Dicamba Symptomology Community Science Monitoring Report

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Introduction

Audubon believes that working lands can and should work for birds and people. However, the increasing use of dicamba on Arkansas cropland is putting birds at risk in our agricultural landscape. Research conducted by the University of Arkansas shows that the current dicamba formulations are volatile—the product can move off target in all directions, damaging 1.5-times more acres than are treated. Further, the science shows that high temperatures and humidity levels dramatically increase volatility and thus exacerbate the collateral damage. Audubon predicts that in a landscape full of GMO crops, the atmospheric loading of volatile dicamba could be enough to cause landscape scale damage to our state natural areas, wildlife management areas, national wildlife refuges, family farms, and the wildlife they harbor.

To test this prediction and gain a better understanding of the geographic extent of the threat, Audubon Arkansas initiated a community science monitoring project in 2019 and 2020. Continuing in Audubon's 100+ year tradition of recruiting and training volunteers to collect data, Audubon Arkansas built a reporting application and trained volunteers to search for signs of dicamba symptoms on native and ornamental plants primarily across eastern Arkansas.

Methods

Audubon trained volunteers to look for symptoms associated with a plant growth regulator (PGR) herbicide, including leaf cupping, epinasty, and chlorosis. They were instructed to look for more than one symptom on a plant, uniform symptomology across a plant, and for incidents where multiple plants and species in an area displayed symptoms. Volunteers used a customized version of the free ArcGIS Collector app to record data. Data fields included: observer name (optional), observation date, location name, species (if known), and comments (optional). They also took and uploaded one or more photos of the vegetation through the app. The app automatically recorded coordinates with each submission. Monitoring and reporting occurred from June 1 to August 25, 2019, and June 22 to August 13, 2020. In 2020 the project's launch was delayed due to coronavirus concerns and restrictions. Volunteers were instructed to stay on public property, though they could also submit data from their own property or others' private property with permission. An expert on dicamba symptomology from outside Arkansas reviewed photos and rated them as probably, possibly, or unlikely showing symptoms consistent with a PGR herbicide.

Results

Audubon staff and trained volunteers collectively submitted 243 records and 728 photos in 2019, and 123 records and 737 photos in 2020. Observations were made across 20 counties: Arkansas, Clay, Craighead, Crittenden, Cross, Desha, Greene, Jackson, Jefferson, Lee, Lincoln, Lonoke, Mississippi, Monroe, Phillips, Poinsett, Prairie, Pulaski, St. Francis, Woodruff (Fig. 1). Of all the records submitted, in

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2019, 178 contained at least one photo showing symptoms probably consistent with a PGR herbicide, and 65 possibly showing such symptoms, while in 2020, 116 contained at least one photo showing probable PGR herbicide symptoms, and 4 possibly showing such symptoms (Table 1). The remainder were judged to show an issue other than PGR herbicide drift, had photos of insufficient quality to assess, or did not have an associated photo. Photos showing probable PGR herbicide symptoms were taken throughout the survey seasons from the first day to the last. Eleven sites where symptoms were documented in 2019 were revisited in 2020 and once again showed symptoms including Lon Mann Cotton Research Station, Keiser Northeast Research and Extension Station, Delta Heritage Trail State Park Lick Creek Access, and Marked Tree Cemetery. Species displaying probable or possible symptoms include Carolina buckthorn, catalpa, elms, grapes, hackberry, hibiscus, magnolias, maples, morning glory, mulberry, oaks, pears, pecan, peppervine, pokeweed, poison ivy, redbud, smooth sumac, sunflowers, sweetgum, sycamore, trumpetvine, tuliptree, Virginia creeper, Virginia crownbeard, and white poplar (Figs. 2-6). Sycamore was the most frequently reported species, with probable symptoms documented at 96 locations. Most of these plants are listed in National Audubon Society's Plants for Birds database (audubon.org/native-plants) as providing food birds, including insects that most landbird species need to feed their young.

Symptoms were documented on a variety of public lands including 4 university research farms, 37 cemeteries, 22 churchyards, 8 Arkansas Game & Fish Commission properties, 6 state natural areas, 4 city parks, 2 national wildlife refuges, 2 state park, the Helena Welcome Center, Brinkley Convention Center, Blytheville Public Library, Mack's Prairie Wings, Stuttgart Airport, Arkansas Northeast College, and many county and state roads.

Locations where plant tissue samples (mostly pigweed) tested positive for dicamba in 2019, according to Plant Board records, were mapped alongside volunteer observations with photos assessed as probable or possible. There were 15 locations where volunteer observations occurred within two miles of dicamba-positive samples, as measured between sampling coordinates (Fig. 7). The actual distance from spraying was likely closer if exact edge-of-field distances could be used. The University of Arkansas Northeast Research and Extension Center at Keiser is one of those locations, where more than experimental soybeans showed symptoms.

While searching for symptoms on public lands in 2020, Audubon staff and volunteers noted soybean and cotton fields with pigweed that was showing signs of having been recently sprayed, i.e. dicamba was used past the May 25 cutoff. Ninety-four locations were submitted to the Plant Board with a request for inspectors to take pigweed tissue samples (Fig. 8). Forty-two were within a mile of where PGR herbicide symptoms were observed on native plants, some immediately adjacent. Some locations were also adjacent to an entire field of cupping soybeans, a well-established sign of dicamba use in the landscape.

Discussion

The data support Audubon Arkansas's prediction that using dicamba during warm weather can have landscape scale off-target impacts. A case in point is Chalk Bluff Natural Area, a 55-acre state preserve in Clay Co. on the St. Francis River. Every oak, every elm, every redbud, and many other species showed leaf cupping (Fig. 8). Symptomatic trees and vines were observed along the entrance road, in the parking lot, and in the interior all along a hiking trail, including at river overlooks. Pasture and forest border this natural area, but cotton is grown as close as a mile away, and throughout the region. Cupping soybeans

were observed a mile away as well as scattered across Clay Co. The Missouri Bootheel region is an area of high dicamba use.

Audubon has concerns about dicamba's effect on an endangered species. Pondberry grows at Swifton Sand Ponds Natural Area (Jackson Co.) and Stateline Sand Ponds Natural Area (Clay Co.), which are surrounded by row crops on three sides and are embedded in landscapes dominated by row crops. Vegetation along the edges of both natural areas showed symptoms, as did a few oaks into the interior. The soybean field on the south side of Stateline Sand Ponds had dying pigweed along its edge on July 24, 2020, which was as close as 0.2 miles from the natural area boundary. If dicamba could be legally sprayed in Arkansas well into the summer months, it is not unreasonable to predict that a 57-foot buffer would be insufficient to protect Pondberry from this herbicide. Similarly, symptoms were documented along the edge and interior of Pine City Natural Area (Monroe Co.) on July 6, 2020. This site hosts the only population of the endangered Red-cockaded Woodpecker in the Delta.

If anything, photo-documentation is an under-representation given the number of poor quality photos that could not be assessed. That is partly due to the difficulty volunteers had with photographing leaves on trees that are beyond their reach, and to unfavorable lighting conditions for taking photos. Though photos of symptoms consistent with PGR herbicide contact are not necessarily proof of dicamba drift, Audubon's supposition is strongly supported given the widespread use of dicamba during the 2019 and 2020 growing seasons. Proof of dicamba use after the May 25 cutoff is in the 233 tissue samples collected from 94 sites in 2019 that tested positive for dicamba (Fig. 9), resulting in 100 violations for dicamba misuse so far. So far in 2020, out of the 41 dicamba-related case files with tissue sampling, 29 sites have tissue samples that tested positive for dicamba (Fig. 9). The geographic scope of these samples is on par with Audubon's data, and pair up with volunteer observations at 30 locations across years despite being independently collected datasets. Of all the tissue samples collected by inspectors for the purposes of testing for dicamba, samples from 13 sites tested positive for 2,4-D only. Further, 2,4-D was detected in conjunction with dicamba at only one site in 2020. This suggests that 2,4-D is much less likely than dicamba to be responsible for most of Audubon's observations. Audubon will continue to review the 2020 case files as they become available.

The number of misuse complaints due to damage to private property the Plant Board receives is itself an under-representation of the extent of dicamba's off-target impacts, limited by the number of inspectors proactively investigating and number of citizens willing to file a complaint. Certainly the number of complaints due to soybean and cotton damage will decline as the acreage of GMO crops increases, making it an inadequate metric for assessing dicamba's off-target impacts. Monitoring and tissue sampling of native and ornamental vegetation will help reveal the true extent of damage that dicamba can cause to the landscape and to bird habitat. This needs to be part of the Plant Board's protocol and deliberation for volatile herbicides like dicamba, if not all herbicides. Unfortunately, federal and state natural areas, city parks, cemeteries, churchyards, and backyards are largely out of the purview of the Plant Board, despite being directly affected by their decisions. There is no requirement for the Plant Board to consult with state conservation agencies on the use of herbicides that impact the lands they manage. There is no compensation for the private land owner who loses trees or gardens due to repeated herbicide exposure. The trend is only towards even more widespread PGR herbicide use with continued adoption of Xtend soybeans and cotton, and with Enlist E3 soybeans and XtendFlex corn on the horizon. The Plant Board must keep to its mission to serve both the regulated industries and the general public as it moves forward with its regulatory decisions. The purpose of Arkansas's regulations

on pesticide use is to "...minimize the adverse effects of certain pesticides to: 1. Plants, including forage plants, or adjacent or nearby lands; 2. Wildlife in the adjoining or nearby areas; 3. Fish and other aquatic life in waters in reasonable proximity to the area to be treated; and 4. Humans, animals, or beneficial insects." Current regulations on dicamba are not serving their purpose.

Recommendations

- Dicamba's volatility is related to temperature. A temperature restriction using the forecasted high for the day of application and for the five-day forecast following application date, regardless of calendar date, should reduce off-target impacts. Use the best available science to determine the temperature cutoff.
- Request data and observations from other states concerning off-target impacts to native and ornamental plants. In addition to state departments of agriculture, consult university researchers and non-profits. For example, Dr. John Ball, South Dakota State University Extension Forestry Specialist, is conducting multi-state research on the effects of dicamba on trees, while the Prairie Rivers Network is leading its own community science effort to document herbicide symptoms on native plants in Illinois. Audubon Arkansas's data contribute to the mounting evidence that a rise in dicamba use will lead to a decline in wildlife habitat health.
- When collecting pigweed tissue for testing, inspectors should also collect samples from nearby woody and herbaceous native plants that display PGR symptoms.
- Establish buffers for public recreation areas, private property, and other areas with sensitive plants such as cemeteries. These places need protection from chemical trespass.

Figure 1. Locations of all observations made by Audubon staff and volunteers in 2019 and 2020 where at least one photo showed symptoms probably or possibly consistent with a plant growth regulator herbicide.

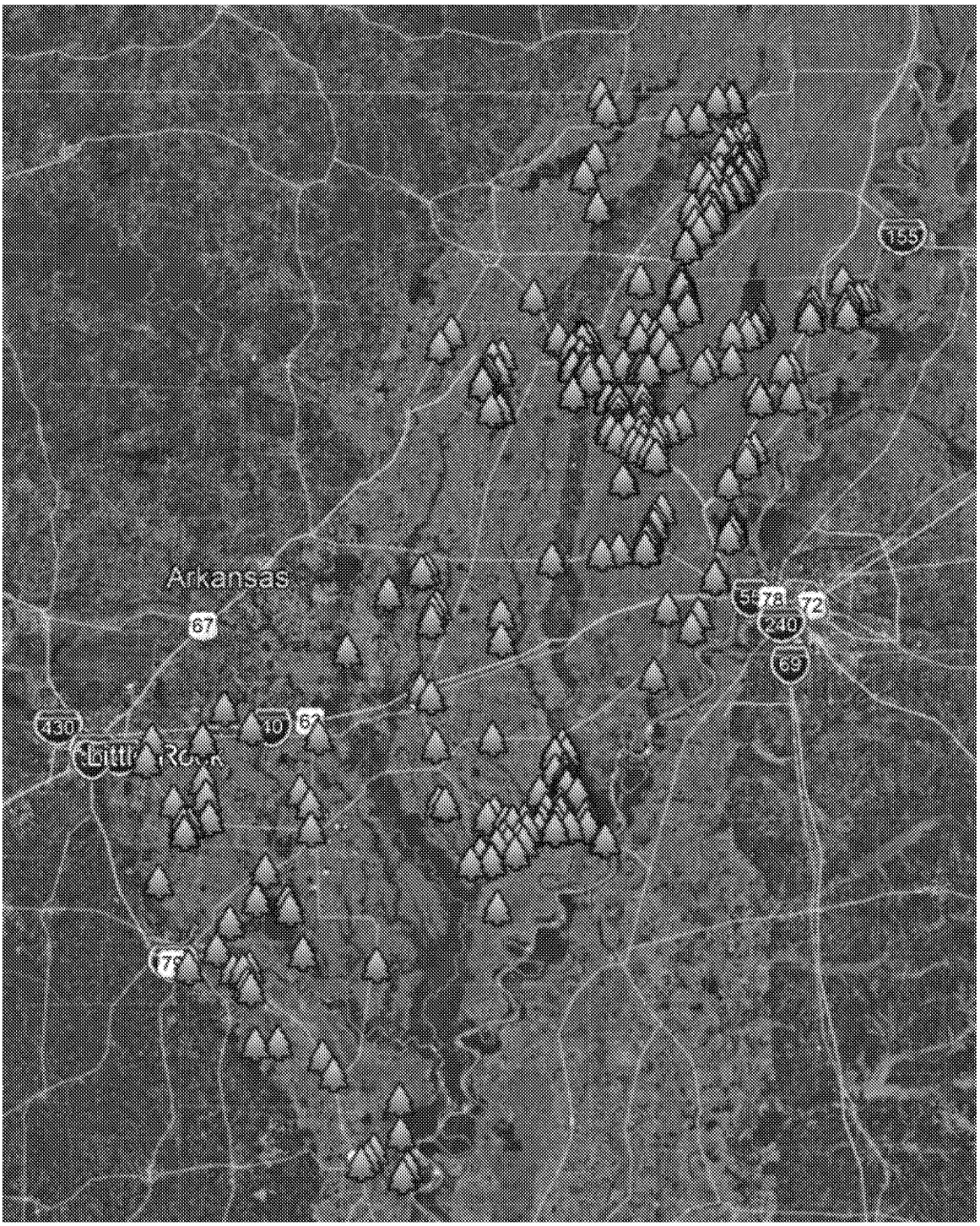


Figure 2. Mulberry showing plant growth regulator herbicide symptoms along Clay County Rd. 536 on August 25, 2019. Many birds rely on mulberry fruit to fuel them during spring migration.

Figure 3. A sycamore showing plant growth regulator herbicide symptoms at Mulberry Cemetery south of England, Lonoke Co, on July 10, 2019. This is one of 37 cemeteries in eastern Arkansas where multiple trees show symptoms. These cemeteries are typically small and surrounded by row crops, making them susceptible to chemical trespass.

Figure 4. An oak showing severe plant growth regulator herbicide symptoms at the Lick Creek access to Delta Heritage Trail State Park, Phillips Co. Will caterpillars feed on such leaves? Across the street was a soybean field where recently sprayed pigweed was observed on July 1, 2020. This site showed symptoms in 2019. How many years can a tree withstand exposure before dying?

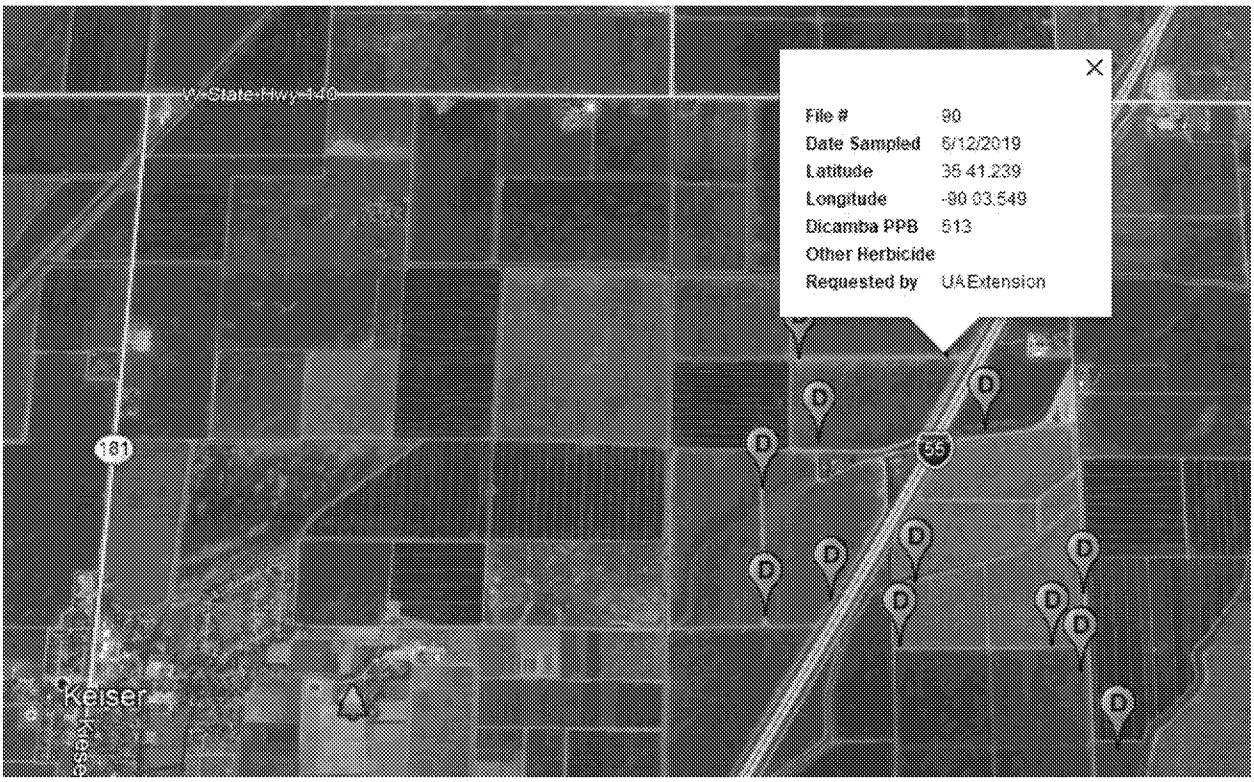
Figure 5. A hibiscus in a yard on the west side of Lon Mann Cotton Research Station, Lee Co., showing plant growth regulator herbicide symptoms on July 25, 2019. Dicamba-positive pigweed tissue was collected by a Plant Board inspector on July 17, 2019, from a farm to the east of the station. On July 1, 2020, all five tuliptrees in the parking lot of the station showed extensive cupping, as did other species.

Figure 6. Plant growth regulator herbicide symptoms on pawpaw in the interior of Chalk Bluff Natural Area, Clay Co., on July 27, 2020. Birds and mammals feed on pawpaw fruit. Zebra Swallowtail caterpillars eat only pawpaws.

Figure 7. Examples from the 15 areas where dicamba-positive plant tissue samples (red marker with letter D) were collected within two miles of where plant growth regulator herbicide symptoms were observed on native or ornamental plants (green tree marker) in 2019. The white boxes show Plant Board data from one tissue sample.

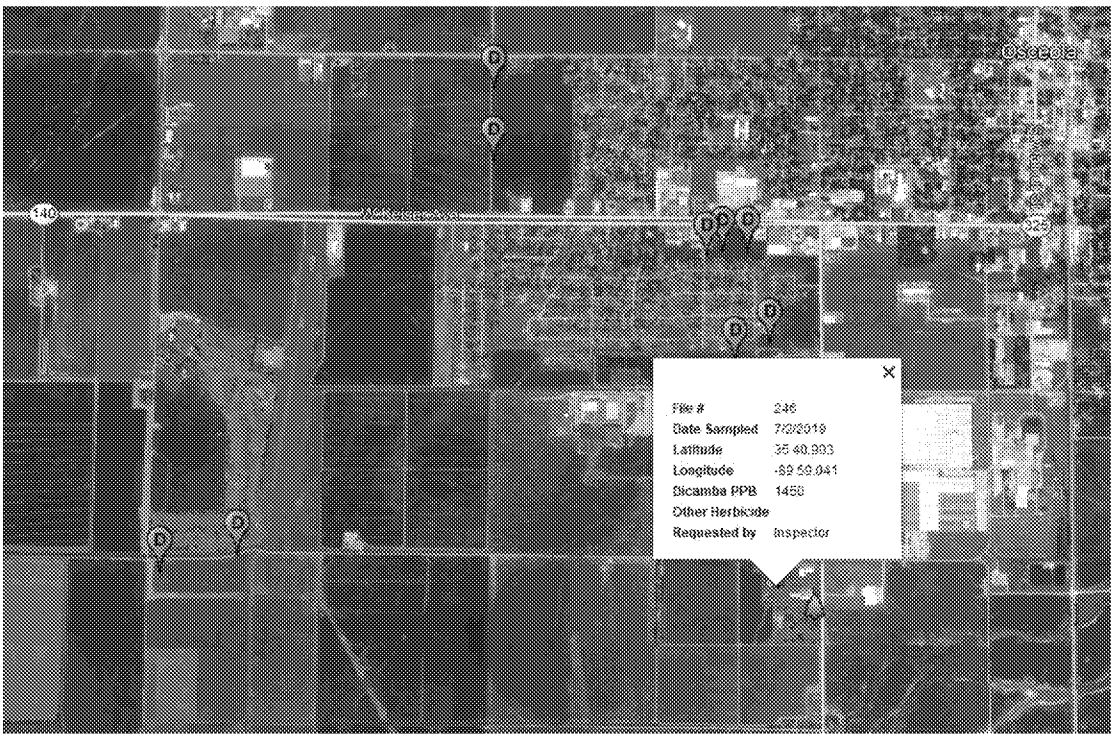
a. Big Lake area, Mississippi Co.

b. Research stations such as the University of Arkansas Northeast Research and Extension Station at Keiser, Lee Co., are supposed to be protected by a one-mile buffer.



c. University of Arkansas Lon Mann Cotton Research Station, Lee Co.

d. Osceola, Mississippi Co.



e. Wilson area, Mississippi Co.

Figure 8. Ninety-four locations where pigweed was showing signs of being recently sprayed in soybean and cotton fields, made from June 6 through August 10, 2020. These locations have been reported to the Arkansas State Plant Board with a request that pigweed tissue samples be taken.

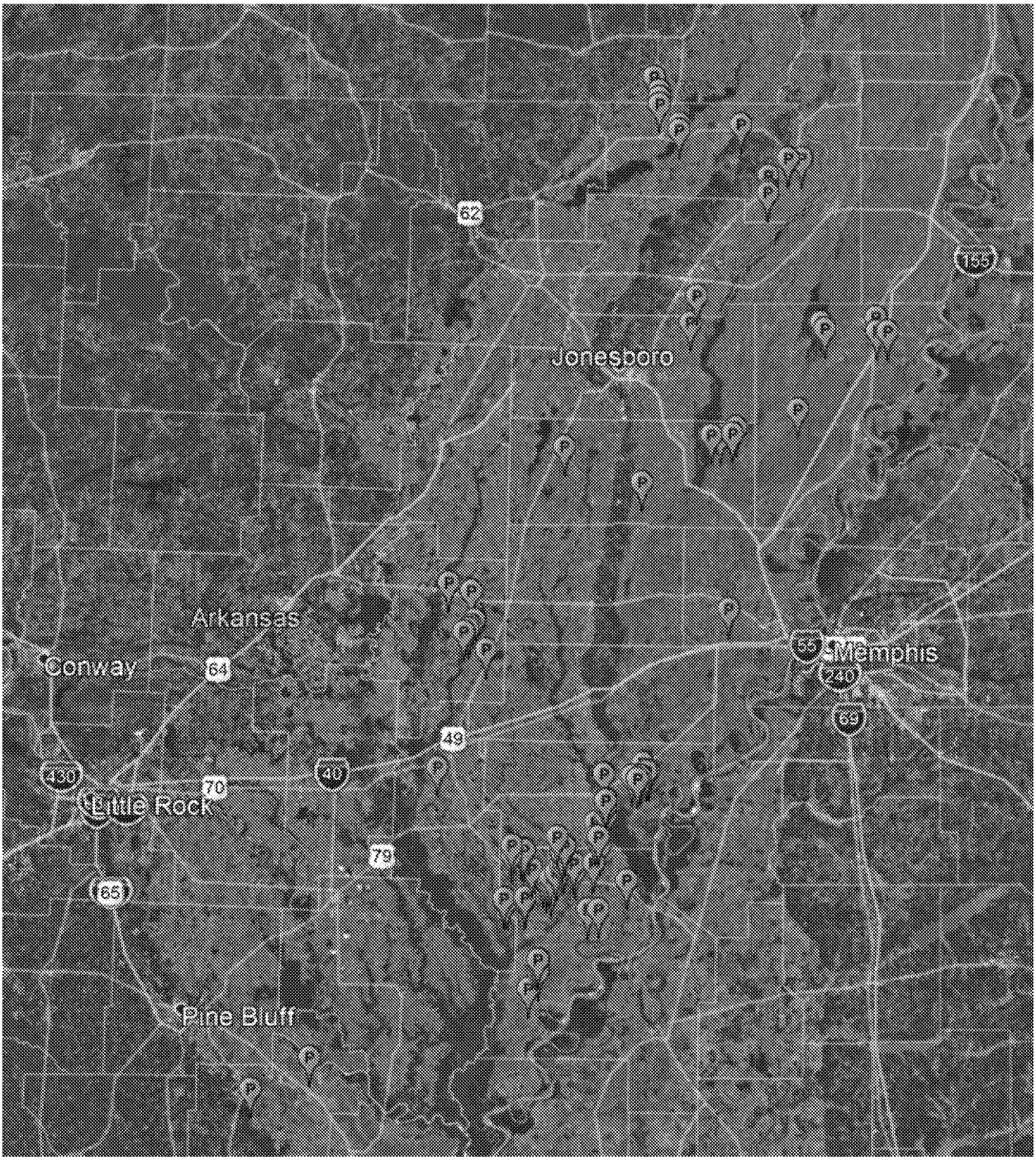


Figure 9. One-hundred and twenty-three locations where vegetation tissue samples collected by Plant Board inspectors tested positive for dicamba during the 2019 and 2020 growing seasons from June to August while a May 25 cutoff was in effect.

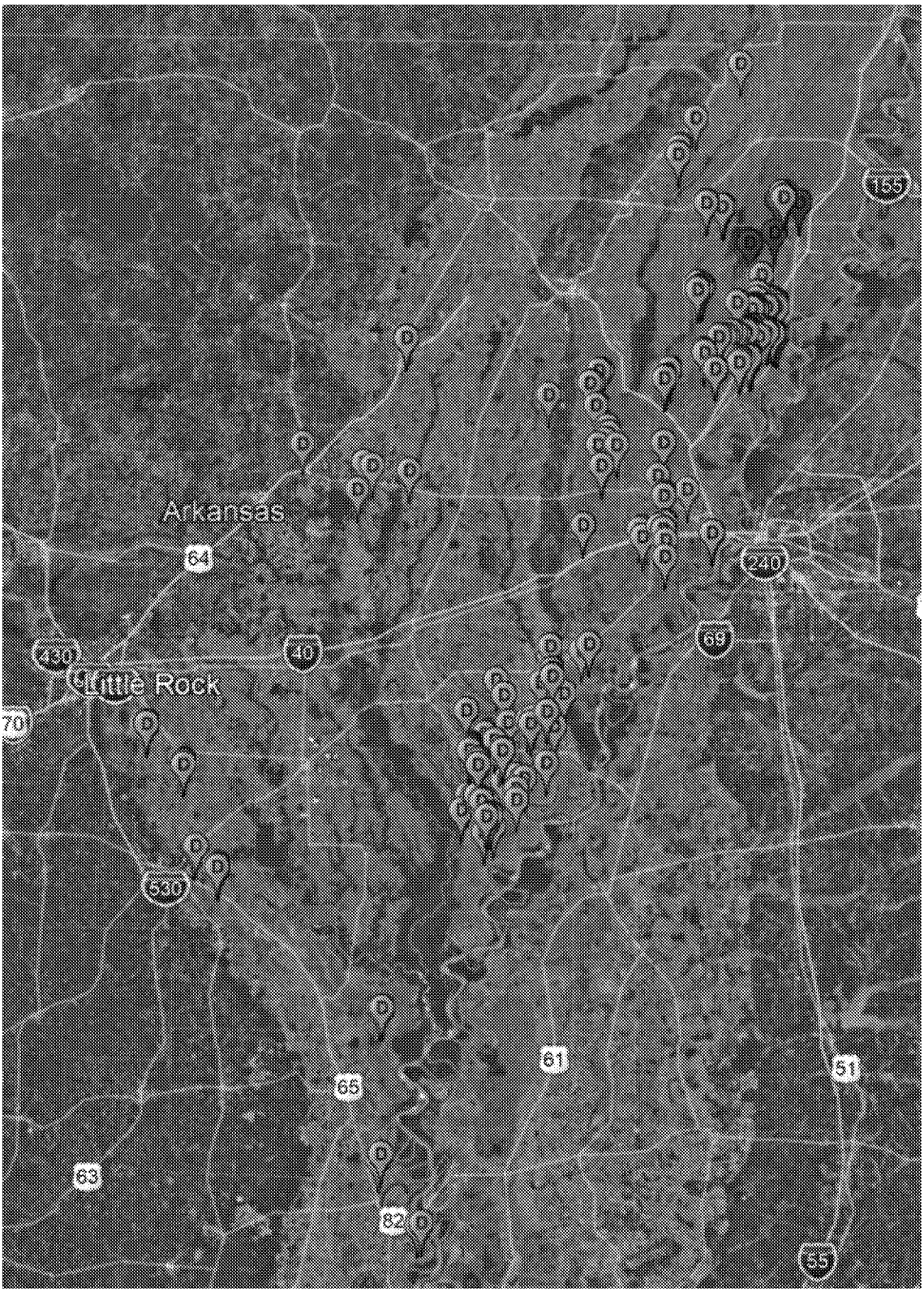


Table 1. Records containing at least one photo showing probable or possible symptoms consistent with a plant growth regulator herbicide collected in 2019 and 2020.

Record #	Obs. Date	Site Name	Latitude	Longitude
11	6/7/19	Delta Heritage Trail SP—Lick Creek	34.53373858	-90.76892311
12	6/7/19	Helena Welcome Center	34.50351038	-90.60505824
15	6/9/19	Scatter Creek WMA—Beech Grove	36.19093382	-90.61699947
16	6/13/19	Lon Mann Cotton Research Station	34.73253231	-90.76695504
17	6/14/19	Eventide Cemetery	34.54947825	-90.90472762
19	6/16/19	St. Francis Sunken Lands WMA levee	35.67940262	-90.47527664
20	6/15/19	St. Francis Sunken Lands WMA levee	35.63080454	-90.47329712
21	6/15/19	Tulot Rd. Bridge	35.62024881	-90.47223156
22	6/15/19	Old Payneway Lane	35.58669486	-90.48357577
26	6/15/19	St. Francis Sunken Lands WMA levee	36.08901272	-90.3236109
27	6/17/19	Hwy 69	35.678373	-90.58469521
29	6/17/19	Maple Grove Rd.	35.62022835	-90.55412335
30	6/17/19	Hwy 214/Maple Grove Rd.	35.60374879	-90.55590311
31	6/17/19	Hwy 214	35.60519596	-90.58532938
32	6/17/19	Hwy 214	35.6038249	-90.55852216
33	6/17/19	Hwy 214	35.60331802	-90.54602465
34	6/17/19	Hwy 214	35.6032859	-90.545601
35	6/17/19	Hwy 214	35.60286952	-90.53598197
36	6/17/19	Hwy 214	35.60277481	-90.53281541
37	6/17/19	Hwy 214/Plantation Ln.	35.60260925	-90.52906261
38	6/17/19	Hwy 214	35.6024503	-90.52587902
39	6/17/19	Hwy 214	35.60224649	-90.52063059
40	6/17/19	Maple Grove Rd.	35.64557005	-90.55363273
41	6/17/19	Maple Grove Rd.	35.67404928	-90.55341154
42	6/17/19	Maple Grove Rd.	35.67279418	-90.55352963
43	6/17/19	Maple Grove Rd.	35.67237173	-90.55350288
44	6/17/19	Maple Grove Rd.	35.67126129	-90.55355609
45	6/17/19	Maple Grove Rd.	35.67036159	-90.55352437
46	6/17/19	Hwy 69	35.67826138	-90.58539895
47	6/17/19	Hwy 69	35.67822946	-90.58607688
48	6/17/19	Hwy 69	35.67822739	-90.58670196
51	6/17/19	Arkansas State University	35.83917215	-90.67963178
52	6/17/19	Arkansas State University	35.84064200	-90.68040985
53	6/17/19	Arkansas State University	35.83921587	-90.67910989
55	6/17/19	Hwy 214 Near Bayou DeView	35.65134478	-90.97204858
58	6/18/19	Forrest L. Wood Crowley's Ridge Nature Center	35.76394859	-90.70138167
60	6/18/19	Forrest L. Wood Crowley's Ridge Nature Center	35.76970871	-90.7010697
61	6/18/19	Forrest L. Wood Crowley's Ridge Nature Center	35.7643207	-90.70059429
62	6/19/19	Punkin Center Rd.	35.69353757	-90.70309419
63	6/19/19	Punkin Center Rd.	35.69347251	-90.70242085
64	6/19/19	Craighead CR 621	35.75932931	-90.60775282
65	6/19/19	Limestone Dr.	35.77789665	-90.65681439
69	6/21/19	Limestone Dr.	35.77804389	-90.6518945
70	6/21/19	Craighead CR 612	35.75605444	-90.66366176
71	6/21/19	Craighead CR 612	35.75596194	-90.65817072

Record #	Obs. Date	Site Name	Latitude	Longitude
73	6/21/19	Bayou DeView WMA	35.65225629	-90.94306737
74	6/21/19	Bayou DeView WMA	35.65245569	-90.93951277
77	6/21/19	Forrest L. Wood Crowley's Ridge Nature Center	35.76699903	-90.70477289
78	6/21/19	Craighead CR 612	35.75564217	-90.6521827
80	6/21/19	Craighead CR 616	35.73397291	-90.64644494
81	6/22/19	Mt. Perion Cemetery	34.65573517	-90.7242655
82	6/22/19	Lagrange Cemetery	34.64870535	-90.72935105
83	6/22/19	Marked Tree Cemetery	35.52230452	-90.43181218
84	6/22/19	Singer Forest Natural Area	35.46149859	-90.54015239
85	6/22/19	Singer Forest Natural Area	35.46294371	-90.53564393
87	6/23/19	Big Lake NWR	35.87227793	-90.13099699
88	6/23/19	Private residence	35.81292769	-90.70283406
89	6/23/19	Big Lake WMA	35.86976567	-90.09637621
92	6/24/19	Arkansas State University	35.83914237	-90.67782257
93	6/24/19	Arkansas State University	35.8427591	-90.68023928
94	6/24/19	Arkansas State University	35.84153735	-90.67849127
95	6/24/19	Arkansas State University	35.84019412	-90.67960748
96	6/24/19	Arkansas State University	35.84058228	-90.67998468
97	6/24/19	Arkansas State University	35.84014005	-90.68068652
98	6/24/19	Arkansas State University	35.83983378	-90.68069675
99	6/24/19	Arkansas State University	35.8391998	-90.67973883
100	6/24/19	Arkansas State University	35.8393756	-90.67644062
101	6/24/19	Arkansas State University	35.83841427	-90.6760347
102	6/26/19	South of Cash, west of Hwy 18	35.72806085	-90.99702953
103	6/25/19	South of Cash, west of Hwy 18	35.72218623	-90.99948828
104	6/27/19	South of Cash, west of Hwy 18	35.72224317	-90.99642305
105	6/25/19	Redd Cemetery	35.75227325	-90.97536352
106	6/26/19	South of Cash, west of Hwy 18	35.75010345	-90.98123932
109	6/25/19	Johnson Cemetery	35.78971813	-90.96640272
110	6/25/19	Cash City Park	35.79552633	-90.93514138
112	6/26/19	Crain Farm Rd, E of Hwy 18	35.75213272	-90.9473395
114	6/26/19	South of Cash, west of Hwy 18	35.73666808	-90.98913328
117	6/27/19	Stokes West	34.56522998	-90.98702892
118	6/24/19	The Meadows Apartments	35.79864759	-90.67428097
122	6/19/19	Forrest L. Wood Crowley's Ridge Nature Center	35.76689923	-90.70525354
125	6/29/19	Hwy 135	35.86988082	-90.46377112
126	6/29/19	Hwy 135	35.87087135	-90.46234501
127	6/29/19	Cane Island Cemetery	35.84623638	-90.43053807
132	6/29/19	Craighead CR 510	35.89177262	-90.38837786
133	6/29/19	Craighead CR 544	35.99049722	-90.3424266
134	6/29/19	Craighead CR 544	35.99052813	-90.34115691
135	6/29/19	Craighead CR 544	35.99052343	-90.3401433
136	6/29/19	Craighead CR 544	35.99054475	-90.33921714
137	6/29/19	Craighead CR 538	35.97595276	-90.34240973
138	6/29/19	Craighead CR 538	35.97596565	-90.3403459
139	6/29/19	Craighead CR 538	35.97601119	-90.33584315
144	6/29/19	Craighead CR 516	35.91916208	-90.3236087

Record #	Obs. Date	Site Name	Latitude	Longitude
145	6/29/19	Craighead CR 516	35.91913823	-90.32176488
147	6/29/19	Craighead CR 522	35.93365497	-90.32398757
149	6/30/19	Brinkley Convention Center	34.90604516	-91.20277125
150	6/30/19	Greenlee Park	34.8868387	-91.16997303
152	6/30/19	Hwy 49/242 near Lexa	34.55531082	-90.81091943
154	6/30/19	Lexa Post Office	34.59880567	-90.75013728
155	6/30/19	West of Jake Lake Hunting Club	34.62766063	-90.68729125
156	6/30/19	West of Jake Lake Hunting Club	34.62767863	-90.69498778
158	6/30/19	East of LaGrange 4 Way Stop	34.65514952	-90.72873828
159	6/21/19	Phillips CR 210	34.6486964	-90.73300533
163	7/1/19	The Meadows Apartments	35.7980172	-90.67473433
170	7/1/19	Needham Rd.	35.76915607	-90.53569985
172	7/1/19	Craighead CR 812	35.75773632	-90.47822307
173	7/1/19	Craighead CR 812	35.75698419	-90.46315271
176	7/1/19	Craighead CR 812	35.75655735	-90.45295428
179	7/1/19	Hwy 158	35.76533615	-90.47991664
183	7/1/19	Craighead CR 963	35.87820758	-90.51475461
185	7/1/19	West Helena Golf Course entrance	34.56931792	-90.66323615
187	7/2/19	Arkansas State University	35.83609939	-90.67079181
188	7/2/19	Arkansas State University	35.8366607	-90.67209146
189	7/2/19	Arkansas State University	35.8483781	-90.67084919
190	7/2/19	Arkansas State University	35.84874663	-90.67097167
191	7/2/19	Lacy Dr.	35.84284546	-90.74971898
193	7/3/19	Greene CR 915	35.99428897	-90.47752316
195	7/3/19	Craighead CR 986	35.83761336	-90.48597591
196	7/3/19	Craighead CR 986	35.83744597	-90.48358175
197	7/4/19	Delta Heritage Trail State Park mile 0.0	34.58228615	-90.74728313
199	7/4/19	Craighead CR 837/Levee Rd.	35.79675926	-90.37754755
200	7/4/19	St. Francis Sunken Lands WMA levee	35.79200731	-90.385352
205	7/4/19	Hwy 158	35.75753088	-90.27963279
207	7/7/19	Mt. Olive Cemetery	34.51180344	-90.93381861
208	7/7/19	Turner Cemetery	34.47059083	-91.00997323
209	7/4/19	Hwy 158	35.77228073	-90.25897287
213	7/4/19	Hwy 158	35.77864707	-90.17869194
214	7/4/19	Hwy 77	35.84458607	-90.17765787
216	7/4/19	St. Francis Sunken Lands WMA levee	35.8297699	-90.41843855
217	7/4/19	St. Francis Sunken Lands WMA levee	35.82889713	-90.41714879
219	7/4/19	St. Francis Sunken Lands WMA levee	35.82724465	-90.41377561
220	7/9/19	Odd Fellows Cemetery (Phillips Co.)	34.54087116	-90.66228476
221	7/9/19	Oak Grove Cemetery (Phillips Co.)	34.54167268	-90.66284677
223	7/9/19	First St. Paul Missionary Baptist Church	34.54068638	-90.71998361
224	7/10/19	Mulberry Cemetery	34.52179391	-91.96657855
227	7/12/19	Joe Hogan State Fish Hatchery	34.76825116	-91.90988763
229	6/16/19	Wrape Plantation Waterfowl Rest Area	34.20298283	-91.58177533
231	6/16/19	Hwy 88 South of Altheimer	34.28309137	-91.81836337
232	7/17/19	Lake Atkins	34.2111222	-91.85960238
233	7/17/19	Rising Star Park Rd.	34.15561801	-91.77424586

Record #	Obs. Date	Site Name	Latitude	Longitude
234	7/18/19	Friendship Church	34.63004887	-90.81722785
236	7/23/19	Mack's Prairie Wings	34.53339181	-91.55762315
237	7/23/19	Hwy 165	34.17134278	-91.34411741
238	7/23/19	Rohwer Research Station	33.80981094	-91.26967727
240	7/25/19	Konecny Grove Natural Area	34.63279705	-91.5928004
241	7/25/19	Stuttgart Airport	34.59742634	-91.56049403
242	7/26/19	St John's Baptist Church	34.94118713	-90.44461713
243	7/26/19	True Vine Baptist Church	35.06610284	-90.32016213
244	7/26/19	Paradise Garden Cemetery	35.1018701	-90.29661611
246	7/26/19	Crittenden Memorial Park	35.20477288	-90.23678893
247	7/26/19	Ridgeview Baptist Church	35.25010382	-90.77528431
248	7/26/19	Marion Memorial Cemetery	35.20109503	-90.242682
249	7/26/19	Hwy 64	35.26735657	-90.61216881
250	7/26/19	Earle Assembly of God	35.27783433	-90.46893631
251	7/26/19	Hwy 42	35.34131733	-90.43996335
252	7/26/19	Hwy 42	35.35700381	-90.43613659
254	7/26/19	Keiser Northeast Research and Extension Center	35.67384622	-90.08653372
255	7/26/19	Roller-Swift Funeral Home Cemetery	35.68092546	-89.98207798
257	7/26/19	Mt. Olive Church	35.54199985	-90.10764853
258	7/27/19	Basset Cemetery	35.53170461	-90.13403459
260	7/24/19	Arkansas State University Farm	35.83909225	-90.66075772
264	7/24/19	Nettleton Cemetery	35.8409381	-90.65382224
265	7/24/19	Elks Lodge	35.8383466	-90.65210592
267	8/4/19	Pilgrim Church	34.6867154	-90.76739685
268	8/6/19	Hwy 70	34.76467869	-92.0741335
270	8/6/19	Hwy 31	34.66165443	-91.90629324
271	8/6/19	Hwy 31	34.61706096	-91.89692767
272	8/6/19	Landmark Church of England	34.54646745	-91.9516594
274	8/6/19	England Post Office	34.54557308	-91.97079362
275	8/6/19	Pleasant Grove Church	34.7140462	-92.09251497
278	8/8/19	Bayou Meto near Halowell Reservoir	34.3195031	-91.62443186
279	8/8/19	Bayou Meto near Halowell Reservoir	34.33944456	-91.63289376
281	8/8/19	Humphrey	34.42217171	-91.70412856
283	8/8/19	Near Armorel	35.938674	-89.78508707
289	8/12/19	Earl Chadick Rd.	34.39136261	-92.04869279
292	8/16/19	Bayou Bartholomew	34.16276466	-91.9504694
294	8/16/19	Hwy 865	34.1056985	-91.74944499
295	8/16/19	Tamo	34.11798527	-91.76115529
296	8/16/19	Blakenship Rd.	34.16136964	-91.75467997
297	8/16/19	Hwy 65	34.15550381	-91.80613467
298	8/5/19	Craighead CR 159	35.9526034	-90.82944915
299	8/20/19	St. Francis Sunken Lands WMA levee	36.08731062	-90.32463942
300	8/20/19	St. Francis Sunken Lands WMA levee	36.09271447	-90.3215669
301	8/20/19	St. Francis Levee	36.12631527	-90.27713778
303	8/20/19	St. Francis Levee	36.15857078	-90.24121998
306	8/20/19	St. Francis Levee	36.17363338	-90.23192977
307	8/20/19	Greene CR 807 Bridge	36.18660917	-90.23168528

Record #	Obs. Date	Site Name	Latitude	Longitude
308	8/20/19	Greene CR 807	36.18653127	-90.23869648
309	8/20/19	Greene CR 807	36.18603482	-90.30270013
310	8/20/19	Hwy 139	36.21581363	-90.23159892
311	8/21/19	CR 520 near St Francis Levee	36.21549027	-90.19548478
312	8/21/19	St. Francis River Levee	36.21566238	-90.19311003
313	8/21/19	Clay CR 524	36.23006987	-90.19038327
314	8/21/19	Clay CR 508	36.23757882	-90.16093042
315	8/21/19	Clay CR 508	36.23736338	-90.14670218
316	8/21/19	Clay CR 508	36.23740383	-90.14599968
317	8/21/19	Clay CR 508	36.23743238	-90.13826837
320	8/21/19	Bethel Baptist Church	36.26654483	-90.1250435
321	8/21/19	Clay CR 553	36.27607503	-90.12201953
322	8/21/19	Nimmons	36.30651892	-90.0966276
323	8/21/19	Clay CR 534	36.30266288	-90.11226007
324	8/21/19	Clay CR 547	36.29858023	-90.13977875
325	8/21/19	Clay CR 547	36.2891363	-90.13984437
326	8/21/19	Clay CR 530	36.28812543	-90.14068737
327	8/21/19	Clay CR 530	36.28817287	-90.14173733
328	8/21/19	Clay CR 533	36.27743138	-90.17559308
329	8/21/19	Union Home Church	36.27297887	-90.17585437
330	8/21/19	Clay CR 533	36.26651098	-90.17573543
331	8/21/19	Clay CR 533	36.26285067	-90.17567628
332	8/21/19	Clay CR 480	36.27370738	-90.23421297
333	8/21/19	Clay CR 484	36.28847018	-90.25706053
334	8/21/19	Clay CR 481	36.27352357	-90.26616043
335	8/22/19	Hwy 31	34.56135097	-91.88733095
336	8/22/19	Pecan St.	34.60275917	-92.00204963
338	8/23/19	Gothard Farm	36.41944875	-90.35635327
339	8/23/19	Clay CR 548	36.36720222	-90.17988128
340	8/23/19	Clay CR 550	36.36746513	-90.15571087
341	8/23/19	Shady Grove Baptist Church	36.38525875	-90.14771665
342	8/23/19	Clay CR 551	36.37970487	-90.12146723
343	8/23/19	Clay CR 551	36.37796297	-90.12146302
344	8/23/19	Clay CR 546	36.34533483	-90.11101977
347	8/23/19	Clay CR 528	36.32698027	-90.10405577
348	8/23/19	Clay CR 528	36.31774503	-90.10405872
349	8/23/19	Clay CR 536	36.31633527	-90.12200753
350	8/23/19	Clay CR 536	36.31626807	-90.12411303
351	8/23/19	Clay CR 536	36.31629493	-90.14418467
352	8/23/19	Clay CR 536	36.31633025	-90.14505473
353	8/23/19	Clay CR 536	36.31631828	-90.14917397
354	8/23/19	Clay CR 536	36.31627853	-90.15240788
355	8/23/19	Clay CR 542	36.33820547	-90.19310658
356	8/23/19	Clay CR 542	36.33833952	-90.2025672
357	8/23/19	Clay CR 481	36.27299233	-90.27719198
358	8/23/19	Greene CR 139	36.14782968	-90.29403173
359	8/7/19	Hwy 137	35.9385285	-89.78473328

Record #	Obs. Date	Site Name	Latitude	Longitude
360	8/24/19	Farm 1 Armorel	35.92232392	-89.79058595
361	8/24/19	Armorel Elementary School	35.91633905	-89.79901553
362	8/24/19	Old Hale Place	35.8989841	-89.79356067
363	8/24/19	Number 9 Cemetery	35.988234	-89.80714592
365	8/24/19	Nucor Hickman	35.94507693	-89.73299468
366	8/24/19	Paterson Place	35.94321645	-89.75422302
367	7/25/19	Hwy 1	34.732794	-90.767857
368	6/22/20	Eventide Cemetery	34.55025464	-90.90529337
370	6/29/20	Helena Welcome Center	34.50457224	-90.61173978
371	6/30/20	Mulberry Cemetery	34.52206716	-91.96708105
372	6/30/20	Hwy 31	34.56053813	-91.88711182
373	6/30/20	Joe Hogan State Fish Hatchery	34.76845547	-91.90993206
374	6/30/20	Turner Cemetery & Church	34.47043409	-91.00951575
376	7/1/20	Sunset Memorial Park Cemetery	34.55272058	-90.76218763
377	7/1/20	Oak Grove Cemetery (Lee Co.)	34.77500324	-90.96999407
378	7/1/20	Lon Mann Cotton Research Station	34.73313966	-90.76709166
379	7/1/20	Hwy 185	34.75696046	-90.74316688
380	7/1/20	Lee CR 215	34.73636673	-90.73047364
381	7/1/20	Lee CR 215	34.68868271	-90.73444675
382	7/1/20	Lee CR 215	34.67583783	-90.73259032
383	7/1/20	Mt. Perion Church	34.66075543	-90.73327613
384	7/1/20	Lagrange Cemetery	34.64852196	-90.72836543
386	7/1/20	Delta Heritage Trail SP—Lick Creek	34.53360686	-90.76879889
387	7/1/20	Phillips CR 353	34.53457539	-90.82132936
388	7/1/20	Phillips CR 115	34.55748162	-90.86573971
389	7/1/20	Cypert Cemetery	34.4908086	-90.95602078
390	7/1/20	Phillips CR 244	34.57640517	-90.75000374
391	7/2/20	Mudline Road/Crittenden CR 14	35.11930395	-90.39943155
392	7/2/20	Upper Cemetery	34.75761138	-91.15402856
393	7/2/20	Schaffhauser Cemetery	34.57906988	-90.96324865
394	7/2/20	Hwy 316	34.53353168	-90.85807814
395	7/2/20	Lee CR 215	34.69303343	-90.73383981
396	7/2/20	Phillips CR 116	34.51119642	-90.88370439
397	7/2/20	Pleasant Grove Cemetery	34.49772578	-90.87014364
398	7/2/20	Phillips CR 120	34.49671463	-90.9191398
399	7/2/20	Phillips CR 376	34.4716084	-90.89650079
400	7/2/20	Phillips CR 617	34.4529574	-90.97608805
401	7/2/20	Phillips CR 617 wetland	34.44979152	-90.97453136
402	7/2/20	Phillips CR 517	34.32339455	-90.95483514
403	7/2/20	Branch Missionary Church & Cemetery	34.44331348	-91.04121661
404	7/6/20	Pine City Natural Area—Skinny 40	34.60440523	-91.14315279
405	7/6/20	Pine City Natural Area	34.60085319	-91.12259869
406	7/4/20	Pecan Farm	34.56310043	-90.66939077
407	7/9/20	Parkin Archeological SP	35.27704362	-90.55488836
408	7/9/20	Earle Assembly of God	35.27771673	-90.46986527
409	7/9/20	Pentecostal Church of Earle	35.29955226	-90.46587355
410	7/9/20	Gibson Bayou Cemetery	35.30529977	-90.45861776

Record #	Obs. Date	Site Name	Latitude	Longitude
411	7/10/20	Lily Rd.	34.85337877	-91.84000921
412	7/10/20	Carlisle Cemetery	34.80281498	-91.75178055
413	7/10/20	Across from Railroad Prairie Natural Area	34.77935613	-91.53391452
414	7/5/20	Turner Cemetery & Church	34.4696931	-91.00897353
415	7/5/20	Lone Valley Cemetery	34.55296628	-90.92787957
416	7/13/20	Clarkedale Rd.	35.30906752	-90.19546565
417	7/13/20	Old River Rd.	35.32392444	-90.18243522
418	7/13/20	Old River Rd.	35.33035323	-90.18235208
419	7/13/20	Old River Rd.	35.33614505	-90.18240505
420	7/13/20	Old River Rd.	35.35006994	-90.18207698
421	7/13/20	Mulberry Grove Rd.	34.3441295	-91.73160782
422	7/13/20	US 61	35.45306908	-90.19359489
423	7/13/20	Joiner	35.50934069	-90.13421338
424	7/15/20	St. Francis Sunken Lands—Payneway	35.54417269	-90.4842083
425	7/15/20	St. Francis Sunken Lands—Spillway	35.56966634	-90.47030188
426	7/15/20	Lincoln CR 293	33.95877527	-91.73356763
427	7/15/20	St. Francis Sunken Lands WMA—Waterfowl Rest Area	35.59123394	-90.4694051
428	7/15/20	Hwy 114	33.96294825	-91.66046513
429	7/15/20	State Police Rd.	33.92582848	-91.51741628
430	7/15/20	Cotton Rd	35.55801956	-90.50627332
432	7/15/20	Quallls Rd	35.57465286	-90.55557266
433	7/15/20	Boggy Bayou	33.60598862	-91.25963557
434	7/15/20	McCormick Baptist Church	35.59530838	-90.5804038
435	7/15/20	Hwy 4 x Desha CR 331 north	33.62938452	-91.24223897
436	7/15/20	Hwy 4	33.72072195	-91.26622748
437	7/15/20	Hwy 1	33.67452348	-91.35119393
438	7/15/20	St. Francis Sunken Lands levee	35.64777909	-90.47103781
439	7/15/20	McGehee High School	33.65401048	-91.37183707
440	7/15/20	Liberty Baptist Church	33.6391949	-91.39323392
441	7/15/20	Dumas McDonalds	33.87959093	-91.48205575
443	7/15/20	Marked Tree Cemetery	35.52223302	-90.43178754
444	7/15/20	St. Francis Sunken Lands levee east	35.53675768	-90.45130472
445	7/15/20	St. Francis Sunken Lands levee east	35.56656759	-90.43707157
446	7/15/20	St. Francis Sunken Lands levee east	35.59037634	-90.42868313
447	7/15/20	Red Oak Church	35.5960731	-90.39341988
448	7/15/20	Potter Cemetery	35.61586667	-90.34590974
449	7/15/20	Keiser Northeast Research and Extension Center	35.67445488	-90.08671909
451	7/17/20	Victoria Exit	35.75624524	-90.00831468
452	7/17/20	Big Lake NWR—Mud Island	35.85065878	-90.12520225
453	7/17/20	Big Lake WMA—Mallard Lake Launch	35.86487269	-90.0992937
454	7/17/20	Big Lake WMA—Mallard Lake Pulloff	35.87001939	-90.09612199
456	7/17/20	Big Lake WMA—Mallard Lake Pulloff	35.87992956	-90.08796992
457	7/17/20	Big Lake WMA	35.89179059	-90.07899055
458	7/17/20	Blytheville Public Library	35.92867469	-89.90841564
459	7/17/20	Memorial Park Cemetery	35.91566795	-89.91959232
460	7/17/20	Arkansas Northeastern College	35.89788528	-89.91964764
461	7/17/20	Dogwood Cemetery	35.89211471	-89.9175608

Record #	Obs. Date	Site Name	Latitude	Longitude
462	7/17/20	New Salem Church	35.75610396	-89.98153928
463	7/17/20	New Jefferson Church	35.6945328	-90.09923126
464	7/22/20	North of Earle	35.31447858	-90.45705051
467	7/22/20	South Black Oak	35.38209615	-90.41370585
468	7/23/20	Sandhill Cemetery	35.00845446	-91.44242864
469	7/23/20	Cache River NWR—Woodruff CR 745	35.16278998	-91.30766247
470	7/23/20	Oddfellows Cemetery (Woodruff Co.)	35.21839586	-91.2004695
471	7/23/20	Woodman Cemetery	35.22335476	-91.1826857
472	7/23/20	Cache River NWR—Woodruff CR 655	35.12777139	-91.15023717
473	7/23/20	Cache River NWR—Woodruff CR 655	35.11165953	-91.16321647
474	7/23/20	Woodruff CR 655	35.08862183	-91.16843839
475	7/23/20	Pine Tree WDA—SFC107	35.10480745	-90.94127222
476	7/23/20	Pine Tree WDA—SFC134	35.03847357	-90.94049597
477	7/24/20	Swifton Cemetery	35.82188459	-91.13989851
479	7/24/20	Swifton Sand Ponds NA	35.85811709	-91.10149842
480	7/24/20	Landmark Church of England	36.4535568	-90.58544953
481	7/24/20	Stateline Sand Ponds NA	36.49194516	-90.60323015
482	7/24/20	Knobel Cemetery	36.32398121	-90.62374997
483	7/24/20	Peach Orchard City Park	36.27667455	-90.66061266
484	7/27/20	New Hope Cemetery	36.42873115	-90.27979841
485	7/27/20	Clay CR 310	36.47641463	-90.21569244
486	7/27/20	Chalk Bluff NA—Entrance	36.47759597	-90.16624692
487	7/27/20	Chalk Bluff NA—Parking	36.47830496	-90.16400996
488	7/27/20	Chalk Bluff NA—Trail	36.47770762	-90.16165934
489	7/27/20	Clay CR 547	36.30245095	-90.13982657
490	7/27/20	Clay CR 530	36.28815888	-90.18010262
491	7/27/20	Clay CR 530 Bridge	36.28808273	-90.21075013
492	7/27/20	Clay CR 513	36.24854836	-90.24787643
493	7/27/20	Greene CR 870	36.19463738	-90.24971802
494	7/27/20	White Oak Church	36.18621348	-90.24957318
495	7/29/20	Lonoke	34.54694468	-91.95176167
496	7/29/20	Lonoke	34.54763222	-91.9518503
497	8/13/20	Central Cemetery	34.58461264	-90.79520825