Nonresponsive

From: GROOM Jeremy [mailto:jeremy.groom@state.or.us]
Sent: Wednesday, January 22, 2014 9:50 AM
To: jeffrey.lockwood@noaa.gov; SEEDS Joshua; Powers, David
Cc: FRUEH Terry
Subject: Presentation for today

Greetings,

Attached is the presentation for today's meeting.

Cheers,

Jeremy

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RipStream Riparian Rule Analysis
Analysis tool development & status

22 January 2014

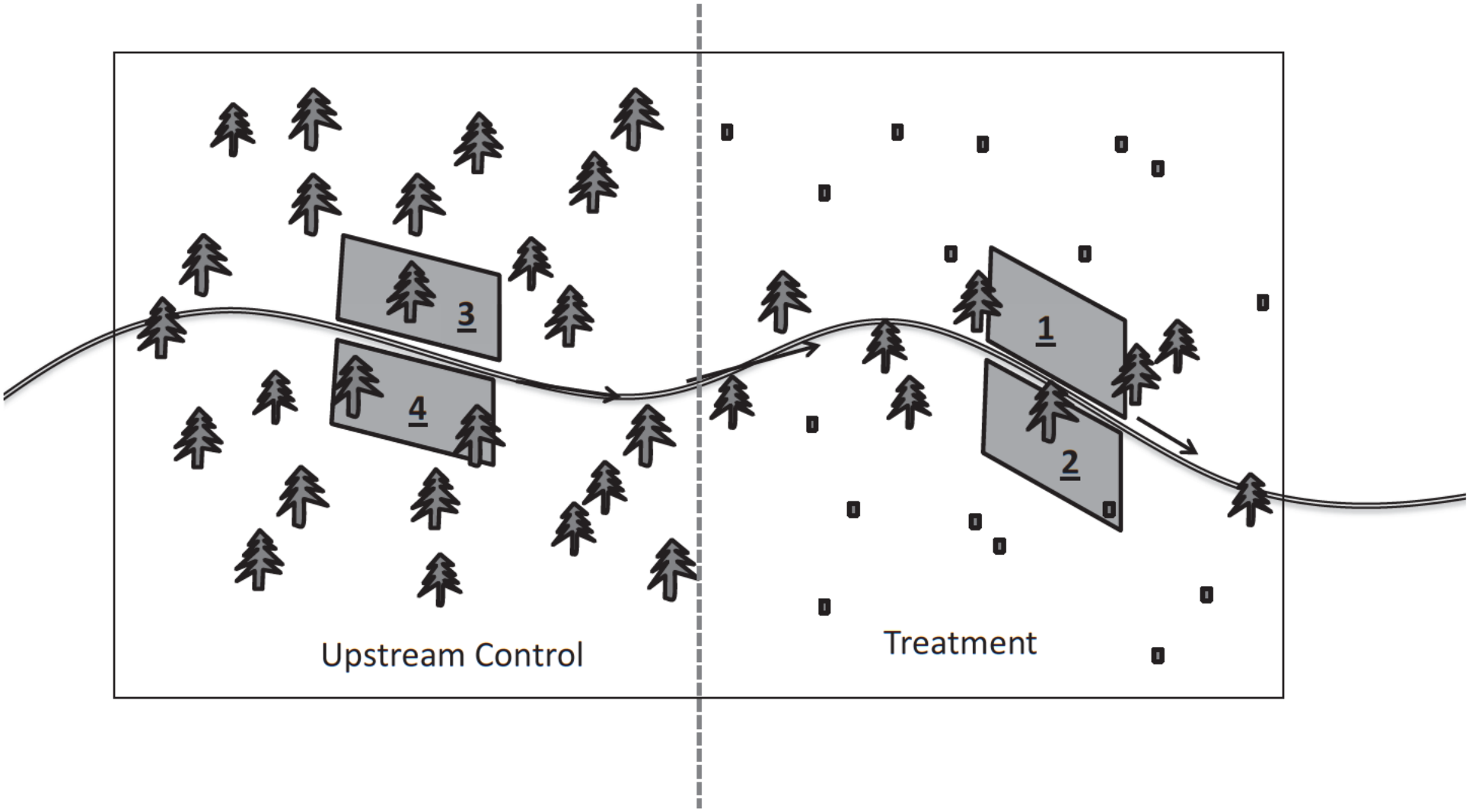
Outline

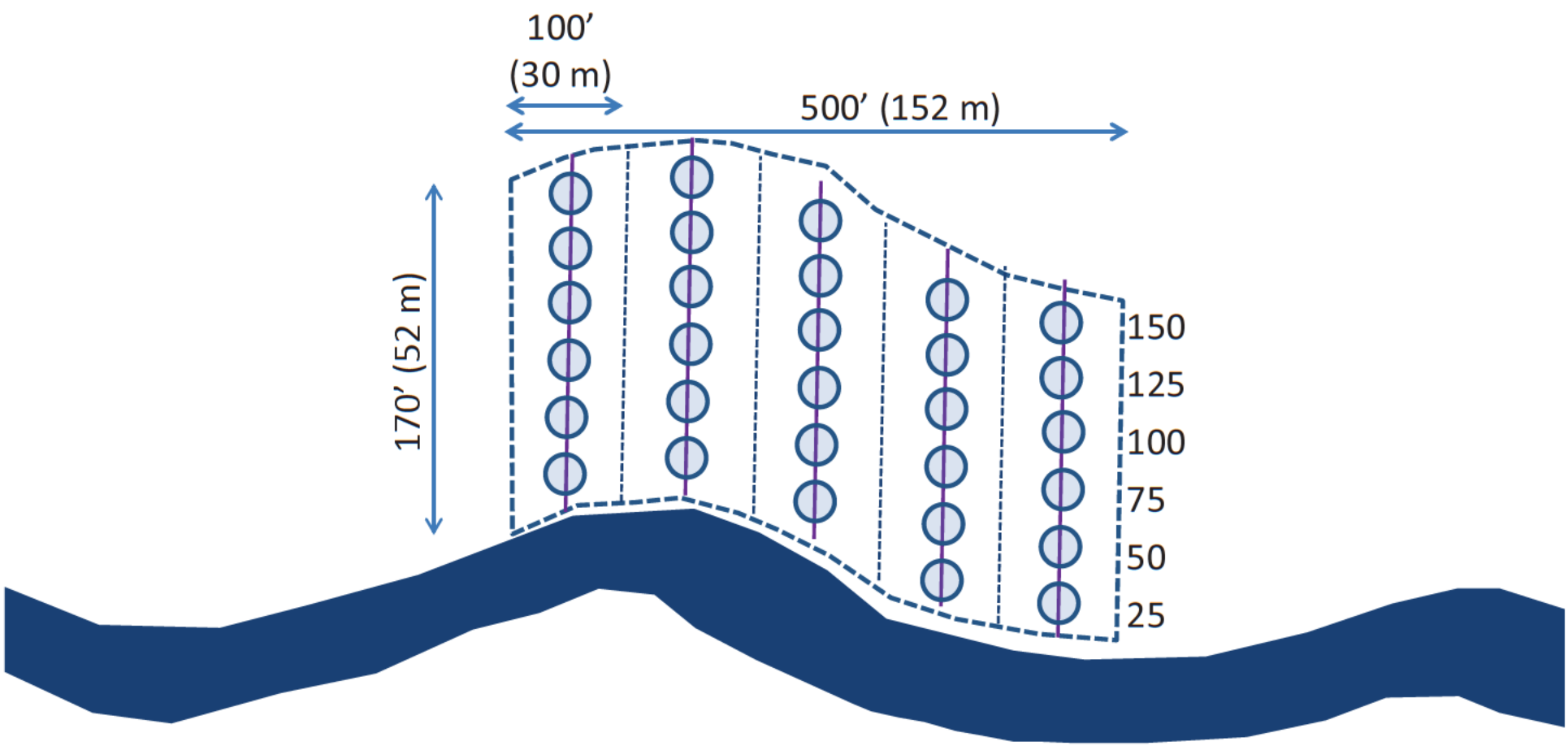
- Meeting goals
- Vegetation plots and what they tell us
- How we are using vegetation plot data
- Analysis
  - Background: what we're doing
  - How it works
  - Shade model alternatives & results
- Prediction: As harvested & State Forests
- Next Steps: FPA, alternatives

Goals

- Common understanding of model:
  - How it works
  - What goes into it
  - How it can be used
  - Role of the vegetation plot data
- Input on the model process
- Input on prescription development

PLOT LAYOUT



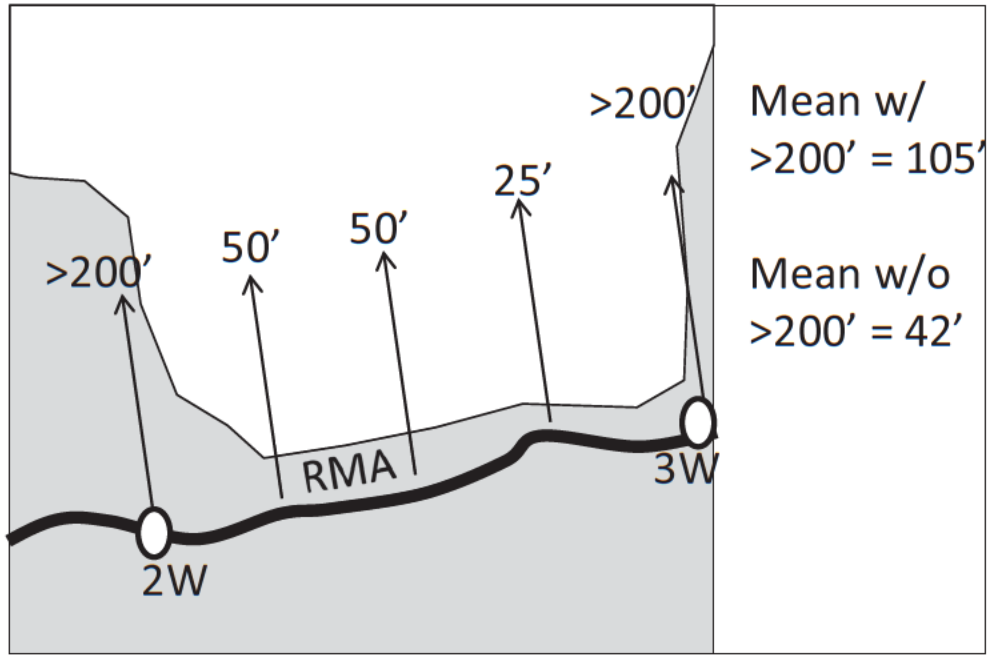

100’
(30 m)
500’ (152 m)
170’ (52 m)
150
125
100
75
50
25

Information from veg plots

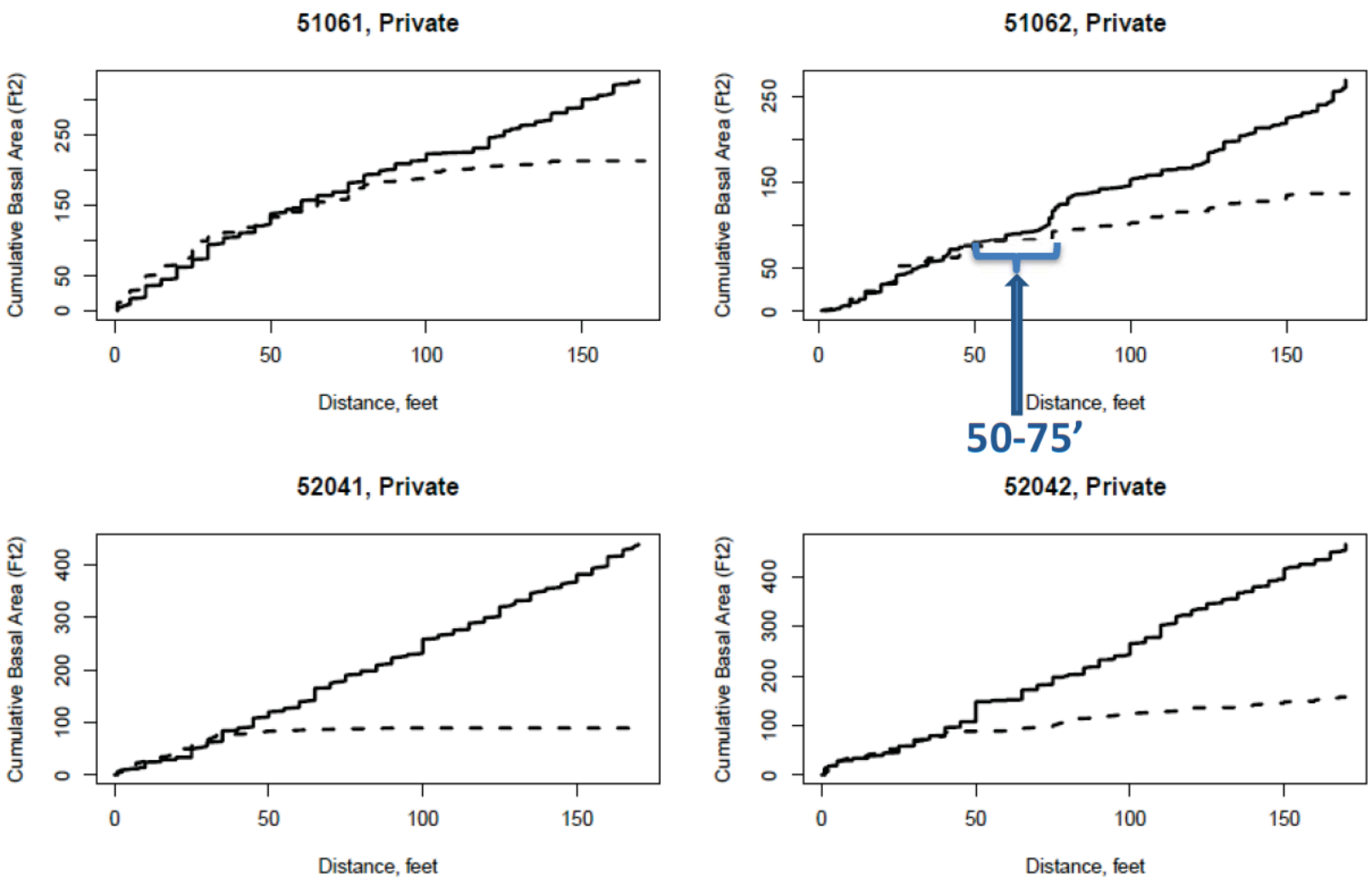
- BA pre, post, change
- Species composition
- Tree height pre (not post)
- Snag/live
- Line that trees were harvested along
- Tree distance (horizontal, slope)
- Distance from stream to “harvest”

Distance

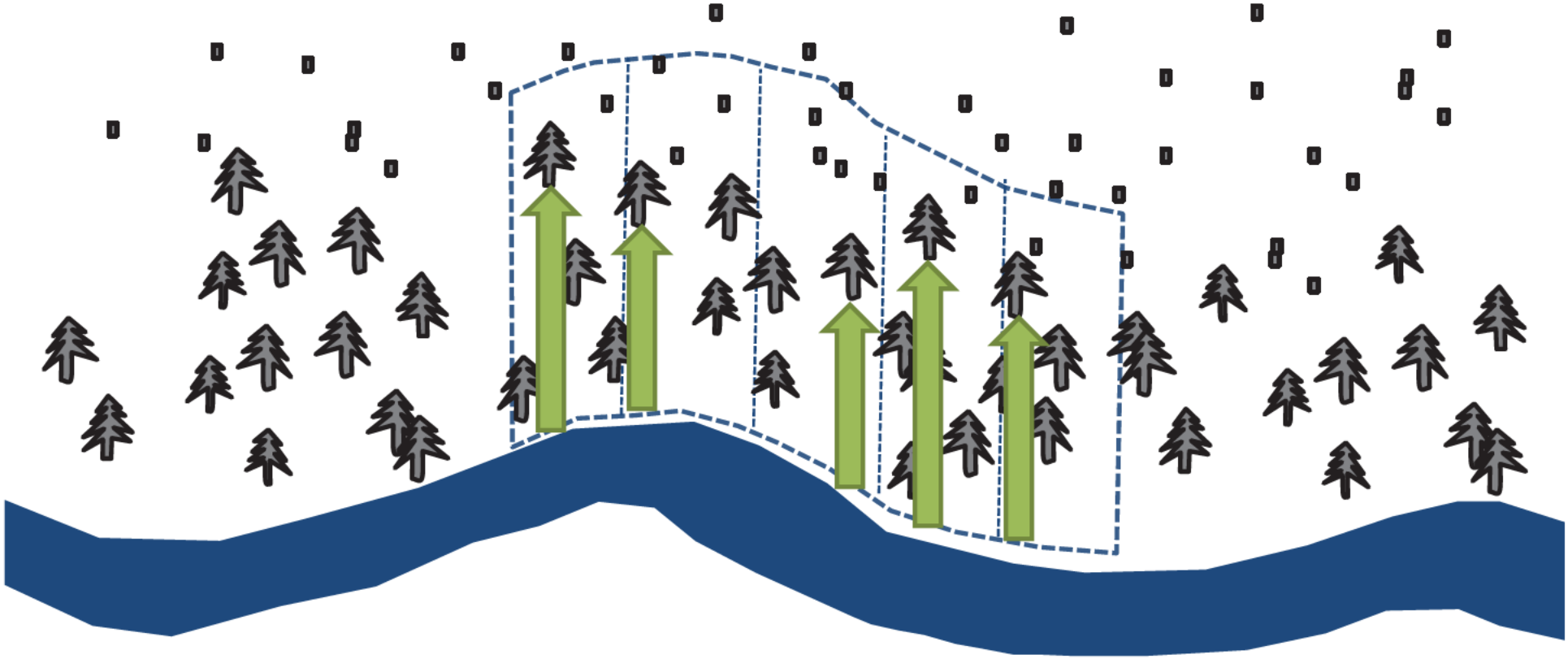
- FEM paper: used intern-measured buffer widths



Distance – Vegetation Plots (visual)



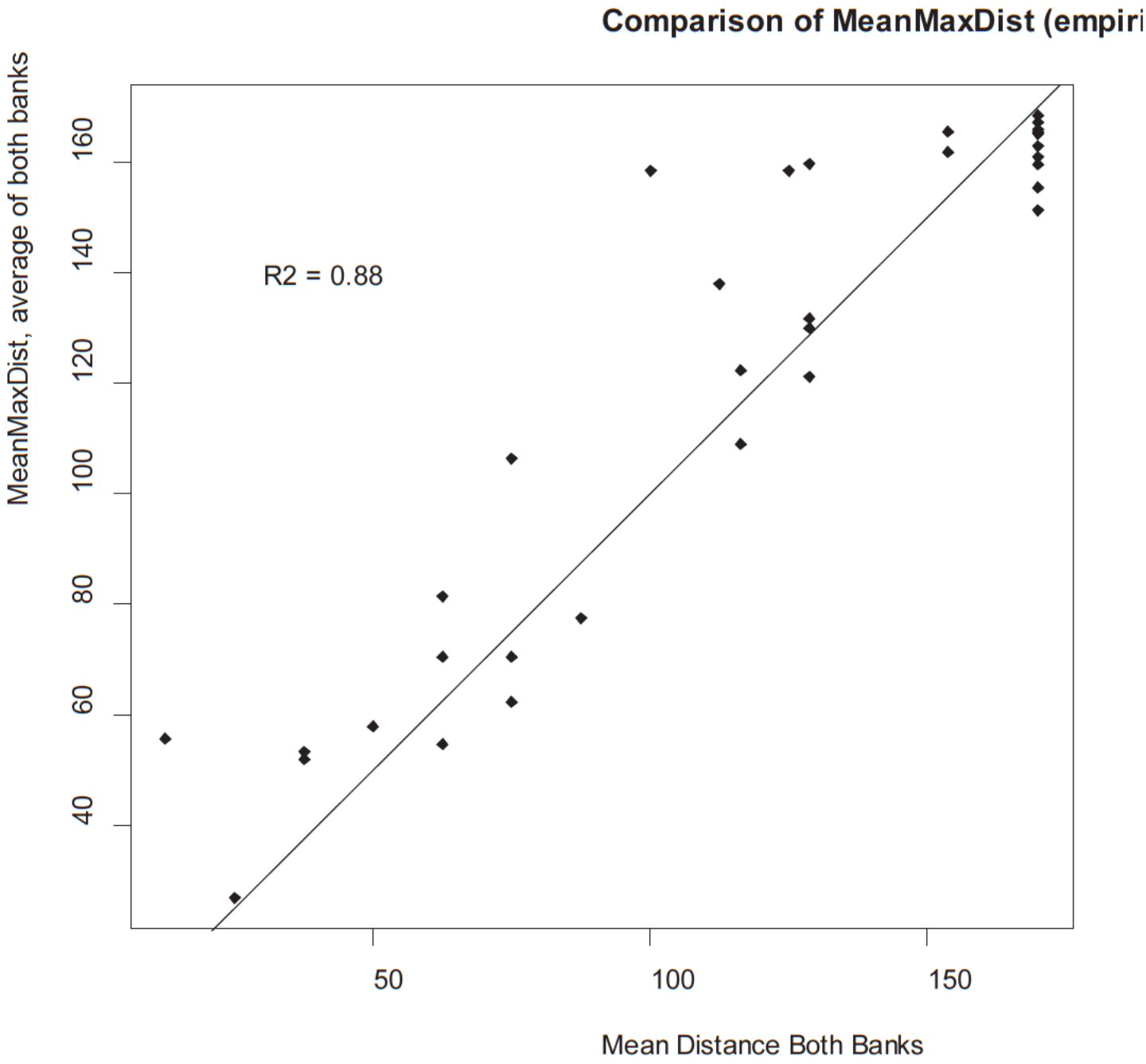
Distance: Vegetation Plot (Empirical)



DISTANCE
Which tree in each line is the farthest from the stream?

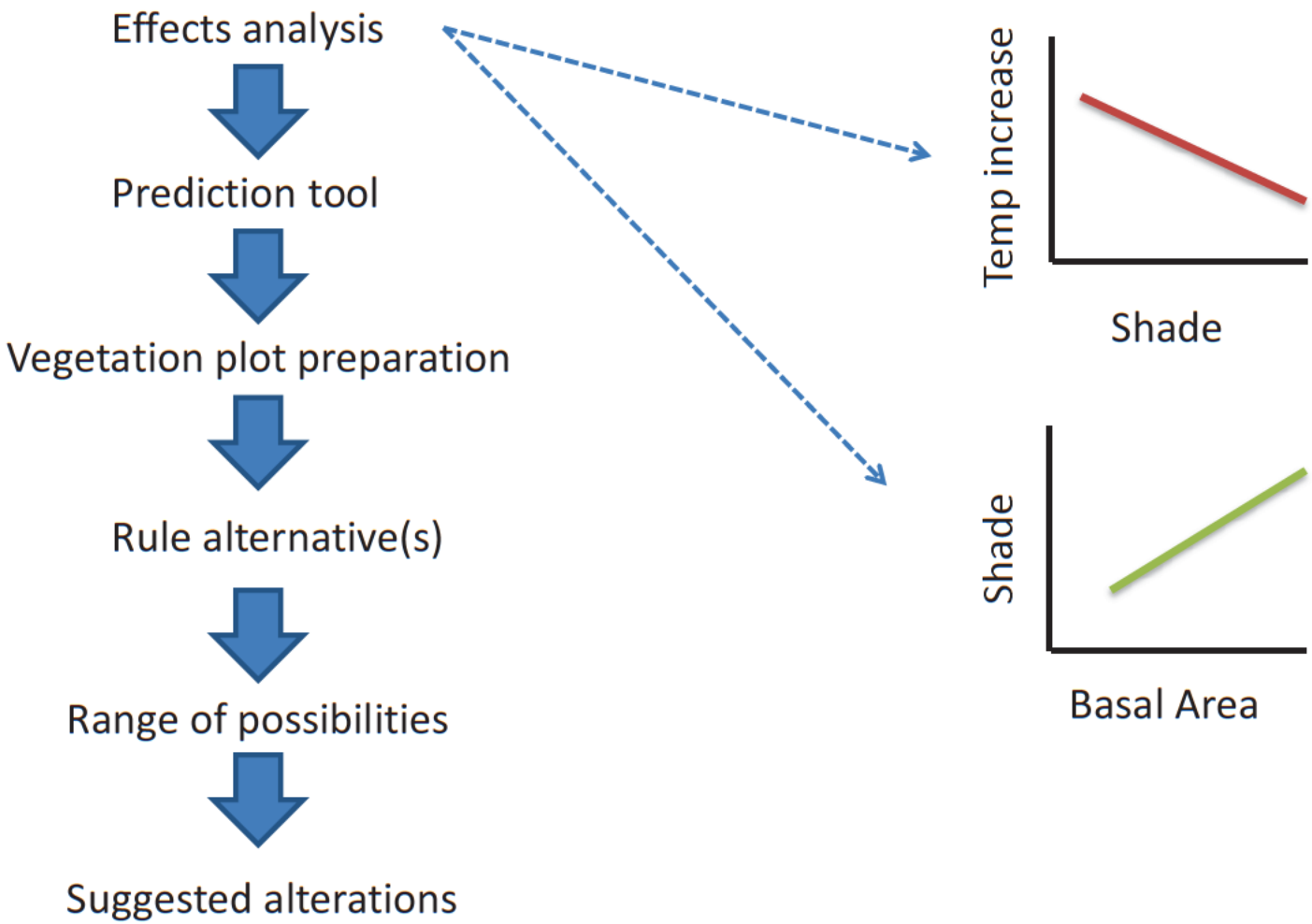
<u>Of the 5 maximum line distances…</u>

Minimum?	MinMaxDist
Mean?	MeanMaxDist
Max?	MaxMaxDist

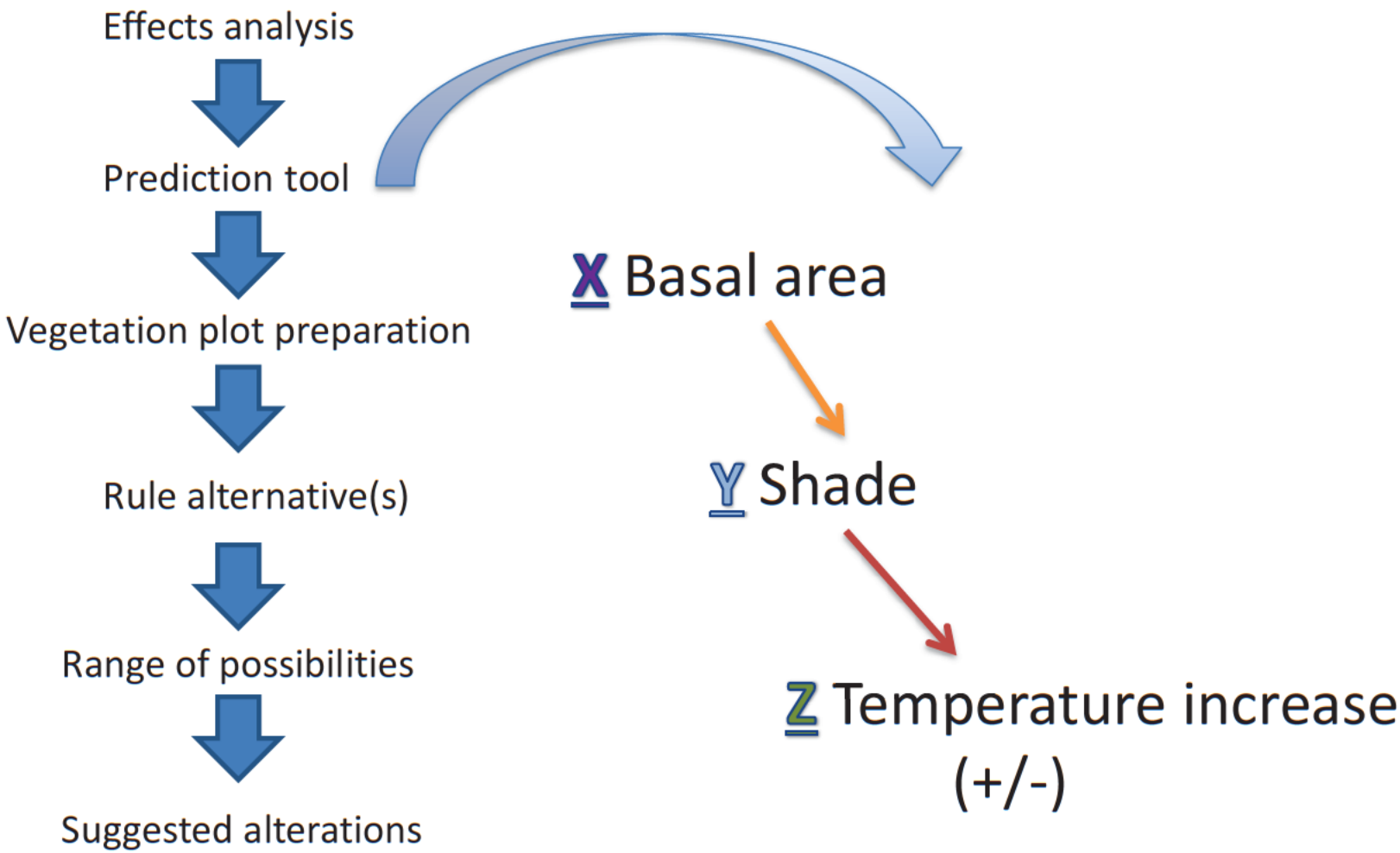

Comparison of MeanMaxDist (empiri
MeanMaxDist, average of both banks
40
60
80
100
120
140
160
R2 = 0.88
50
100
150
Mean Distance Both Banks

On to the Analysis…

Analysis path concept



Analysis path concept



Analysis path concept

Effects analysis

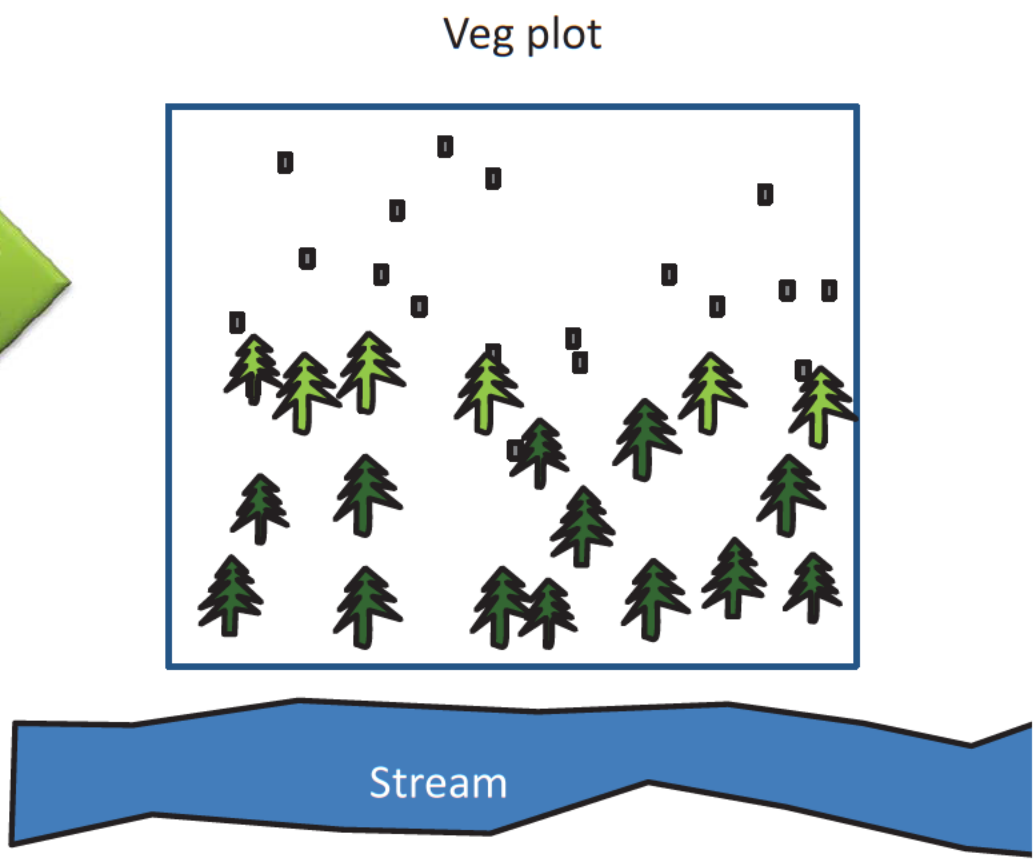
Prediction tool

Vegetation plot preparation

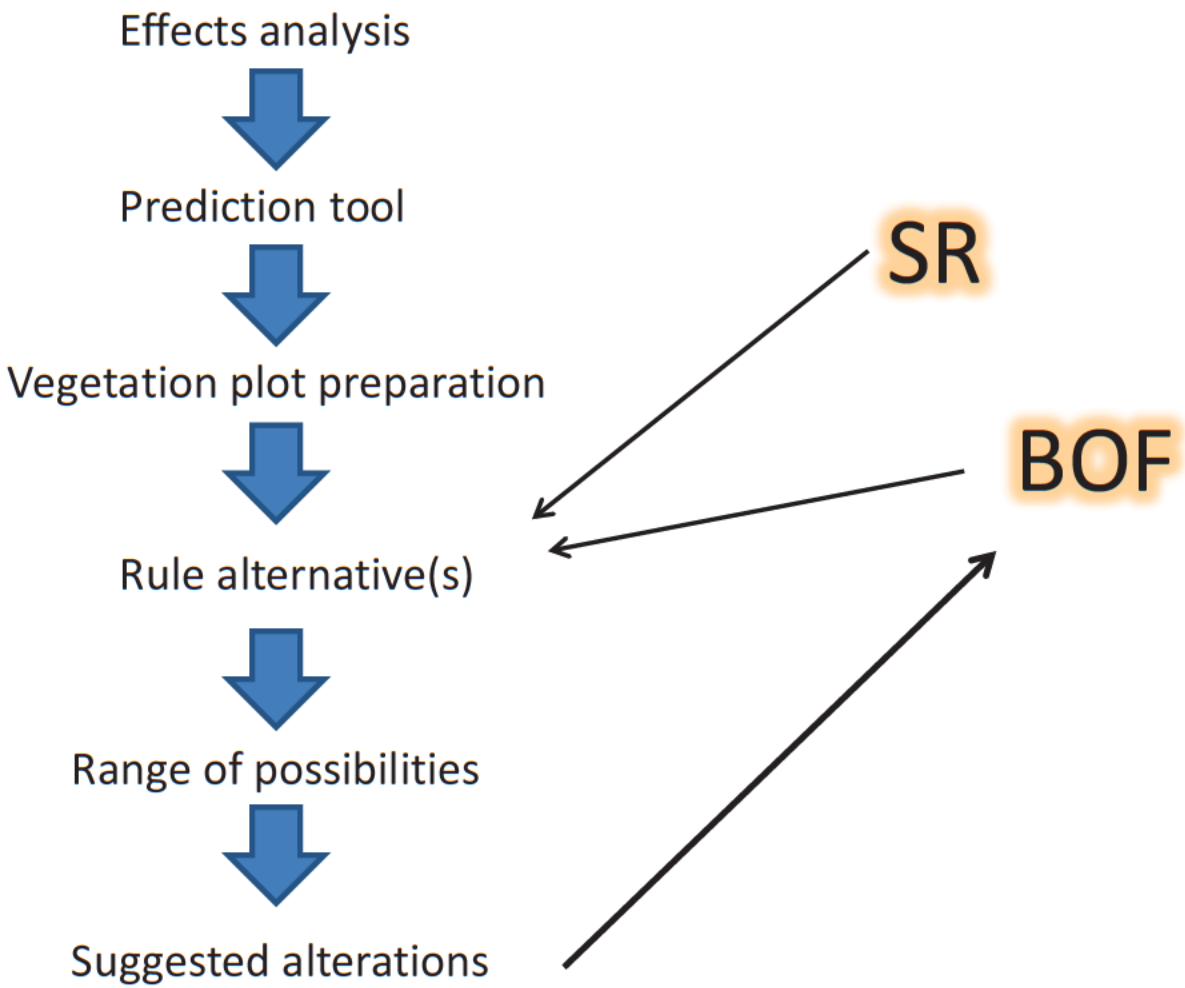
Rule alternative(s)

Range of possibilities

Suggested alterations

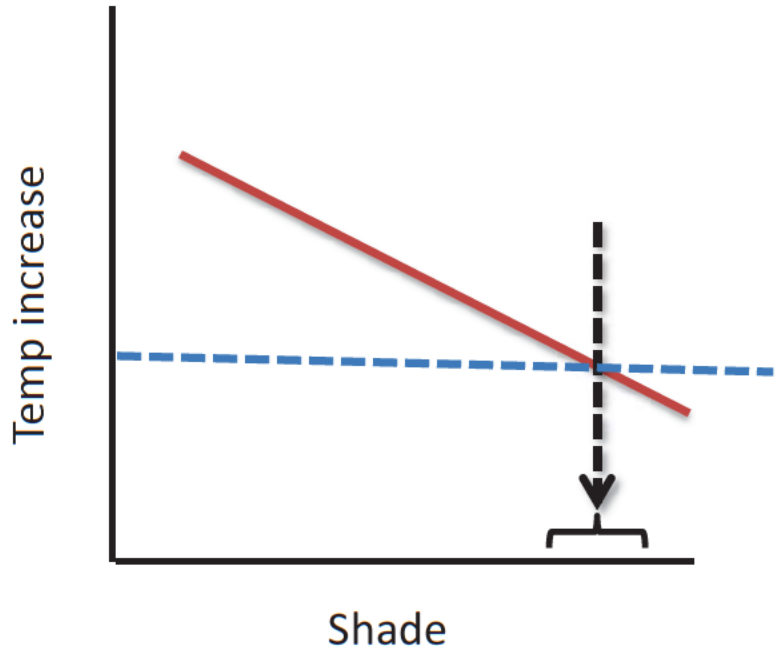


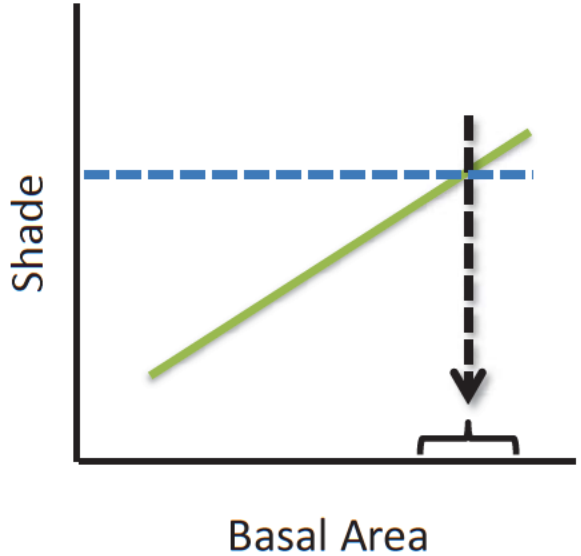
Analysis path concept



Prediction Tool

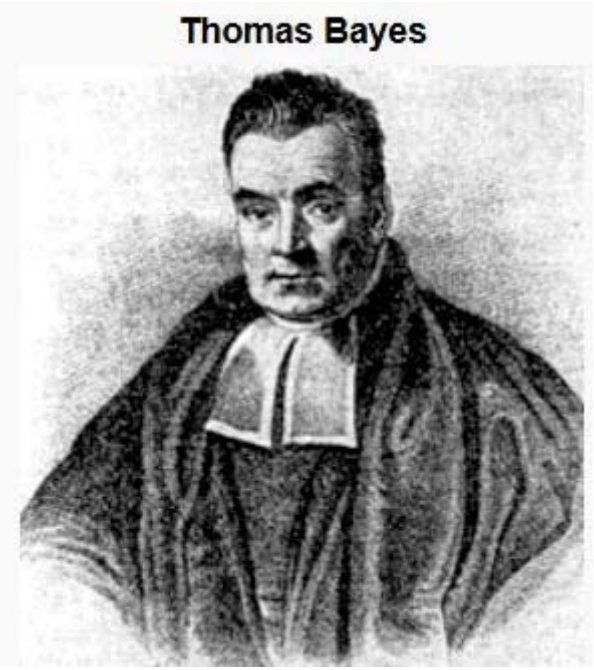
Temperature ⟷ Shade ⟷ Basal Area





Linking analyses

How can we effectively “tie” analyses together?



Bayesian Analysis

- Bayesian & Frequentist
  - Frequentist: Data are random (random draws)
    - » Variables = fixed
  - Bayesian: Variables are random
    - » Data = fixed

- Key point: <u>Models</u> are the same.
  - Probabilities = different

Bayesian Analysis

- Why?? What does this give us?
  - Be able to say "80% chance that temperature increase will be less than 0.2 ˚C"
  - Single model, more information
    - Integrates many data sources easily, defensibly
  - Missing data estimated
  - Many assumptions, but true of MLE models too
    - Restrictions not as limiting

Making the jump

- Using same/similar models as before
  - Shade = weighted regression, Temp = mixed effects
- Coolness:
  - Two sites = missing pre-harvest temperature data, so analysis imputes values
  - With a Bayesian analysis, easy to estimate ***whatever***
- Get ready for equations

Stream Temperature Change

- Temperature: for year i, measuring temperature change in j site…

Mixed Effects

$$\Delta T_{3-2ij} = \alpha_0 + \alpha_j + (\beta_1 \Delta TControl_{2-1} + \beta_i \Delta TControl_{2-1j}) + \beta_2 TreatmentReachLength + \beta_3 Shade + \beta_4 GradientQuartile$$

Detour: shade model development

The ideal shade model

For RipStream, the ideal shade model…

- Explains shade results well
- Makes sense
- Includes all data out to 170’
- Includes a measure of harvest distance

Published model
Forest Ecology & Mgt 2011

Logit of shade = Basal area post-harvest + tree height

Model does well (explains ~ 70% variation)

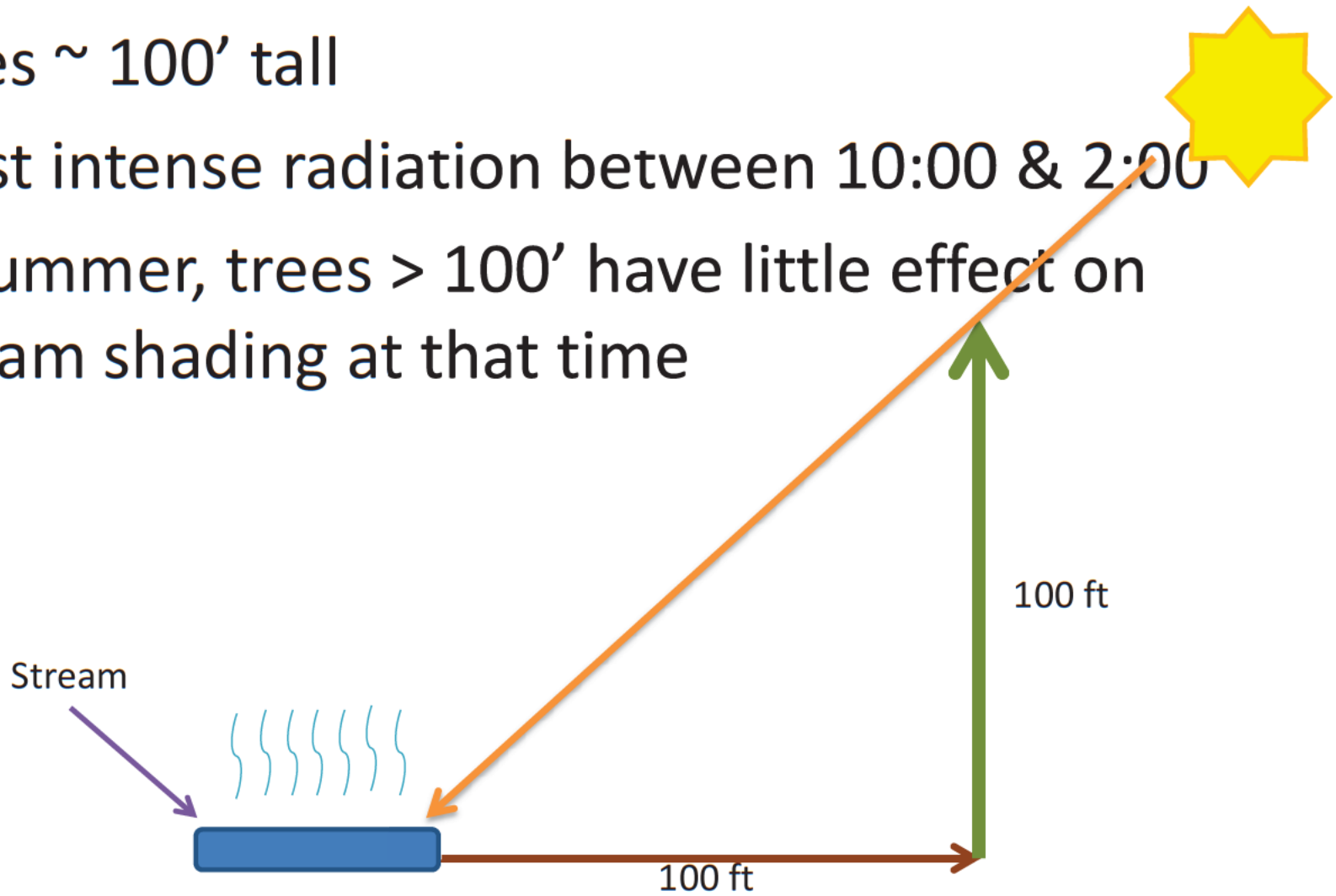
Examines forest out to 100’

Revised shade model: Shade 1

$$Shade_{Post} = \alpha_{Shade} + \beta_{1Shade} Basal\ AreaPre + \beta_{2Shade} TreeHeight + \beta_{3Shade} Basal\ AreaPre * TreeHeight + \beta_{4Shade} BA_Reduction + \beta_{5Shade} PctHardwoodPre$$

Why 100'?

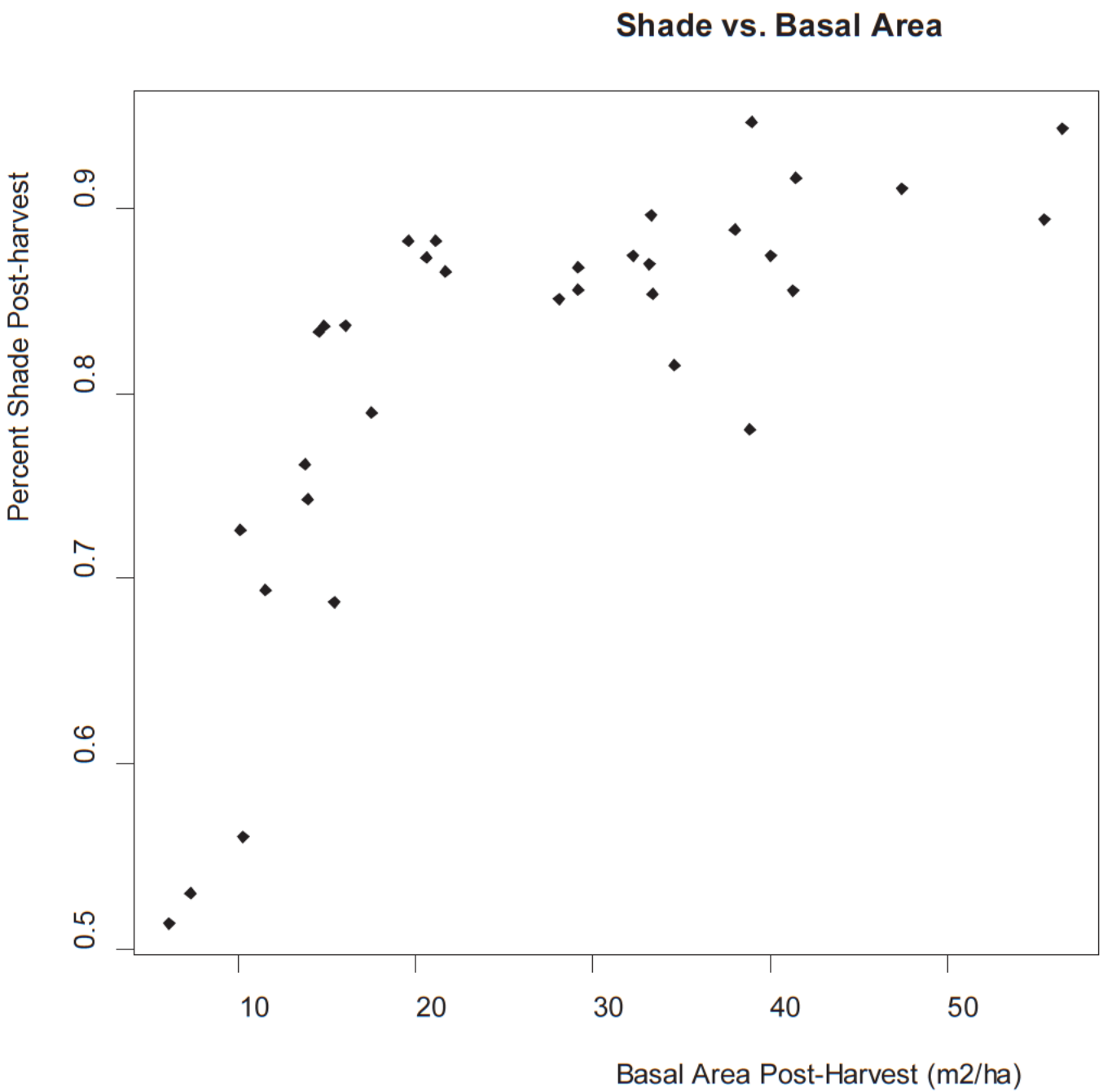
- Trees ~ 100' tall
- Most intense radiation between 10:00 & 2:00
- In summer, trees > 100' have little effect on stream shading at that time

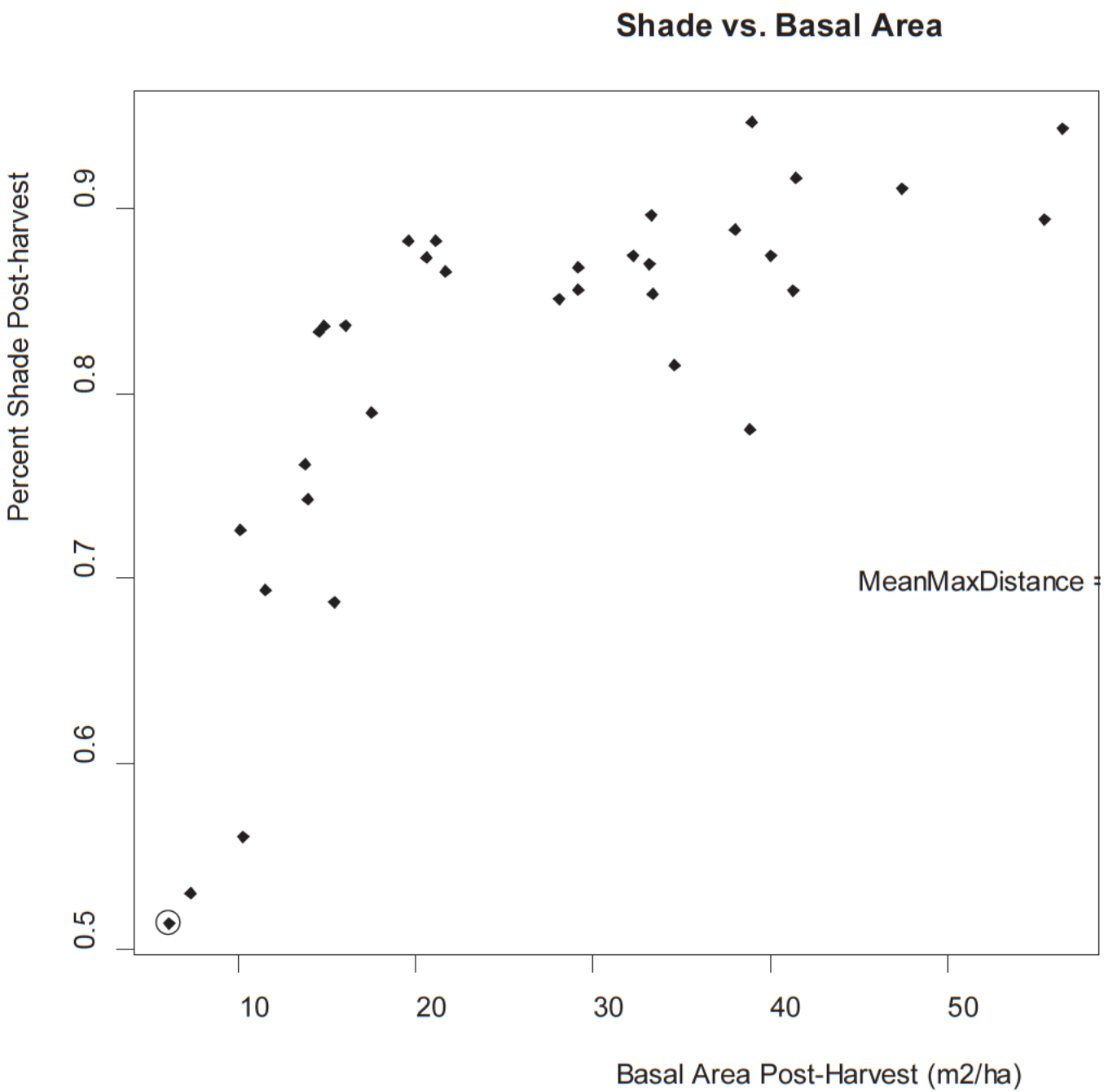


Out to 170'… how to include distance?

- We can include all trees out to 170'
- How do we include a measure of distance in the analysis? (What was the relationship between shade and distance?)
- How do we relate distance to basal area?

Using MeanMaxDist


Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)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Percent Shade Post-harvest
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0.8
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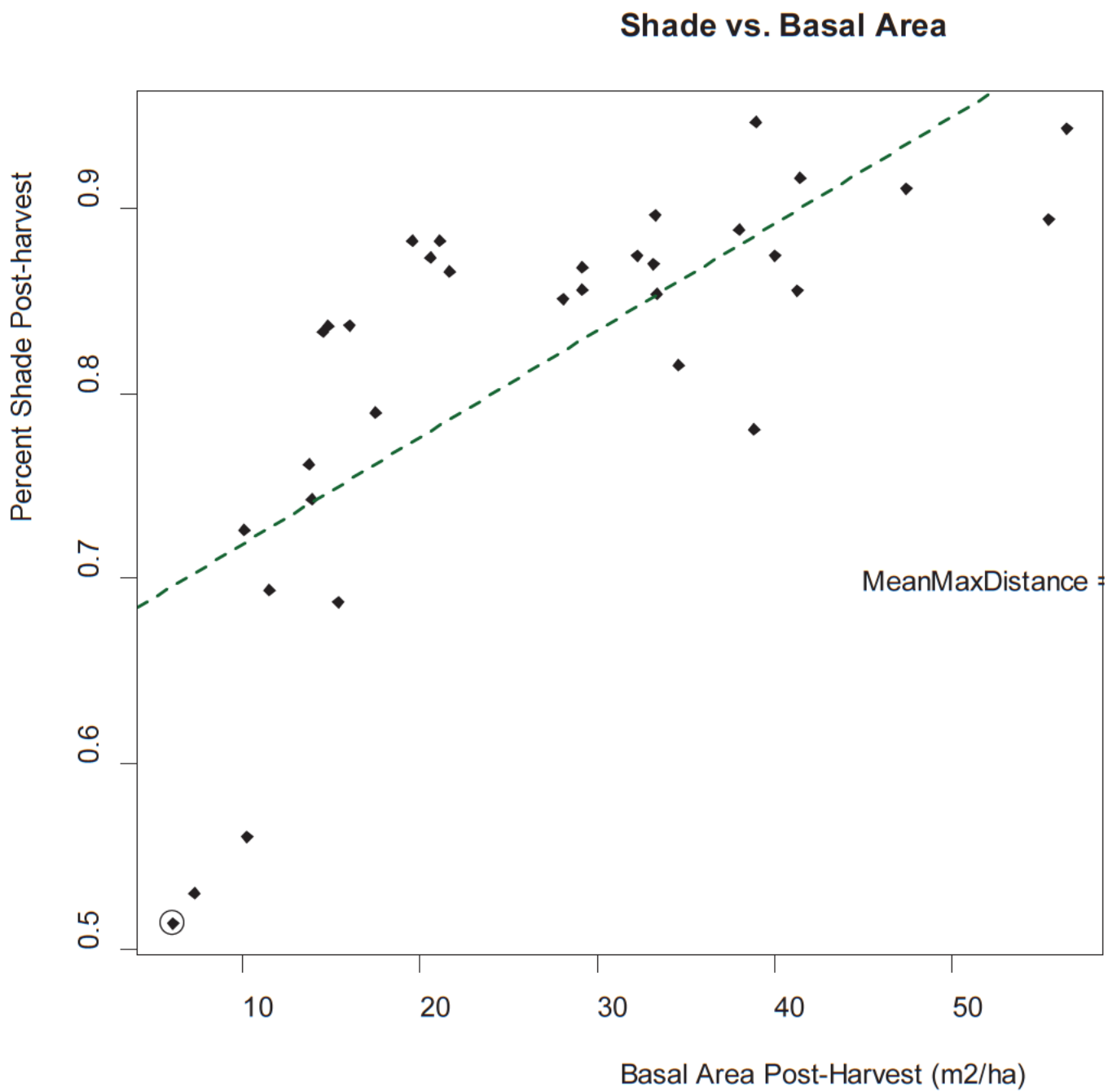
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =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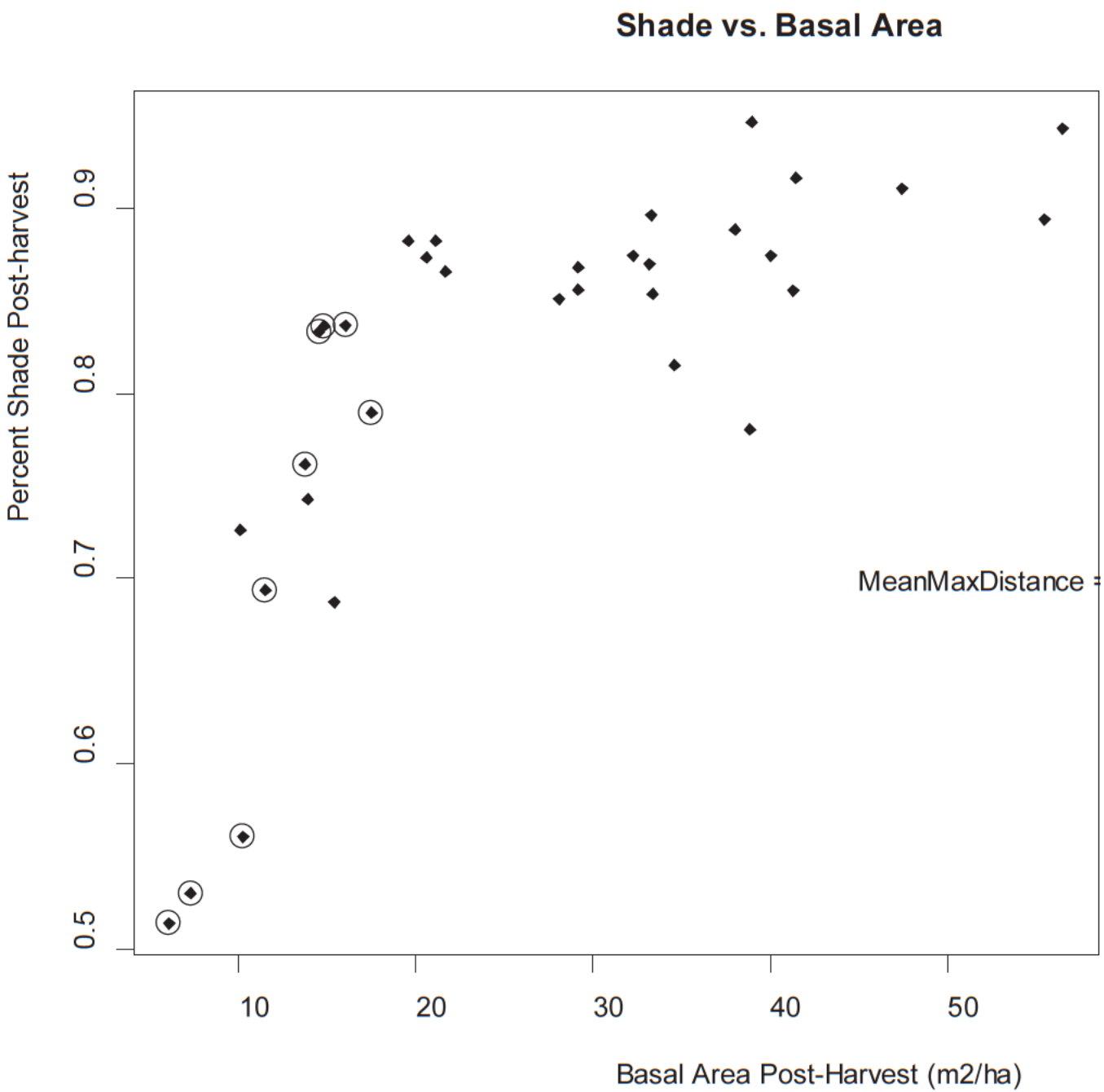
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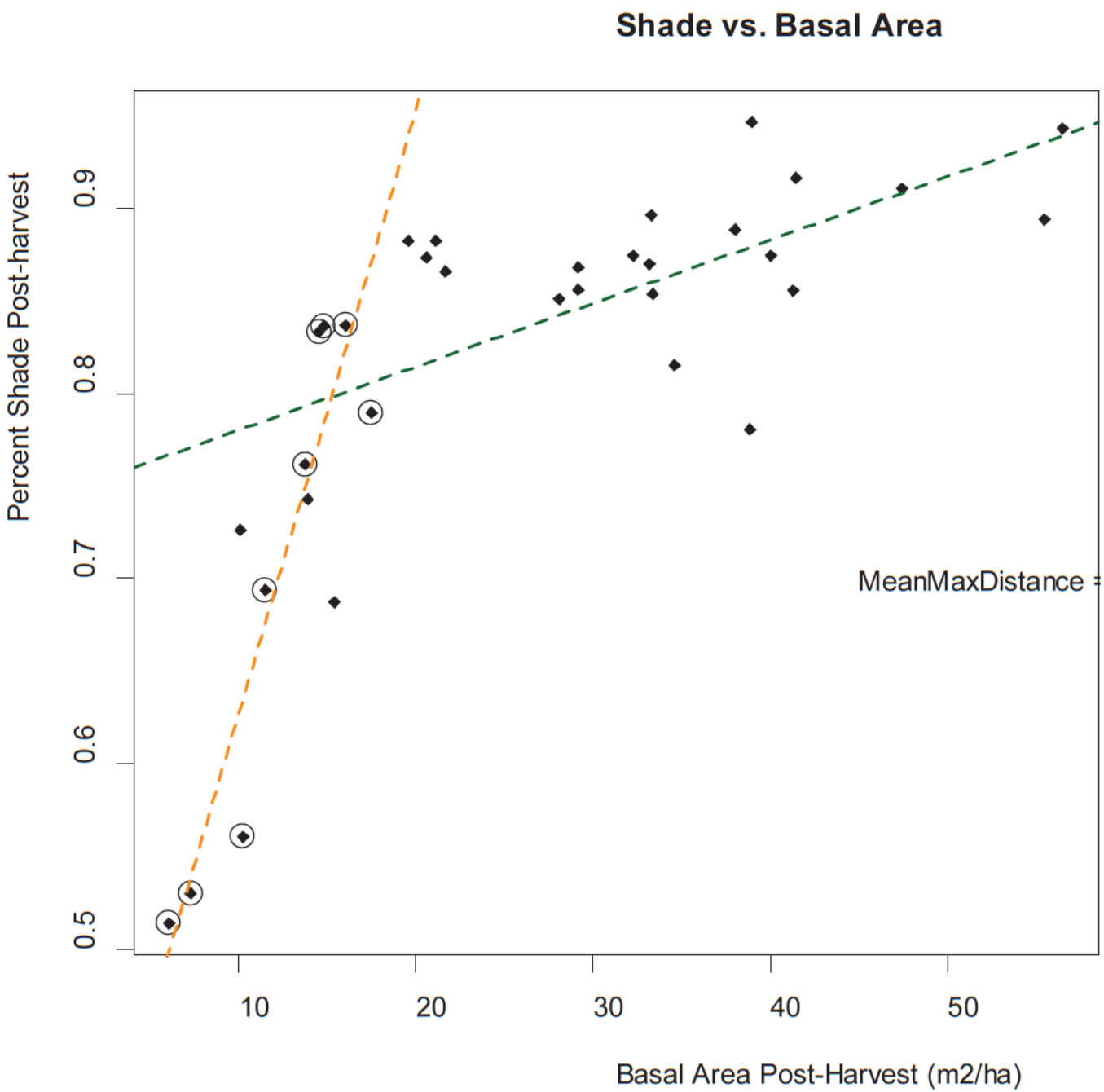
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0.8
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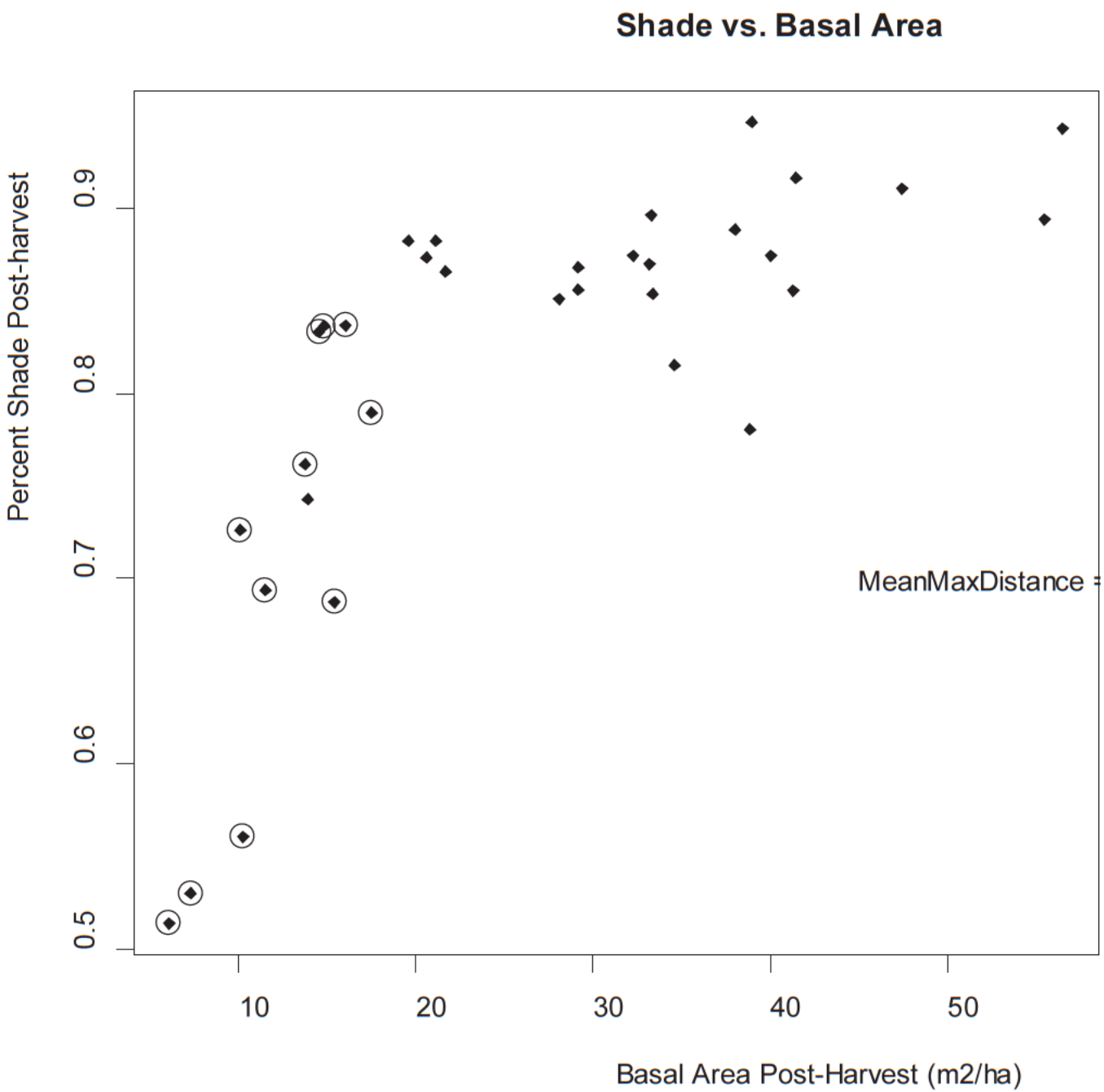
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =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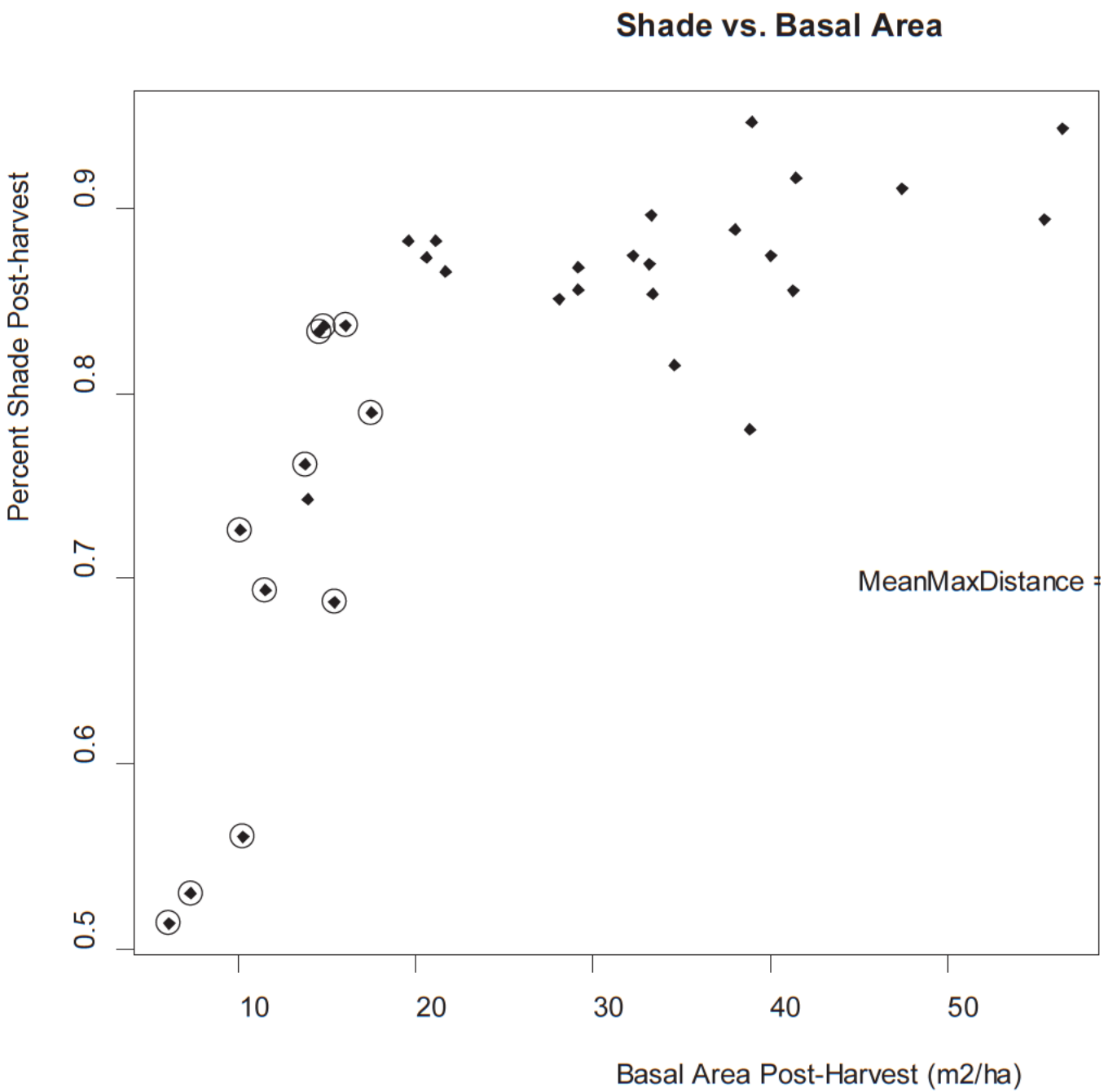
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0.6
0.7
0.8
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10
20
30
40
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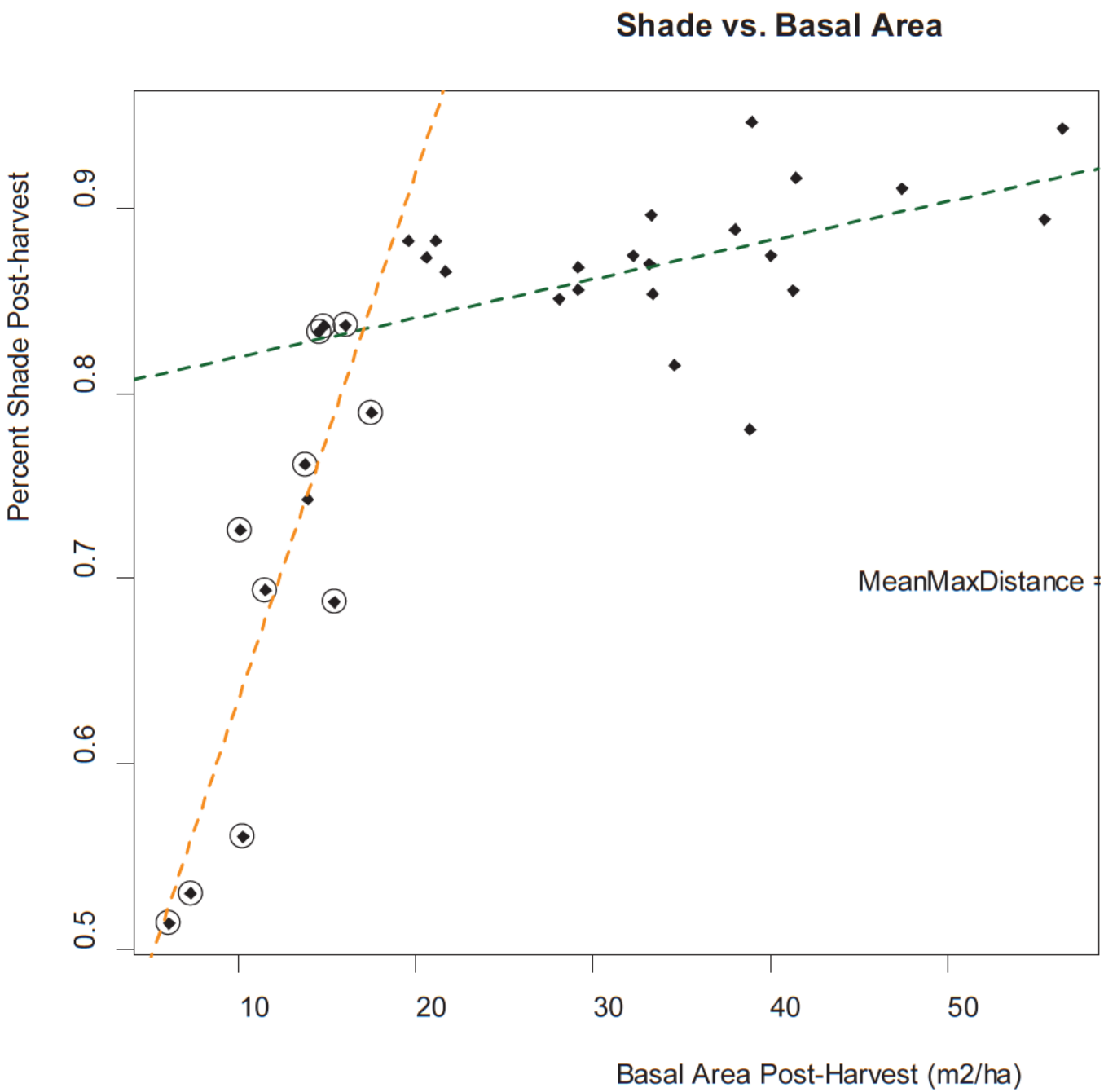
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =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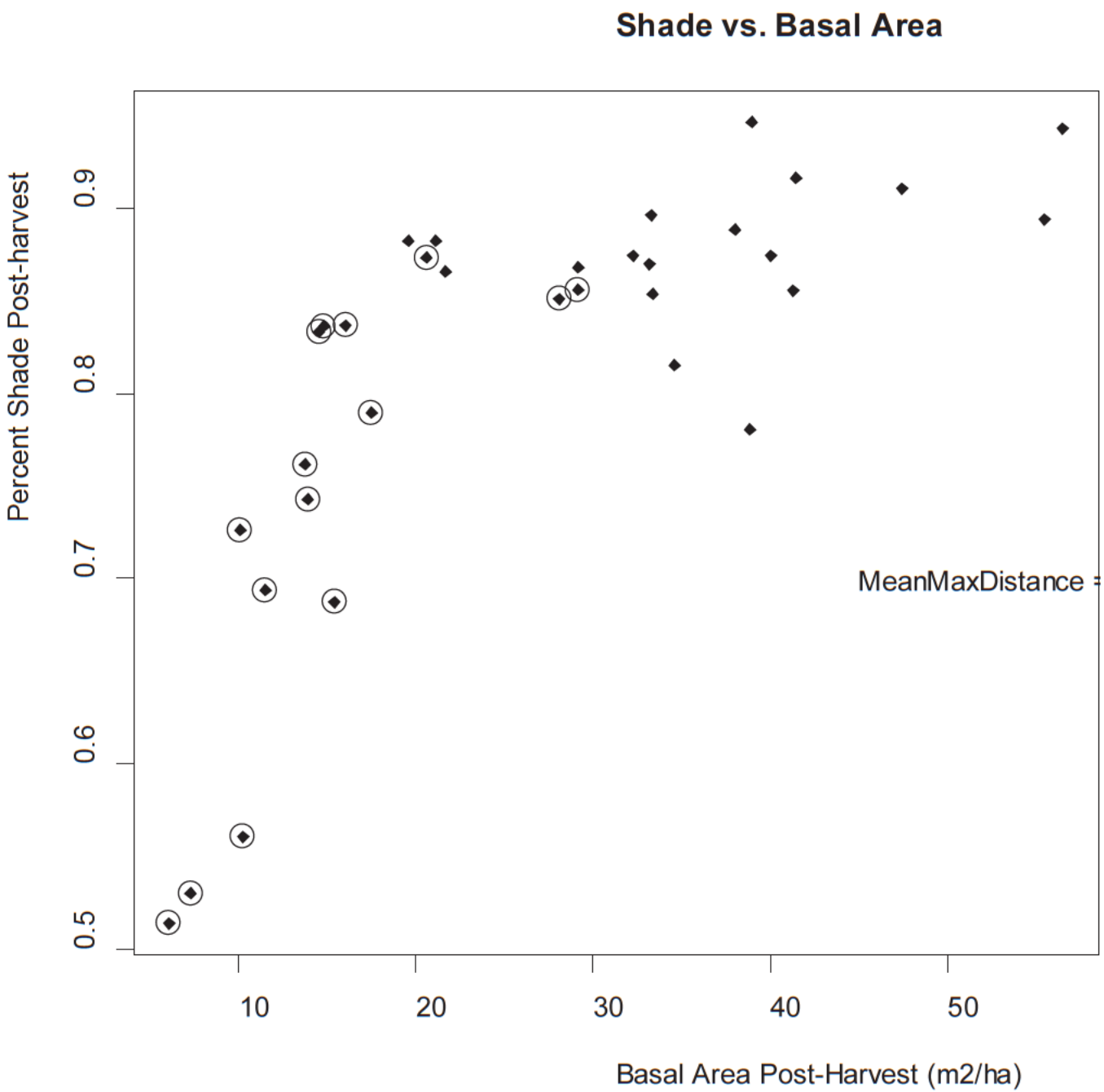
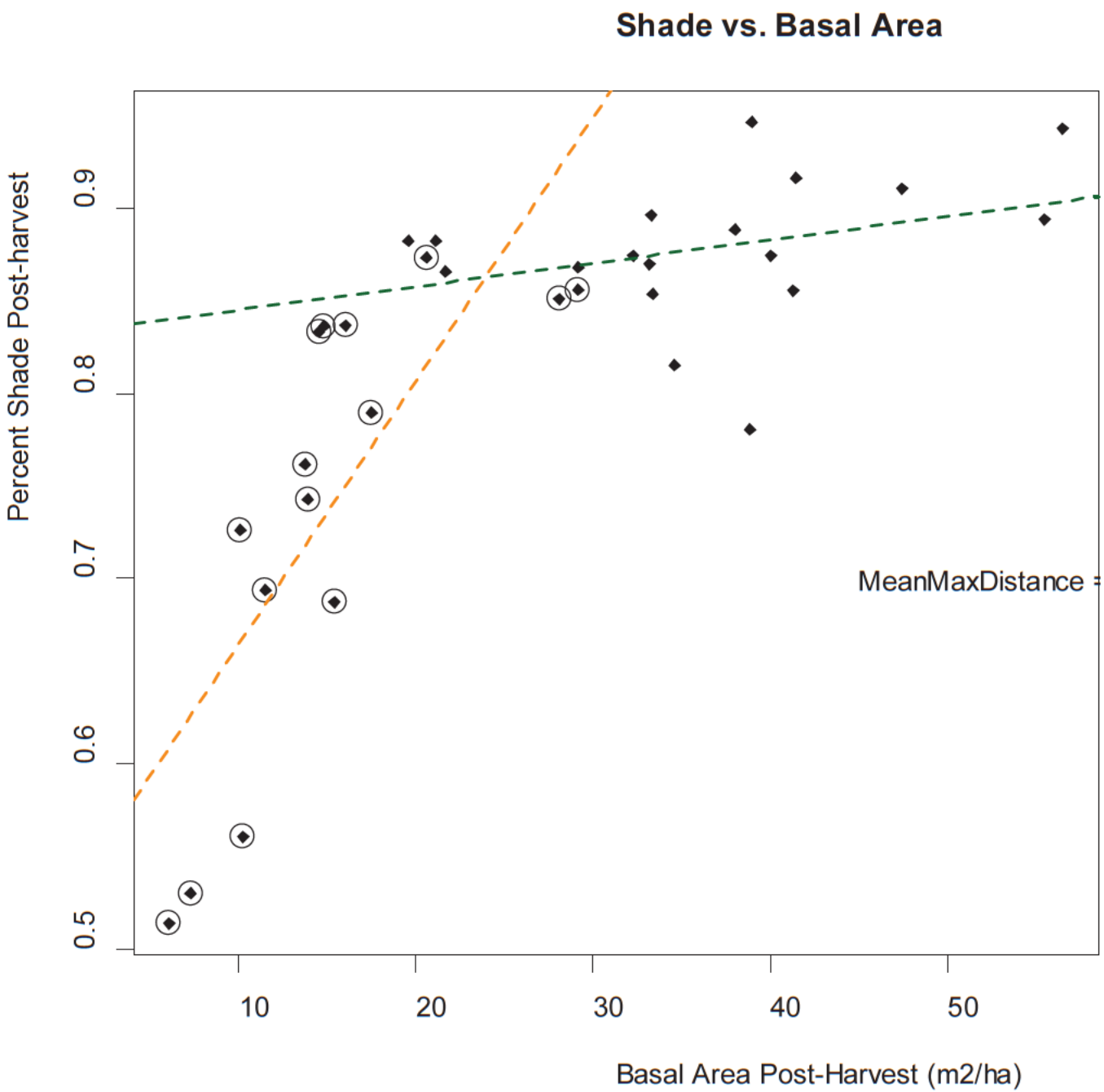
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =


Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =

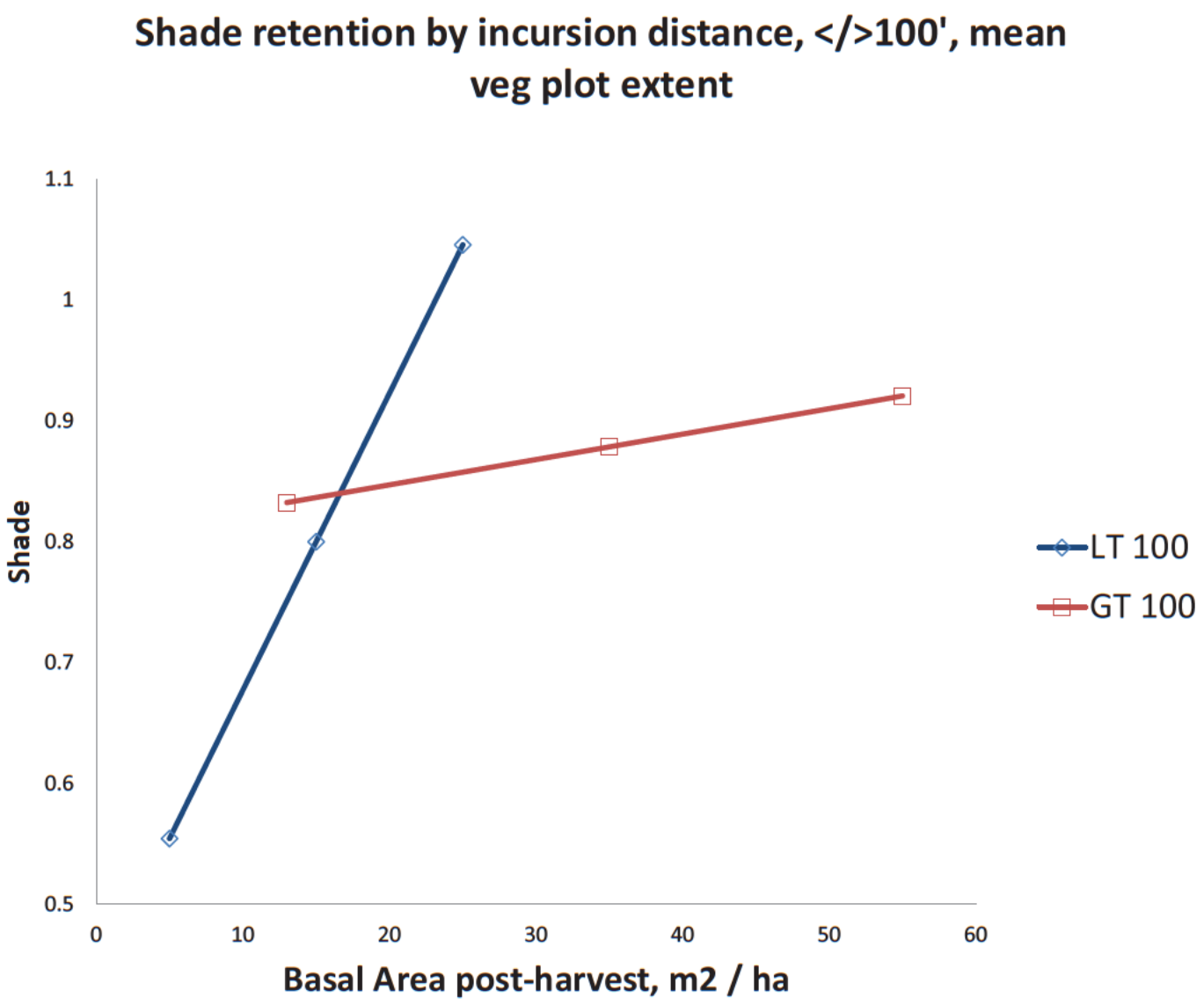

Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =

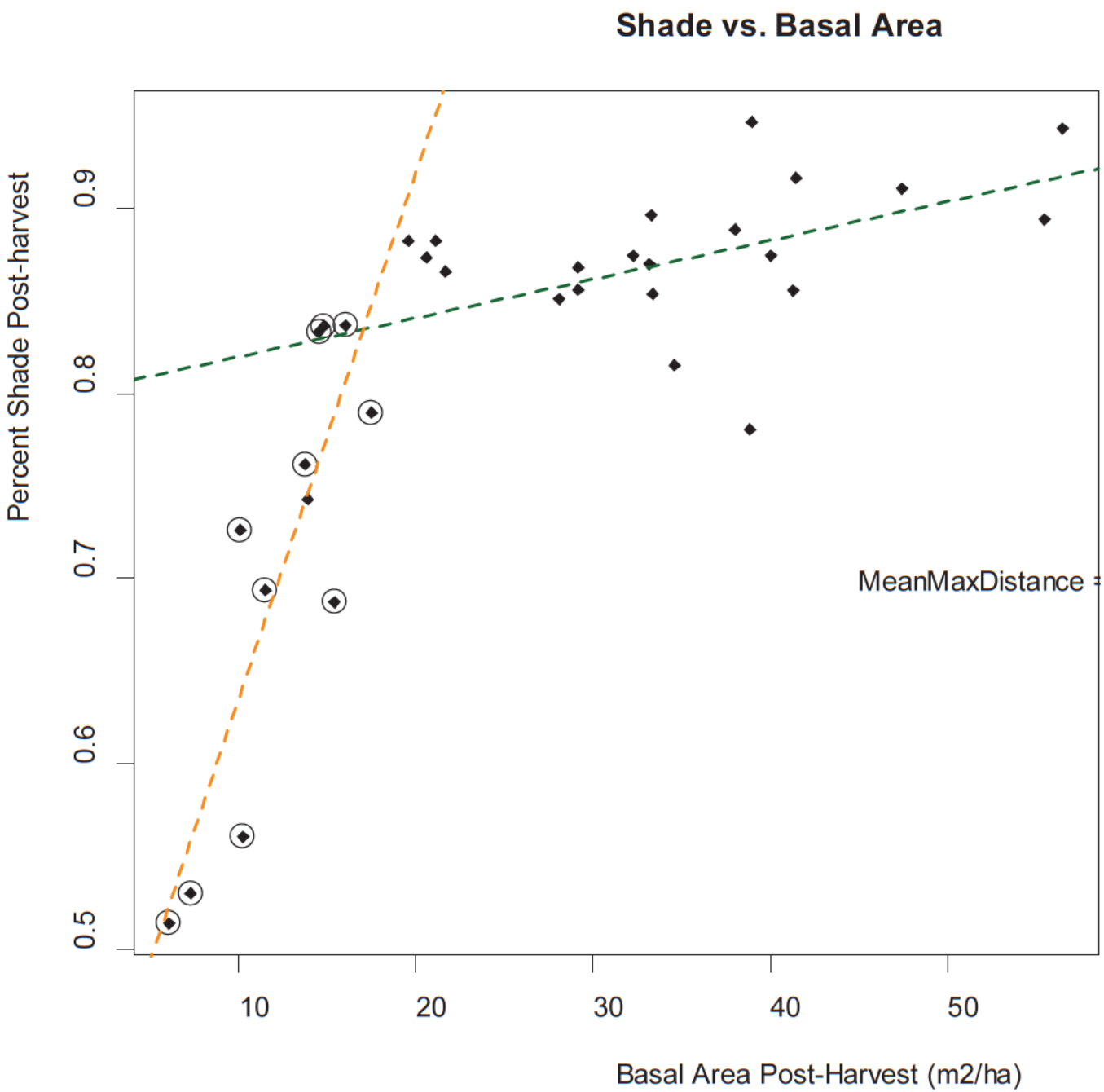
Shade v.2.0

- Pre-harvest: Shade = raw shade data (not modeled)

- Post-harvest:

$$Shade_{Post} = \alpha_{Shade} + \beta_{1Shade} LT100 + \beta_{2Shade} BasalAreaPost170 + \beta_{3Shade} LT100 * Basal\ AreaPost170 + \beta_{4Shade} TreeHeightPre170$$

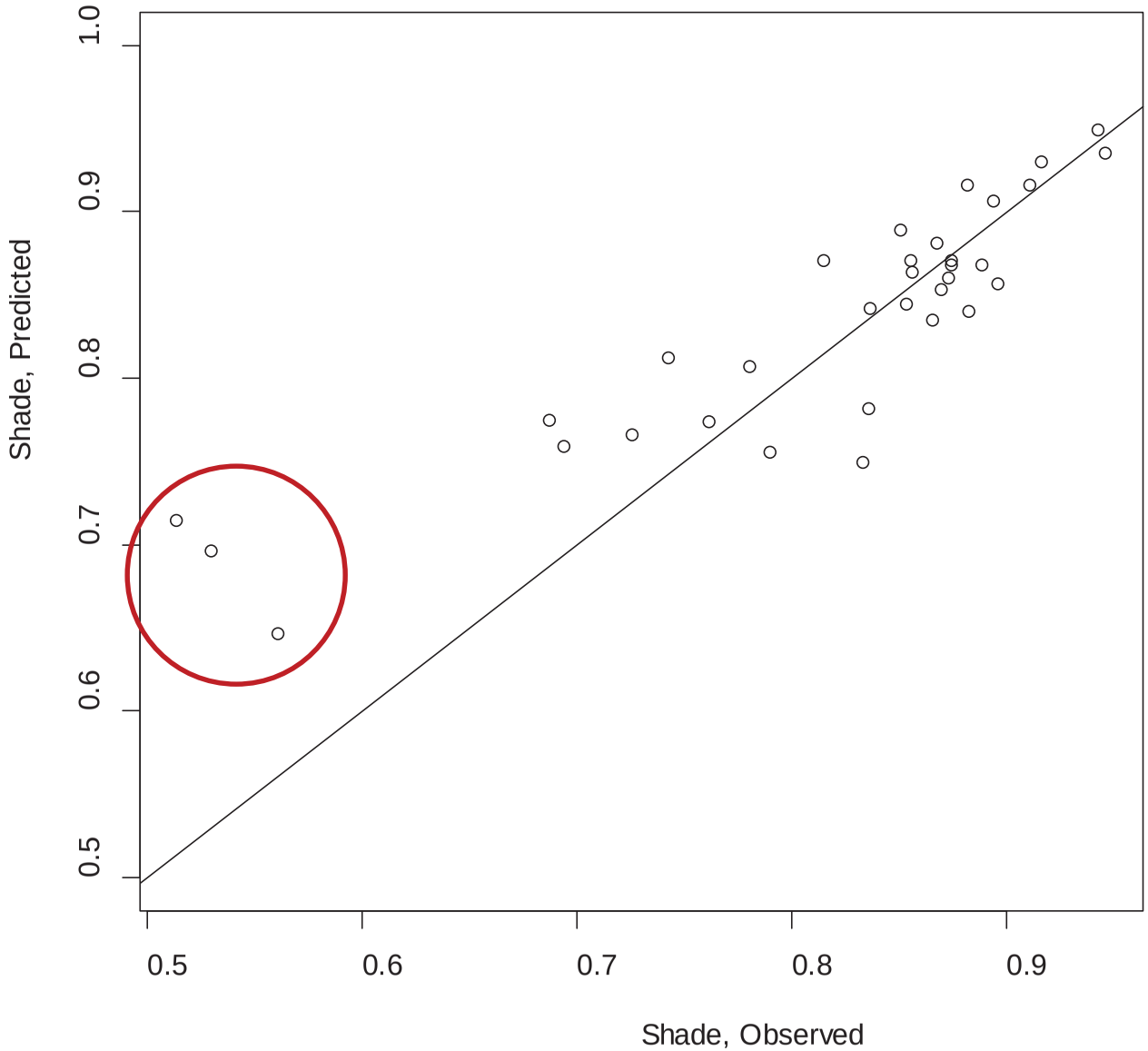

Shade retention by incursion distance, </>100', mean veg plot extent
Shade
1.1
1
0.9
0.8
0.7
0.6
0.5
0
10
20
30
40
50
60
Basal Area post-harvest, m2 / ha
LT 100
GT 100


Shade vs. Basal Area
Percent Shade Post-harvest
0.5
0.6
0.7
0.8
0.9
10
20
30
40
50
Basal Area Post-Harvest (m2/ha)
MeanMaxDistance =

Shade decisions

- Reason to limit BA examined to <100’
- Didn’t like Shade 1 (fit, too many variables, hard to explain)
- Logit of shade?

Shade 1: Observed data vs. Predicted data



Shade 4(?)

- Within 100’ of stream
- Logit shade depends on

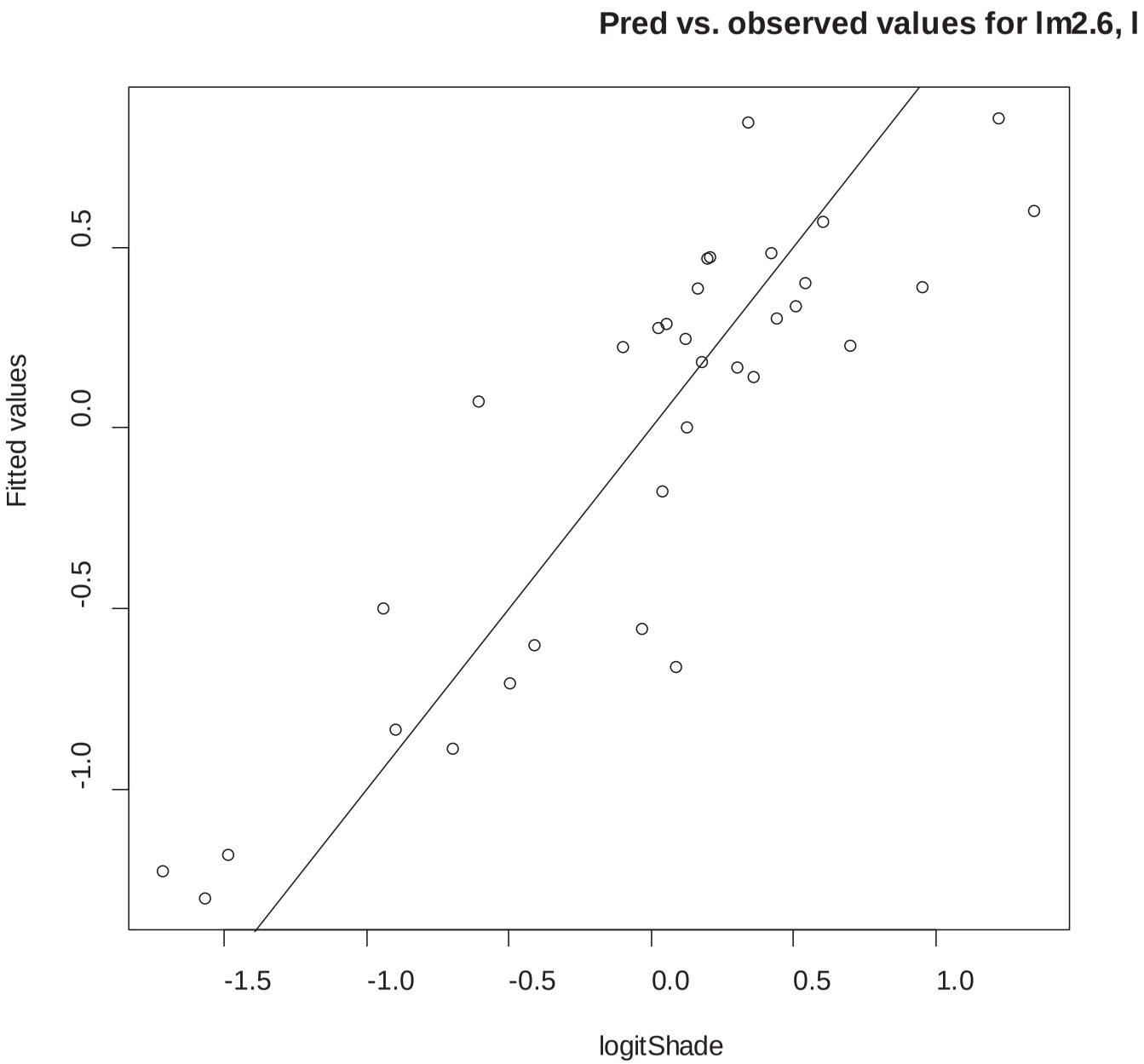
  % difference in basal area

  Percent hardwood (preharvest)

  Tree height (like original model)

[4] $$Logit\ Shade_{Post} = \alpha_{Shade} + \beta_{1Shade} PctDifferenceBA_{100} + \beta_{2Shade} PctHWD_{Pre100} + \beta_{3Shade} TreeHt_{100})$$

$R^2 = 0.78$

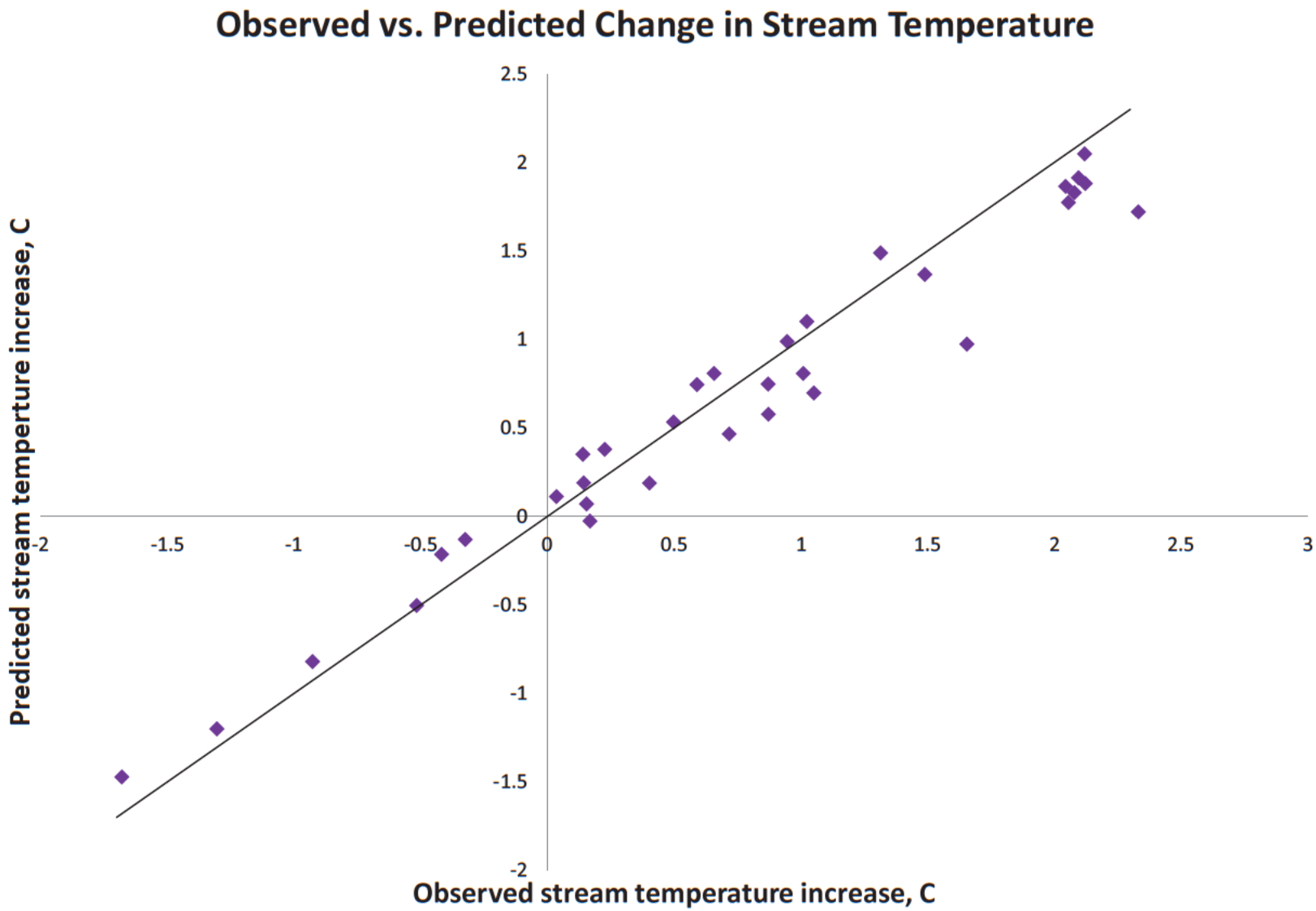

Pred vs. observed values for lm2.6, l
Fitted values
0.5
0.0
-0.5
-1.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
logitShade

Back to the Analysis…

All estimated at once, Shade 4

$$Logit\ Shade_{Post} = \alpha_{Shade} + \beta_{1Shade} PctDifferenceBA_{100} + \beta_{2Shade} PctHWD_{Pre100} + \beta_{3Shade} TreeHt_{100})$$

$$\Delta T_{3-2ij} = \alpha_0 + \alpha_j + (\beta_1 \Delta TControl_{2-1} + \beta_i \Delta TControl_{2-1j}) + \beta_2 TreatmentReachLength + \beta_3 Shade_{Post} + \beta_4 GradientQuartile$$


Observed vs. Predicted Change in Stream Temperature
Predicted stream temperture increase, C
Observed stream temperature increase, C
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3

Prediction

$$\Delta\hat{T}_{3-2ij} = \alpha_0 + \alpha_j + (\beta_1 \Delta TControl_{2-1} + \beta_i \Delta TControl_{2-1j}) + \beta_2 TreatmentReachLength + \beta_3 (inverse\ logit\ of: \alpha_{Shade} + \beta_{1Shade} \boldsymbol{PctDifferenceBA} + \beta_{2Shade} PctHwd_{100} + \beta_{3Shade} TreeHeightPre_{100}) + \beta_4 GradientQuartile$$

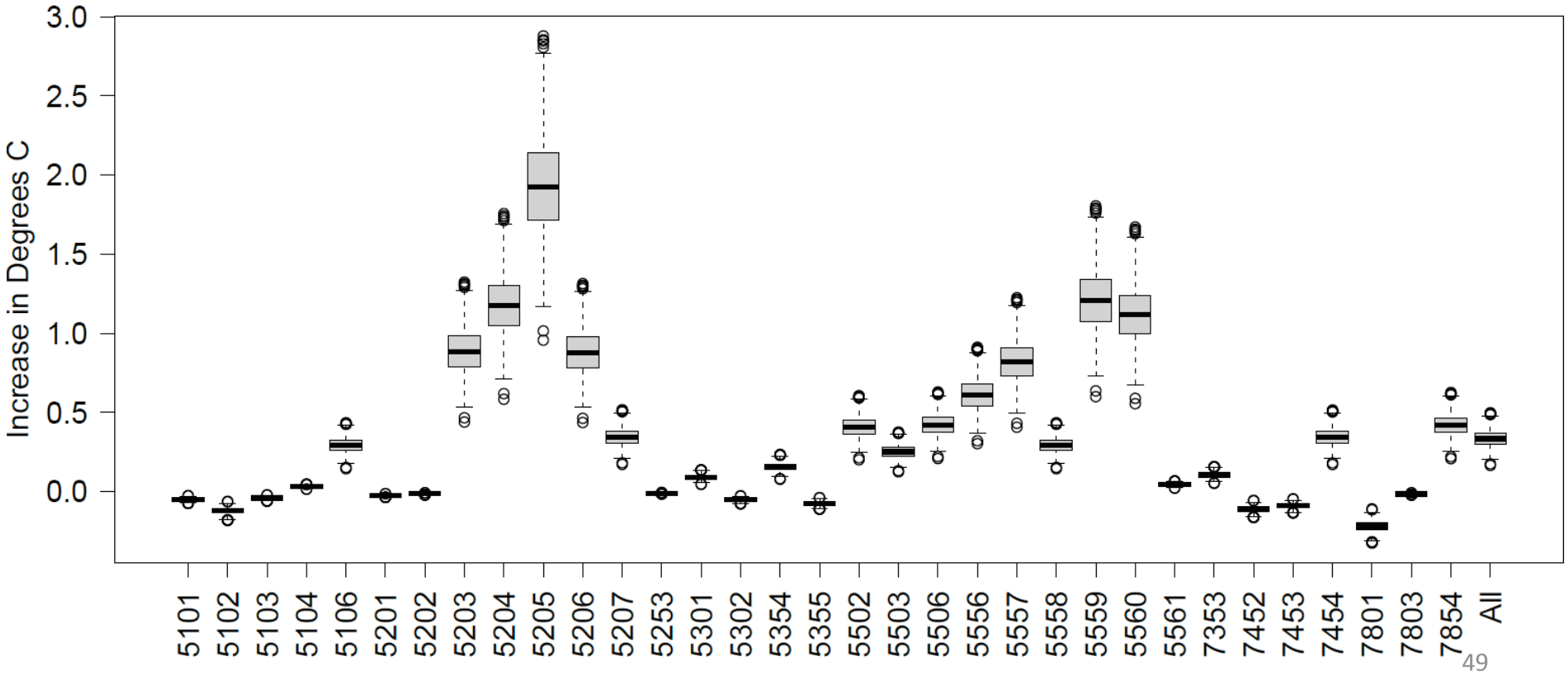
For first year post-harvest, **BA_Reduction** =

1) Simulated change 2) Zero change

→ Subtract these values. Get estimates.

As Harvested – Predicted (Shade 2)

State Mean = 0.001 Private = 0.57



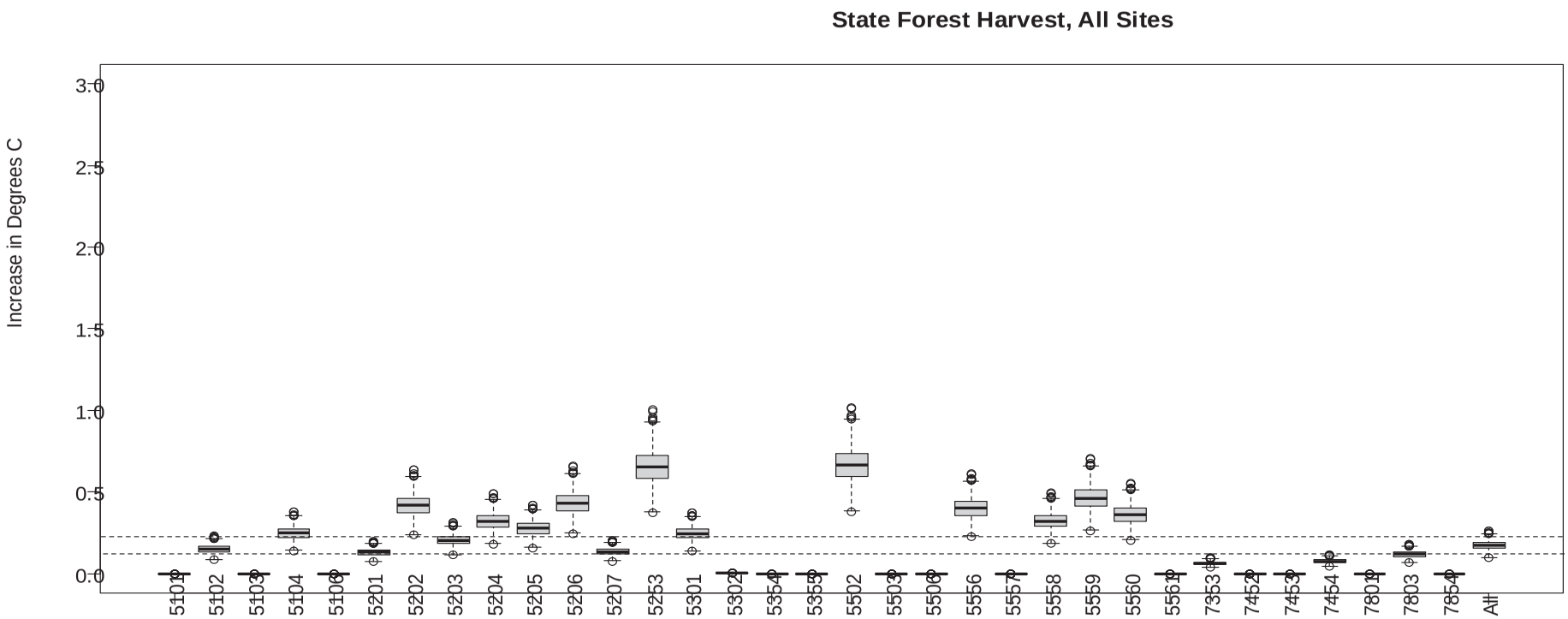
Harvest simulation

- Simulate harvests by specifying:
  - hardwood and conifer BA retention
  - Distance of no-cut buffers
  - Retention by diameter class
  - Number of retention trees
  - SDI
  - Height (harder)
- Report resulting basal area, basal area reduction, harvest distance (LT100)

- Can report other metrics

State Forests – Simulated (Shade 2, < 100’)

Quantiles: 50% = **0.17** 75%= **0.19** 95% = **0.21**



Next Steps

- Statistician input (Friday)
- Finalize shade model selection
- Predictions for SF & Private
  - Incorporating slope distance correction for Private
- Sensitivity analysis
- Explore suite of possible prescriptions
- Write up methods