.....	0.0021	|.....	0.0417	||.....
43	-1.4697	-1.1527	||||.....	0.0326	|.....	0.0472	|||.....
44	-2.6593	-0.1184	|.....	0.0006	|.....	0.0809	|||||||||.....
45	-3.2189	0.6129	||.....	0.0217	|.....	0.1019	||||||||||||...
46	1.3110	1.2506	|||||.....	0.0215	|.....	0.0271	|.....
47	2.1633	* 2.5083	||||||||||.....	0.1077	||||.....	0.0374	||.....
48	1.9488	1.6312	||||||.....	0.0450	|.....	0.0341	|.....
49	3.3673	-0.8078	|||.....	0.0230	|.....	0.0652	||||||.....
50	1.8500	-0.2699	|.....	0.0013	|.....	0.0327	|.....
51	2.7726	0.3278	|.....	0.0029	|.....	0.0495	||||.....

Outliers are rows that are separated from the rest of the data. Influential rows are those whose omission results in a relatively large change in the results. This report lets you see both.

An outlier may be defined as a row in which |RStudent| > 2. A moderately influential row is one with a CooksD > 0.5. A heavily influential row is one with a CooksD > 1.

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Inverse Prediction of X Means

Row	lnMammal (Y)	lnVegetation (X)	Predicted lnVegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Conf. Limit of X Mean|Y	Upper 95% Conf. Limit of X Mean|Y
10	3.3429	3.4532	2.7058	0.7473	2.2189	3.3361
11	3.1384	2.8622	2.3394	0.5228	1.8863	2.9109
13	2.7007	1.4061	1.5551	-0.1490	1.1540	2.0212
14	2.8094	2.6462	1.7499	0.8963	1.3390	2.2390
15	0.9555	-0.9943	-1.5723	0.5780	-2.2131	-1.0790
16	2.4592	-2.5257	1.1222	-3.6480	0.7332	1.5469
17	0.7308	-0.8440	-1.9750	1.1310	-2.6860	-1.4390
18	1.0225	-2.2073	-1.4523	-0.7550	-2.0732	-0.9709
19	0.7467	-0.4780	-1.9465	1.4684	-2.6524	-1.4136
20	0.6881	0.4055	-2.0514	2.4569	-2.7762	-1.5069
21	-0.1165	-3.5066	-3.4933	-0.0132	-4.4954	-2.7696
22	3.4372	2.6101	2.8749	-0.2648	2.3709	3.5337
23	2.0541	0.7031	0.3964	0.3067	-0.0071	0.7862
24	3.6055	2.5014	3.1765	-0.6750	2.6400	3.8882
25	3.4144	2.7014	2.8341	-0.1327	2.3343	3.4860
26	3.6055	3.3844	3.1765	0.2079	2.6400	3.8882
27	3.9782	3.2108	3.8444	-0.6336	3.2293	4.6803
28	3.5056	2.0464	2.9974	-0.9510	2.4804	3.6774
29	3.9964	3.3429	3.8769	-0.5340	3.2578	4.7190
30	3.1506	2.1759	2.3613	-0.1854	1.9063	2.9361
31	2.9481	2.2138	1.9984	0.2153	1.5719	2.5201
32	1.8050	1.6734	-0.0500	1.7233	-0.4851	0.3411
33	3.8774	2.4681	3.6637	-1.1956	3.0707	4.4653
34	1.3995	-2.4079	-0.7766	-1.6314	-1.2949	-0.3518
35	1.0942	-1.0498	-1.3238	0.2740	-1.9238	-0.8546
36	0.6098	-1.0788	-2.1918	1.1130	-2.9422	-1.6312
37	1.0886	0.1044	-1.3338	1.4382	-1.9354	-0.8637
38	1.1663	-0.2614	-1.1946	0.9332	-1.7741	-0.7370
39	1.0784	-1.1087	-1.3520	0.2434	-1.9565	-0.8802
40	0.4187	-1.1087	-2.5342	1.4255	-3.3485	-1.9329
41	0.3293	-2.6593	-2.6944	0.0351	-3.5393	-2.0735
42	1.3678	-1.2040	-0.8335	-0.3705	-1.3596	-0.4047
43	0.2443	-1.4697	-2.8468	1.3771	-3.7211	-2.2068
44	0.2700	-2.6593	-2.8006	0.1414	-3.6660	-2.1665
45	0.4383	-3.2189	-2.4992	-0.7197	-3.3068	-1.9022
46	3.4045	1.3110	2.8163	-1.5053	2.3183	3.4652
47	4.6240	2.1633	5.0016	-2.8382	4.2361	6.0665
48	3.9973	1.9488	3.8785	-1.9298	3.2592	4.7209
49	3.1739	3.3673	2.4030	0.9643	1.9444	2.9843
50	2.6810	1.8500	1.5198	0.3302	1.1202	1.9821
51	3.6019	2.7726	3.1699	-0.3974	2.6342	3.8806

This confidence interval estimates the mean of X in a large sample of individuals with this value of Y.
This method of inverse prediction is also called 'calibration.'

Linear Regression Report

Dataset C:\Formation\Smoky Canyon\FS\PRG Calcs\AllSeEPC.NCSS
Filter Type = "UPL"
Y = lnMammal X = lnVegetation

Inverse Prediction of X Individuals

Row	lnMammal (Y)	lnVegetation (X)	Predicted lnVegetation (Xhat|Y)	X-Xhat|Y	Lower 95% Prediction Limit of X|Y	Upper 95% Prediction Limit of X|Y
10	3.3429	3.4532	2.7058	0.7473	0.1886	5.3664
11	3.1384	2.8622	2.3394	0.5228	-0.1807	4.9779
13	2.7007	1.4061	1.5551	-0.1490	-0.9773	4.1525
14	2.8094	2.6462	1.7499	0.8963	-0.7787	4.3567
15	0.9555	-0.9943	-1.5723	0.5780	-4.2368	0.9447
16	2.4592	-2.5257	1.1222	-3.6480	-1.4204	3.7005
17	0.7308	-0.8440	-1.9750	1.1310	-4.6662	0.5412
18	1.0225	-2.2073	-1.4523	-0.7550	-4.1094	1.0653
19	0.7467	-0.4780	-1.9465	1.4684	-4.6357	0.5697
20	0.6881	0.4055	-2.0514	2.4569	-4.7479	0.4649
21	-0.1165	-3.5066	-3.4933	-0.0132	-6.3036	-0.9613
22	3.4372	2.6101	2.8749	-0.2648	0.3583	5.5462
23	2.0541	0.7031	0.3964	0.3067	-2.1693	2.9484
24	3.6055	2.5014	3.1765	-0.6750	0.6603	5.8680
25	3.4144	2.7014	2.8341	-0.1327	0.3174	5.5028
26	3.6055	3.3844	3.1765	0.2079	0.6603	5.8680
27	3.9782	3.2108	3.8444	-0.6336	1.3248	6.5848
28	3.5056	2.0464	2.9974	-0.9510	0.4811	5.6768
29	3.9964	3.3429	3.8769	-0.5340	1.3570	6.6198
30	3.1506	2.1759	2.3613	-0.1854	-0.1586	5.0011
31	2.9481	2.2138	1.9984	0.2153	-0.5260	4.6181
32	1.8050	1.6734	-0.0500	1.7233	-2.6335	2.4894
33	3.8774	2.4681	3.6637	-1.1956	1.1456	6.3903
34	1.3995	-2.4079	-0.7766	-1.6314	-3.3949	1.7482
35	1.0942	-1.0498	-1.3238	0.2740	-3.9730	1.1947
36	0.6098	-1.0788	-2.1918	1.1130	-4.8983	0.3248
37	1.0886	0.1044	-1.3338	1.4382	-3.9837	1.1846
38	1.1663	-0.2614	-1.1946	0.9332	-3.8361	1.3250
39	1.0784	-1.1087	-1.3520	0.2434	-4.0030	1.1662
40	0.4187	-1.1087	-2.5342	1.4255	-5.2659	-0.0156
41	0.3293	-2.6593	-2.6944	0.0351	-5.4384	-0.1743
42	1.3678	-1.2040	-0.8335	-0.3705	-3.4548	1.6905
43	0.2443	-1.4697	-2.8468	1.3771	-5.6029	-0.3251
44	0.2700	-2.6593	-2.8006	0.1414	-5.5530	-0.2794
45	0.4383	-3.2189	-2.4992	-0.7197	-5.2282	0.0192
46	3.4045	1.3110	2.8163	-1.5053	0.2996	5.4839
47	4.6240	2.1633	5.0016	-2.8382	2.4628	7.8398
48	3.9973	1.9488	3.8785	-1.9298	1.3586	6.6215
49	3.1739	3.3673	2.4030	0.9643	-0.1165	5.0452
50	2.6810	1.8500	1.5198	0.3302	-1.0133	4.1156
51	3.6019	2.7726	3.1699	-0.3974	0.6538	5.8610

This prediction interval estimates the predicted value of X for a single individual with this value of Y.
This method of inverse prediction is also called 'calibration.'

Attachment 3 – Detailed Statistical Results
Comparison of NOAEL and LOAEL Bird vs. Mammal TRVs
ANOVA

One-Way Analysis of Variance Report

Dataset Untitled
Response NOAEL

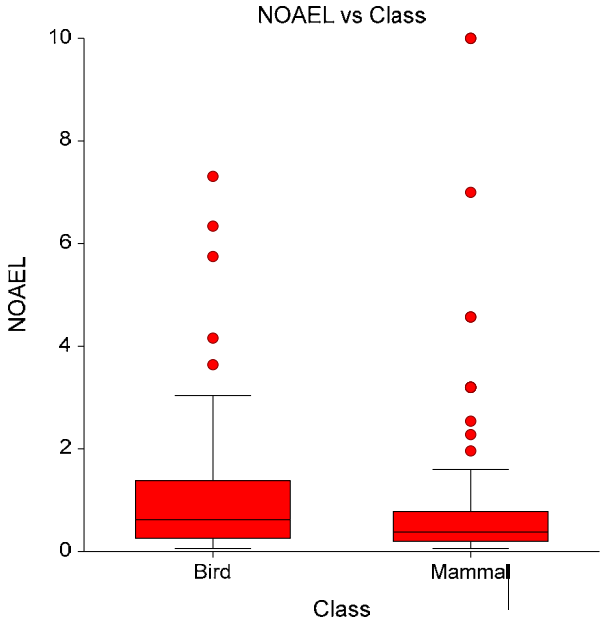
Tests of the Normality of Residuals Assumption

Normality Attributes	Test Value	Prob Level	Reject Normality? (α=0.20)
Skewness	9.3001	0.00000	Yes
Kurtosis	6.5559	0.00000	Yes
Skewness and Kurtosis (Omnibus)	129.4715	0.00000	Yes

Tests of the Equality of Group Variances Assumption

Test Name	Test Value	Prob Level	Reject Equal Variances? (α=0.20)
Brown-Forsythe (Data - Medians)	0.7742	0.38040	No
Levene (Data - Means)	0.5485	0.46013	No
Conover (Ranks of Deviations)	11.5724	0.00067	Yes
Bartlett (Likelihood Ratio)	0.0004	0.98471	No

Box Plot Section



Expected Mean Squares Table

Model Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Class	1	Yes	σ^2	σ^2 + sA
Error	144	No		σ^2

Note: Expected Mean Squares are for the balanced cell-frequency case.

One-Way Analysis of Variance Report

Dataset Untitled
Response NOAEL

Analysis of Variance Table and F-Test

Model Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Reject Equal Means? (α=0.05)	Power (α=0.05)
Between (Class)	1	2.715083	2.715083	0.9496	0.33145	No	0.16231
Within (Error)	144	411.7075	2.85908				
Adjusted Total	145	414.4226					
Total	146						

Welch's Test of Means Allowing for Unequal Variances

Model Term	Numerator DF	Denominator DF	F-Ratio	Prob Level	Reject Equal Means? (α=0.05)
Between Groups	1	84.75	0.9514	0.33213	No

Kruskal-Wallis One-Way ANOVA on Ranks

Hypotheses
H0: All medians are equal.
H1: At least two medians are different.

Test Results

Method	DF	Chi-Squared (H)	Prob Level	Reject H0? (α=0.05)
Not Corrected for Ties	1	2.7389	0.09793	No
Corrected for Ties	1	2.7391	0.09792	No

Number Sets of Ties	20
Multiplicity Factor	228

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
Bird	45	3698.00	82.18	1.6550	0.617
Mammal	101	7033.00	69.63	-1.6550	0.384

Normal Scores Tests

Hypotheses
H0: All group data distributions are the same.
H1: At least one group has observations that tend to be greater than those of the other groups.

Results

Test	DF	Chi-Squared (H)	Prob Level	Reject H0? (α=0.20)
Terry-Hoeffding - Expected Normal Scores	1	2.2292	0.13543	No
Van der Waerden - Normal Quantiles	1	2.2885	0.13033	No

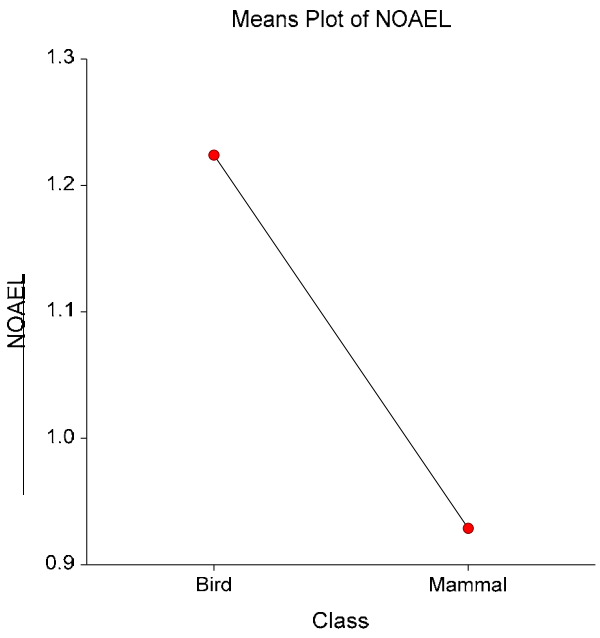
One-Way Analysis of Variance Report

Dataset Untitled
Response NOAEL

Descriptive Statistics

Group	Count (ni)	Mean	Effect	Median	Standard Deviation	Standard Error √(MSE/ni)
All	146	1.019658	1.076295			
A: Class						
Bird	45	1.223958	0.1476628	0.617	1.68799	0.2520617
Mammal	101	0.9286327	-0.1476628	0.384	1.692152	0.168249

Plots of Means Section



Bonferroni (All-Pairwise) Multiple Comparison Test

Response: NOAEL
Term A: Class

Alpha=0.050 Error Term=S(A) DF=144 MSE=2.85908 Critical Value=1.9766

Group	Count	Mean	Different From Groups
Bird	45	1.223958	
Mammal	101	0.9286327	

Notes:
This section presents the results of all paired comparisons among the means. Since this procedure uses the Bonferroni inequality, it is not as accurate as the Tukey-Kramer's method.

One-Way Analysis of Variance Report

Dataset Untitled
Response NOAEL

Tukey-Kramer Multiple-Comparison Test

Response: NOAEL
Term A: Class

Alpha=0.050 Error Term=S(A) DF=144 MSE=2.85908 Critical Value=2.8035

Group	Count	Mean	Different From Groups
Bird	45	1.223958	
Mammal	101	0.9286327	

Notes:
This report provides multiple comparison tests for all pairwise differences between the means.

Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

NOAEL	Bird	Mammal
Bird	0.0000	1.6550
Mammal	1.6550	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 1.9600

One-Way Analysis of Variance Report

Dataset Untitled
Response LOAEL

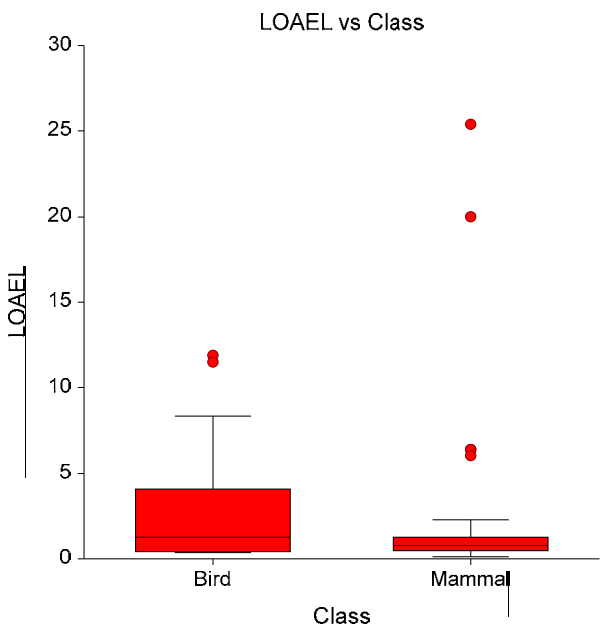
Tests of the Normality of Residuals Assumption

Normality Attributes	Test Value	Prob Level	Reject Normality? (α=0.20)
Skewness	7.7105	0.00000	Yes
Kurtosis	5.8351	0.00000	Yes
Skewness and Kurtosis (Omnibus)	93.5004	0.00000	Yes

Tests of the Equality of Group Variances Assumption

Test Name	Test Value	Prob Level	Reject Equal Variances? (α=0.20)
Brown-Forsythe (Data - Medians)	0.4977	0.48273	No
Levene (Data - Means)	0.2080	0.64964	No
Conover (Ranks of Deviations)	13.1874	0.00028	Yes
Bartlett (Likelihood Ratio)	2.0728	0.14994	Yes

Box Plot Section



Expected Mean Squares Table

Model Term	DF	Term Fixed?	Denominator Term	Expected Mean Square
A: Class	1	Yes	σ^2	σ^2 + sA
Error	74	No		σ^2

Note: Expected Mean Squares are for the balanced cell-frequency case.

One-Way Analysis of Variance Report

Dataset Untitled
Response LOAEL

Analysis of Variance Table and F-Test

Model Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level	Reject Equal Means? (α=0.05)	Power (α=0.05)
Between (Class)	1	10.22658	10.22658	0.5948	0.44301	No	0.11858
Within (Error)	74	1272.224	17.19222				
Adjusted Total	75	1282.451					
Total	76						

Welch's Test of Means Allowing for Unequal Variances

Model Term	Numerator DF	Denominator DF	F-Ratio	Prob Level	Reject Equal Means? (α=0.05)
Between Groups	1	57.46	0.7234	0.39856	No

Kruskal-Wallis One-Way ANOVA on Ranks

Hypotheses
H0: All medians are equal.
H1: At least two medians are different.

Test Results

Method	DF	Chi-Squared (H)	Prob Level	Reject H0? (α=0.05)
Not Corrected for Ties	1	1.9046	0.16756	No
Corrected for Ties	1	1.9050	0.16751	No

Number Sets of Ties	10
Multiplicity Factor	96

Group Detail

Group	Count	Sum of Ranks	Mean Rank	Z-Value	Median
Bird	24	1047.50	43.65	1.3801	1.26
Mammal	52	1878.50	36.13	-1.3801	0.763

Normal Scores Tests

Hypotheses
H0: All group data distributions are the same.
H1: At least one group has observations that tend to be greater than those of the other groups.

Results

Test	DF	Chi-Squared (H)	Prob Level	Reject H0? (α=0.20)
Terry-Hoeffding - Expected Normal Scores	1	2.2234	0.13593	No
Van der Waerden - Normal Quantiles	1	2.2395	0.13453	No

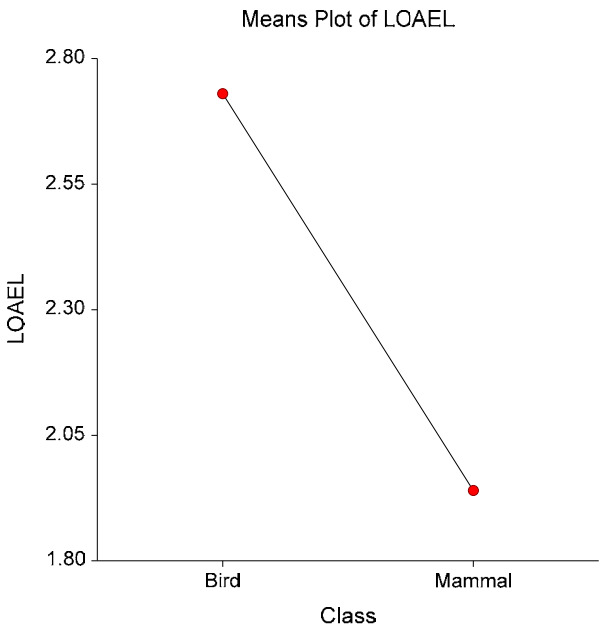
One-Way Analysis of Variance Report

Dataset Untitled
Response LOAEL

Descriptive Statistics

Group	Count (ni)	Mean	Effect	Median	Standard Deviation	Standard Error √(MSE/ni)
All	76	2.189093	2.334464			
A: Class						
Bird	24	2.729044	0.3945798	1.26	3.398949	0.8463701
Mammal	52	1.939885	-0.3945798	0.763	4.442461	0.5749953

Plots of Means Section



Bonferroni (All-Pairwise) Multiple Comparison Test

Response: LOAEL
Term A: Class

Alpha=0.050 Error Term=S(A) DF=74 MSE=17.19222 Critical Value=1.9925

Group	Count	Mean	Different From Groups
Bird	24	2.729044	
Mammal	52	1.939885	

Notes:
This section presents the results of all paired comparisons among the means. Since this procedure uses the Bonferroni inequality, it is not as accurate as the Tukey-Kramer's method.

One-Way Analysis of Variance Report

Dataset Untitled
Response LOAEL

Tukey-Kramer Multiple-Comparison Test

Response: LOAEL
Term A: Class

Alpha=0.050 Error Term=S(A) DF=74 MSE=17.19222 Critical Value=2.8261

Group	Count	Mean	Different From Groups
Bird	24	2.729044	
Mammal	52	1.939885	

Notes:
This report provides multiple comparison tests for all pairwise differences between the means.

Kruskal-Wallis Multiple-Comparison Z-Value Test (Dunn's Test)

LOAEL	Bird	Mammal
Bird	0.0000	1.3802
Mammal	1.3802	0.0000

Regular Test: Medians significantly different if z-value > 1.9600
Bonferroni Test: Medians significantly different if z-value > 1.9600

Procedure Input Settings

Autosave Inactive

Variables Tab

Input Type:	Response Variable(s) and a Factor (Grouping) Variable

-- Variables ----------

Response Variable(s):	NOAEL, LOAEL
Factor Variable:	Class

-- Comparisons ----------

Planned Comparisons:	None

Reports Tab

-- Select Reports ----------

Assumptions (Normality and Equal Variance) Reports	Checked
EMS Report	Checked
ANOVA Report	Checked
Welch's Test	Checked
Kruskal-Wallis / Van der Waerden / Terry-Hoeffding Tests	Checked
Means Report	Checked

·· Alpha ·····

Test Alpha:	0.05
Assumption Alpha:	0.20

One-Way Analysis of Variance Report

Dataset	Untitled
Response	LOAEL

Procedure Input Settings (Continued)

Reports Tab (Continued)

-- Multiple Comparison Tests ----------

Bonferroni Test (All Pairs)	Checked
Bonferroni Test (Versus Control)	Unchecked
Dwass-Steel-Critchlow-Fligner Test	Unchecked
Duncan's Test	Unchecked
Dunnett's 2-Sided (Versus Control)	Unchecked
Dunnett's Lower 1-Sided (Versus Control)	Unchecked
Dunnett's Upper 1-Sided (Versus Control)	Unchecked
Dunnett's Confidence Intervals	Unchecked
Fisher's LSD Test	Unchecked
Hsu's M.C. with Best	Unchecked
Kruskal-Wallis Z Test (Dunn's Test)	Checked
Newman-Keuls Test	Unchecked
Scheffe's Test	Unchecked
Tukey-Kramer Test	Checked
Tukey-Kramer Confidence Intervals and P-Values	Unchecked

·· Multiple Comparison Alpha and Decimals ·····

MC Alpha:	0.05
MC Decimals:	All

Report Options Tab

-- Report Options ----------

Variable Names:	Names
Value Labels:	Data Values

-- Decimal Places ----------

Means and C.I. Limits:	Auto (Up to 7)
Std Deviations and Std Errors:	Auto (Up to 7)
P-Values:	5
Test Statistics:	4
Rank Statistics:	2
Fractional DF:	2
α in Titles:	2

Plots Tab

-- Select Plots ----------

Means Plot	Checked
Box Plot	Checked

Storage Tab

-- Data Storage Options ----------

Storage Option:	Do not store data