Annual Monitoring Report
Arkansas Department of Transportation
Voluntary Prelisting
Species Conservation Program
2025

Program FWS Log #: 04ER1000-2020-FC-0754

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BACKGROUND INFORMATION

This document represents the 2025-2026 monitoring report for the Arkansas Department of Transportation (ARDOT) Voluntary Prelisting Species Conservation Program (VPL). ARDOT developed the program in cooperation with the US Fish & Wildlife Service (USFWS) in 2020. The USFWS finalized the Programmatic Conference Opinion as FWS Log number **04ER1000-2020-FC-0754** in January of 2021. The VPL is designed to benefit seven species that were proposed, candidate, or petitioned for listing under the Endangered Species Act. The seven species are the Monarch Butterfly (monarch; *Danaus plexippus*), Texas Frosted Elfin (elfin; *Callophyrus irus hadros*), Irons Fork Burrowing Crayfish (*Procambarus reimeri*), Ouachita Burrowing Crayfish (*Fallicambarus harpi*), Slenderwrist Burrowing Crayfish (*Fallicambarus petilicarpus*), Bayou Bodcau Crayfish (*Bouchardina robisoni*), and Jefferson County Crayfish (*Creaserinus gilpini*). These species all require habitats with an open canopy and abundant herbaceous vegetation, which can be found in prairies, woodlands, savannahs, old fields, and roadsides including highway rights-of-way.

METHODS

Baseline Plot Establishment

ARDOT used a stratified approach to ensure adequate spatial representation when establishing the baseline plot locations. To prioritize monitoring within landscapes where the Monarch Butterfly is most likely to occur, the Monarch Landscape Prioritization Model was used to assign roadside suitability scores to all roads in Arkansas (*Figure 1*). The model assigns higher scores to grasslands (including pastures and hayfields), moderate scores to forests, and the lowest scores to pesticide-intensive agriculture. The following procedure produced 231 baseline plots:

1. The 100-meter resolution raster data was converted to points.
2. All points more than 60 feet from a highway were removed.
3. Points were clustered to select the point with the highest score within 5 miles.
4. Points with a score less than the statewide median score of 0.63 were rejected.
5. Restricted access roads were removed. On- and off-ramps and service roads were retained.
6. ARDOT highways are divided into sections. To ensure broad coverage across the state, the highest scoring point in each route and section was selected. If any part of a section was designated as a Wildflower Route, the highest scoring point within the Wildflower Route was selected.

Points within Wildflower Routes were preferred in order to prioritize monitoring in areas where ARDOT has special conservation measures in place that would benefit the covered species. ARDOT limits herbicide use within wildflower routes with the intention of benefitting wildflowers and their pollinators. No broadcast herbicide is allowed, while spot-applications to treat non-native invasive weeds (NNIS) are encouraged. The resulting 231 points included 75 points within Wildflower Routes.

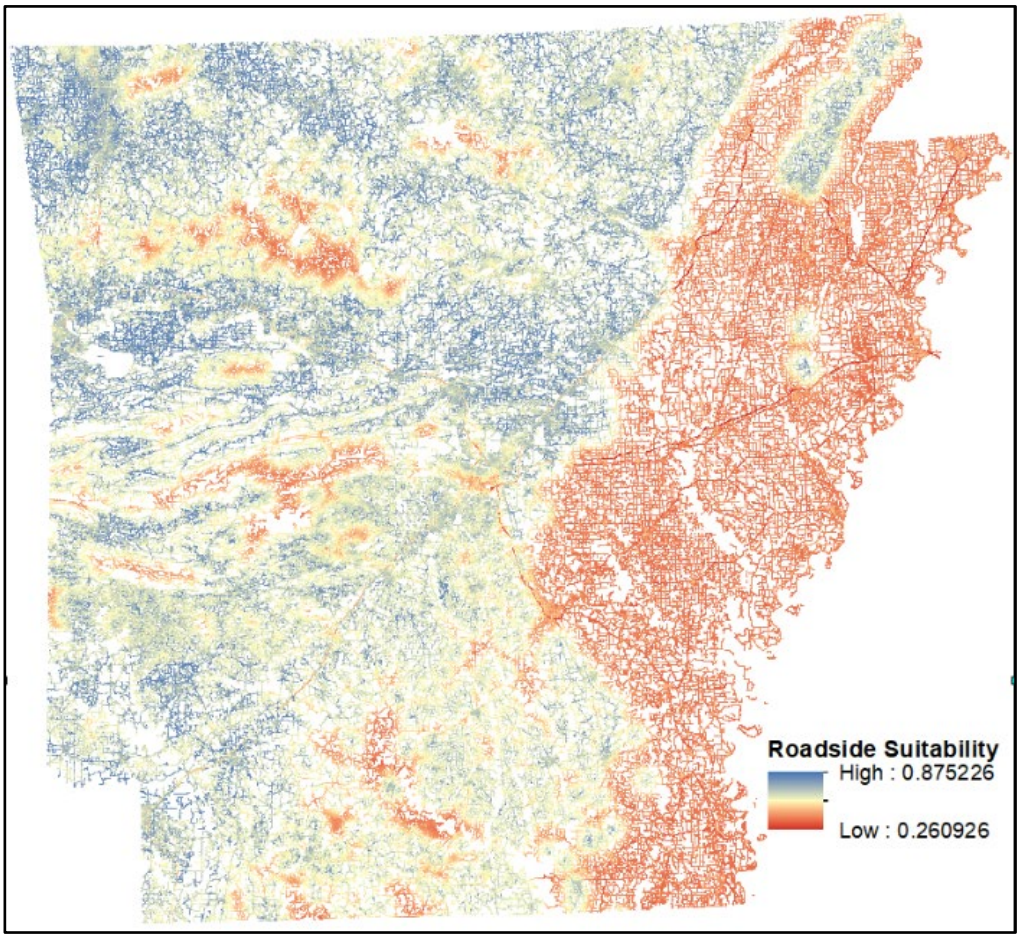

Figure 1. Arkansas Monarch Landscape Prioritization Model Output

Rapid Roadside Assessment Method

Each Monarch Rapid Roadside Assessment survey protocol (Cariveau et al 2019) rectangular survey plot evaluates the full ROW width along 150 feet of roadway length. Each point generated by the process above was used as one corner of a plot. The side of the highway nearest the point was selected for the plot. For simple repeatability, each plot extends 150 feet to the surveyor's left when standing on the highway shoulder and facing the ROW at the generated point. When the ROW containing the plot had the appearance of a frequently mowed lawn, with thicker, more uniform, and shorter grass, mowing by the private landowner was assumed and the plot location was moved to the nearest part of the ROW that was not being mowed. At two of the points, the ROW was being mowed by a private landowner and there were no alternative locations within at least a mile. These were removed, for a final tally of 229 baseline plots. These plot locations can be seen in Figure 2.

Baseline plot visits began in 2021 and have been conducted in August and September each year. The surveyor records the nearest neighboring landscape type, frequency of mowing, frequency and type of herbicide application, and estimates the:

- Width of the vegetated ROW
- Width of mowing
- Percent areal coverage of potential blooming nectar plants (PBNP)

- Percent areal coverage of NNIS, by species

The surveyor meanders through the plot and records the name of each PBNP species. Many plants do not produce nectar. The survey template provided by the Monarch Joint Venture removed grasses and sedges but retained many wind-pollinated species found in Arkansas. Surveyors do not include wind-pollinated species, like ragweeds, docks, oaks, and hickories, in the species tallies or the estimates of areal coverage. The Foraging Component Score increases with increasing richness of PBNP. The survey template includes information on whether each species is native to Arkansas. The Foraging Component Score also increases with increasing

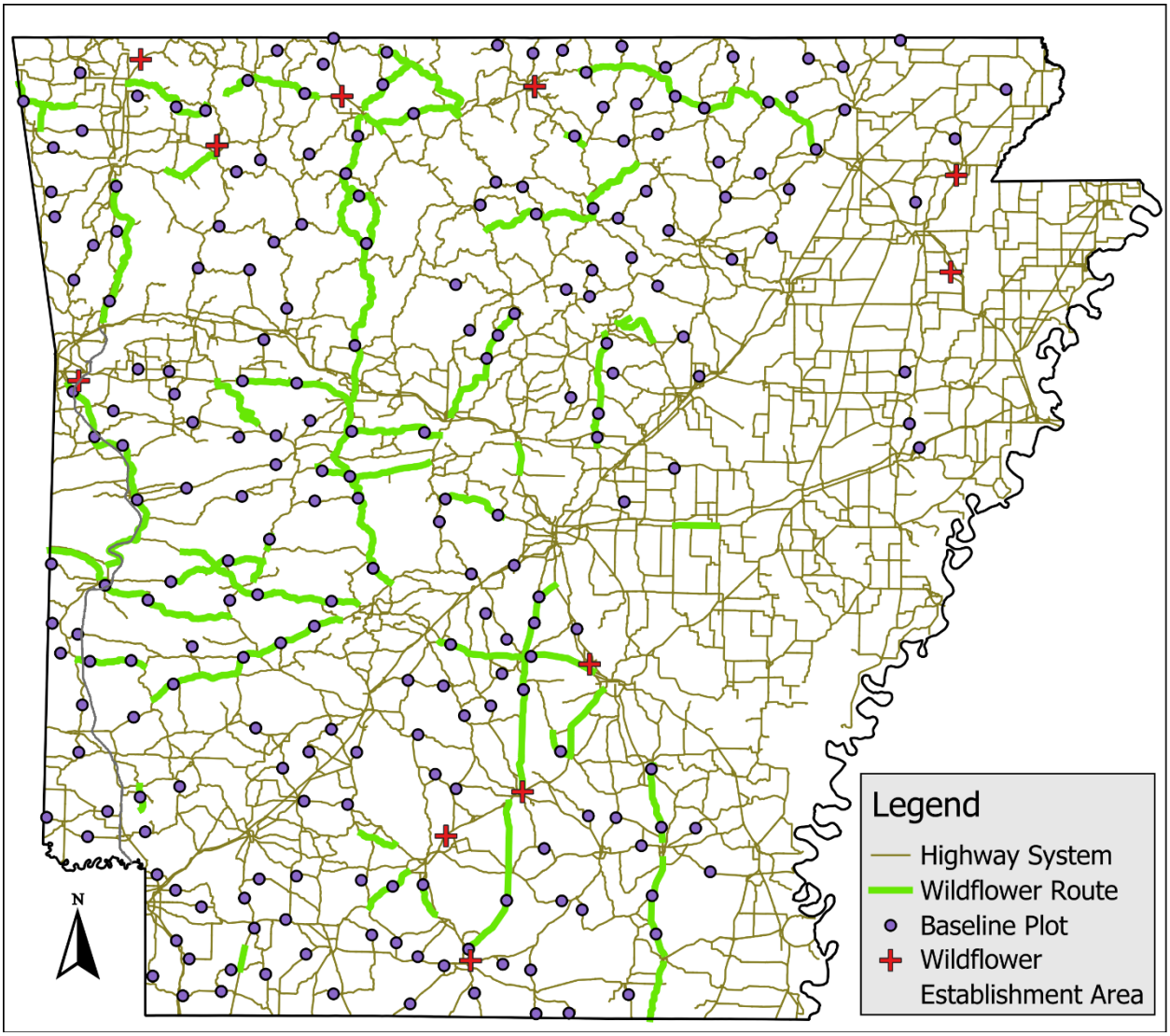

Figure 2. Map of baseline plots, monitored wildflower establishment areas, wildflower routes, and highways

species richness of native PBNP. If any species of milkweed are found, the number of plants of each milkweed species is recorded. Each milkweed plant is searched for monarchs of any life stage, from egg to adult.

Four main category scores are calculated from the survey data using the formulas developed by the Monarch Joint Venture: Breeding, Threats, Foraging, and Management. Each of these is designed with a maximum of 25 points, adding up to 100 points for the overall habitat score. The

Threats score includes two main component scores. The Weeds Component Score is based on the richness and abundance of NNIS and can reach a maximum of ten. The Context Component Score is based on the landscape outside the ROW and can reach a maximum of fifteen. The Context Component Score is beyond the control of ARDOT, so only the Weeds Component Score is evaluated separately below. Both scores are included in the Overall Habitat Score.

RESULTS

First Round of Visits to All Baseline Plots

The initial round of monitoring of all 229 baseline plots was completed in 2023. The mean overall habitat score was 51.86 out of 100. A breakdown of four component scores and the overall habitat score is shown in Table 1.

Table 1. Mean scores from initial visits to all baseline plots.

Component	Mean Score (/ Maximum)
Foraging	18.14 / 25
Breeding	0.472 / 25
Weeds	5.61 / 10
Management	15.18 / 25
Overall Habitat	51.86 / 100

The average breeding score is very low, at 0.472 out of 25. This score is based on the abundance and species richness of milkweeds in the plot. Milkweeds are rare on Arkansas highways. During the initial round of visits to all 229 plots, only 16 plots (7%) had milkweeds. All of the milkweed plants encountered were examined for monarchs of any life stage, and no monarchs have been found during any surveys. Due to the timing of surveys before the beginning the fall migration, it is unlikely that monarchs will be observed during the surveys.

Annual Baseline Plot Results

The baseline plot score averages have been stable across years, with a different subset of the plots being evaluated each year. The mean scores for each year of monitoring can be seen in Table 2.

Table 2. Mean scores by year, with the number of plots sampled each year.

	2021	**2022**	**2023**	**2024**	**2025**
Component	N = 88	N = 75	N = 60	N = 50	N = 52
Foraging	18.55	18.35	17.31	18.23	17.34
Breeding	0.36	0.34	0.83	0.51	0.20
Weeds	4.93	6.14	5.89	5.01	6.74

Management	16.11	14.85	14.25	15.49	14.97
Overall Habitat	52.47	51.97	50.82	51.76	51.73

Revisits

A primary purpose of establishing and then continuing to monitor baseline plots is the ability to monitor for changes in habitat suitability. As of 2025, 100 of the baseline plots have been assessed twice. A Welch two-sample t-test was used to determine whether there were statistically significant changes in scores. The breeding score was not evaluated, due to the sparse data available. Of the 100 revisited plots, milkweed plants were found during twelve visits across ten plots. Milkweeds were only documented during both visits at a plot two times. Of the eight plots where milkweeds were only found on one visit, they were found only during the first visit at three plots and only during the second visit at the other five plots. Differences in the timing and extent of mowing in the different years is the most likely explanation for inconsistency in finding milkweeds at a plot, with climate variability and variation in the timing of visits also potentially explaining the inconsistency. Revisit dates ranged from 28 days earlier to 28 days later than the date of the first visit to a given plot.

Neither mean overall habitat score nor the foraging score was significantly different at the second visit (Table 3). The mean weeds score improved slightly at the visited plots. There was a statistically significant reduction in the management score. The change of -0.72 is 4.5% drop in the mean score.

Table 3. Mean scores and change in mean score among the 100 revisited plots.

Component	Mean Initial Score	Mean Revisit Score	Change*	95% CI*	p-value*
Foraging	18.55	17.80	-0.75	-1.8 to +0.28	0.2
Weeds	5.09	5.86	+0.78	+0.18 to +1.4	0.011
Management	15.96	15.24	-0.72	-1.4 to +0.08	0.027
Overall Habitat	52.33	51.75	-0.59	-2.1 to +0.90	0.4

* *Welch Two-sample t-test* | *CI = Confidence Interval*

Figure 3 shows a map of the revisited plots, with color categories indicating the amount that the overall habitat score changed. There are no strong patterns indicating consistent changes based on geography. ARDOT will review maps like this each year to determine and after each revisit to determine whether habitat quality is declining consistently and to investigate whether the ROW maintenance practices need to be improved. More detailed data from plot revisits is shown in Appendix A.

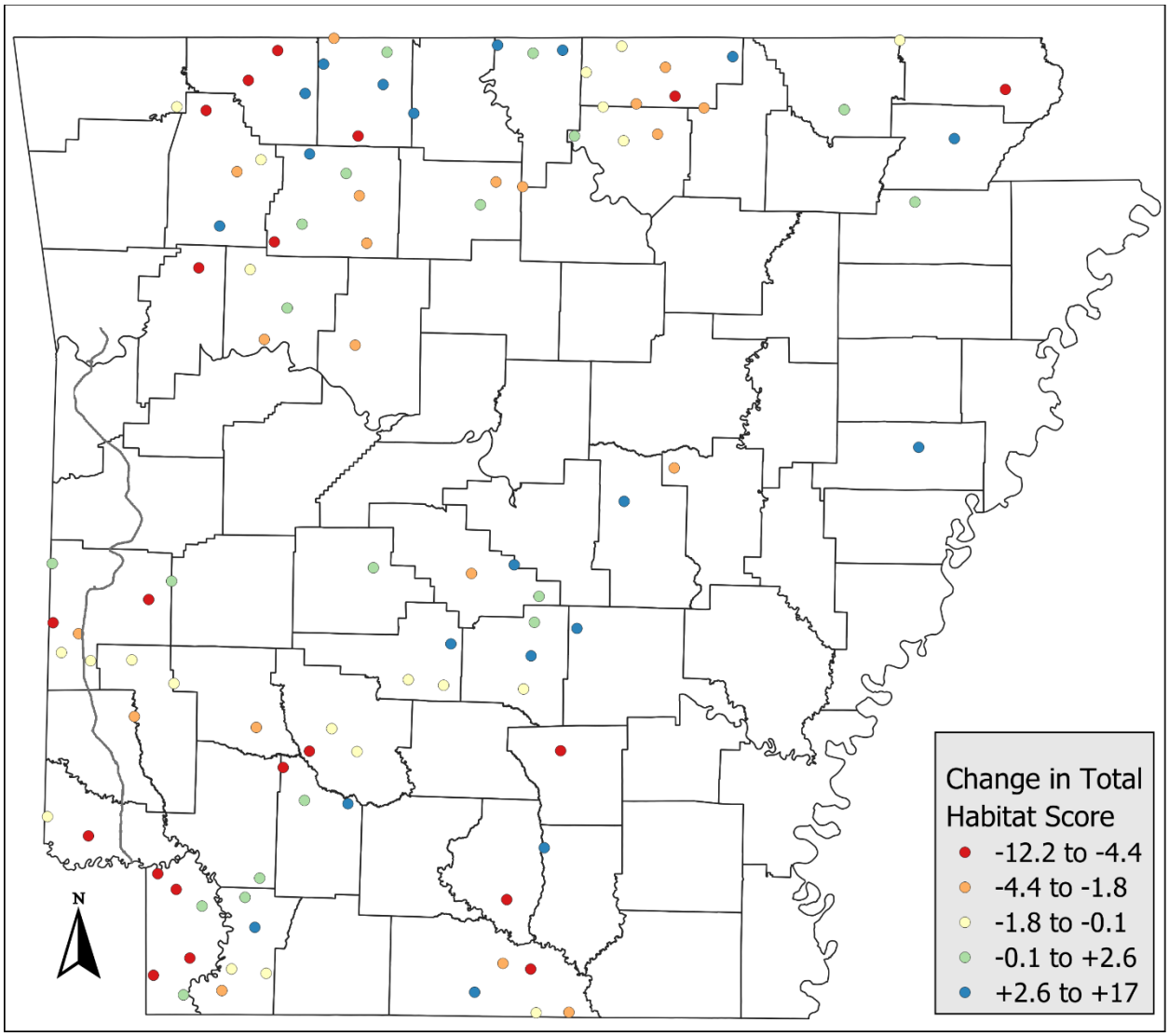

Figure 3. Map of revisited baseline plots and Arkansas counties

Wildflower Meadows Established by ARDOT

In addition to the baseline plots, Rapid Roadside Assessments have been conducted at 16 areas where ARDOT has established wildflower meadows under the Wildflower Program. The mean overall habitat score of 49.54 for these meadows is slightly lower than the mean score of 52.47 for the baseline plots (Table 4). The primary goal of these areas is to establish and maintain nectar resources, and therefore the foraging component is the main target component of the assessment scores. The mean foraging score of 19.16 at these established meadows was higher than the score of 18.14 at baseline plots. More detailed data from established wildflower meadows is shown in Appendix B.

Table 4. Rapid Roadside Assessment scores at wildflower meadows established by ARDOT

Component	Score
Foraging	19.16
Breeding	0.88
Weeds	3.34
Management	15.36
Overall Habitat	49.54

Wild Indigo occurrences

The Texas Frosted Elfin requires native wild indigo (*Baptisia* species) as food during the larval stage. The presence of wild indigo plots is therefore noted during surveys. Wild indigo has been found at 11 of the 245 plots (229 baseline plots and 16 established meadows). Five of these plots are in the southwestern portion of the state, broadly within range of the Elfin. Three species have been observed (*Baptisia alba, B. bracteata, and B. nuttalliana*) but each plot had only a single species. Seven of these plots were revisited in 2024. The indigo was observed during the revisit at five of them. Full results are shown in Table 5.

Table 5. Plots where a species of wild indigo was observed.

In Elfin Range	Plot	Year First Found	Year Revisited
Yes	154_2	2022	NA
	88_2	2021	2024
	9_5	2023	NA
	98_2	2022	NA
	D7 El Dorado west	2022	NA
No	12_4	2022	2024*
	202_2	2021	2024*
	21_2	2021	2024
	43_1	2021	2024
	7_17	2021	2024
	74_8	2021	2024

**Wild indigo was not found during revisit*

CONSERVATION ACTIONS UNDERTAKEN BY ARDOT

In addition to implementing conservation mowing and conservation herbicide programs on all habitat available to all species, ARDOT promised to increase implementation of existing Wildflower Programs, including a target of establishing an average of 15 acres of wildflower meadows each year. We consider the year that seed is successfully broadcast or sown to be the year of establishment, disregarding any preceding site preparation or subsequent maintenance. In 2022, seven acres of wildflower meadows were established at three sites. Due to problems with implementation of new methods of site preparation, only one acre was established in 2023,

but maintenance and site preparation were undertaken on 42 acres. In 2024, 41 acres were established. No new meadows were established in 2025, but site prep was completed on 48.5 acres. Wildflower meadow establishment averages 12.25 acres per year starting in 2022. Full tables of conservation actions for each species can be found in Appendix C.

ARDOT partnered with the Illinois Natural History Survey and the Arkansas Game and Fish Commission on a State Wildlife Grant (SWG) for developing a translocation strategy for four primary burrowing crayfish species in Arkansas. The purpose of this project is to collect these data for the Jefferson County Crayfish (*Creaserinus gilpini*), Slenderwrist Burrowing Crayfish (*Fallicambarus petilicarpus*), Caramel Crayfish (*Fallicambarus schusteri*), and Irons Fork Burrowing Crayfish (*Procambarus reimeri*). We will evaluate habitat suitability and find potential translocation sites which will inform future efforts to translocate these species. We will also pilot a translocation effort for the Jefferson County Crayfish which will help us develop a standard operating procedure for conservation agencies to continue this work.

REFERENCES

Cariveau, A.B., Anderson, E., Baum, K.A., Hopwood, J., Lonsdorf, E., Nootenboom, C., Tuerk, K., Oberhauser, K. and Snell-Rood, E., 2019. Rapid assessment of roadsides as potential habitat for monarchs and other pollinators. *Frontiers in Ecology and Evolution*, *7*, p.386.

APPENDIX A: DETAILED RESULTS FROM REVISITS

Plot	Years Between Visits	Weeds	Management	Foraging	Habitat
101_1	3	-49%	37%	42%	19%
108_4	4	21%	0%	-25%	-12%
109_4	2	-17%	0%	11%	-6%
111_2	3	66%	0%	15%	19%
12_3	2	0%	0%	-3%	-1%
12_4	2	-71%	-3%	-17%	-14%
129_1	4	-42%	10%	-10%	-6%
129_2	4	0%	0%	-16%	-5%
134_1	4	0%	0%	-25%	-8%
14_0	3	76%	0%	-31%	-6%
14_1	3	64%	0%	0%	3%
141_1	3	0%	0%	0%	0%
16_5	3	100%	-8%	-14%	6%
16_6	3	-39%	0%	-16%	-10%
160_0	4	25%	0%	11%	2%
160_1	4	0%	-9%	-3%	-4%
166_0	3	0%	0%	23%	6%
167_10	3	0%	-8%	-1%	-3%
167_11	3	0%	0%	0%	0%
167_12	3	28%	0%	-21%	0%
167_3	4	0%	-63%	-10%	-23%
201_1	3	24%	12%	30%	5%
202_2	3	100%	0%	29%	15%
21_1	3	51%	-17%	16%	5%
21_2	3	8%	0%	-1%	0%
21_4	3	-14%	0%	2%	-1%
21_6	3	76%	-9%	-42%	-13%
211_1	3	100%	0%	-4%	-3%
215_3	3	-17%	0%	-18%	-8%
215_4	3	-22%	11%	-6%	-1%
221_0	3	1%	-15%	-17%	-12%
222_1	4	28%	12%	-20%	-1%
223_1	3	-2%	0%	0%	0%

Plot	Years Between Visits	Weeds	Management	Foraging	Habitat
223_3	3	73%	-10%	-13%	-2%
236_1	3	0%	0%	83%	21%
237_1	4	50%	-26%	-36%	-17%
24_5	4	38%	10%	2%	0%
246_1	4	-1%	-9%	-6%	-5%
26_3	4	-33%	13%	-10%	-6%
263_3	3	16%	-26%	-3%	-8%
27_17	3	-49%	0%	-22%	-3%
270_10	3	0%	0%	16%	9%
270_8	4	68%	11%	13%	16%
275_1	4	0%	-9%	-1%	-3%
275_2	4	28%	-62%	-16%	-19%
275_3	4	0%	0%	13%	10%
278_1	4	79%	-15%	-14%	-3%
278_2	4	-33%	-8%	11%	-2%
281_0	3	309%	0%	11%	25%
289_3	3	70%	-8%	-22%	-8%
29_2	3	-22%	0%	18%	1%
29_5	4	0%	0%	0%	-9%
296_1	4	79%	10%	-18%	-9%
313_1	4	82%	0%	10%	12%
32_1	4	0%	0%	-9%	-2%
32_2	4	0%	-10%	-25%	-10%
34_3	3	51%	0%	0%	6%
35_4	3	17%	-15%	-21%	-11%
355_4	3	51%	0%	-22%	1%
360_0	4	28%	-17%	-4%	-3%
365_14	3	0%	6%	9%	5%
374_1	3	104%	-8%	-20%	-8%
38_1	3	-24%	10%	-17%	-6%
38_5	3	-18%	39%	153%	43%
396_0	3	152%	-26%	84%	14%
4_0	4	64%	-17%	-27%	-13%
43_1	3	0%	0%	-3%	8%
5_17	3	2%	0%	1%	0%

Plot	Years Between Visits	Weeds	Management	Foraging	Habitat
5_7	3	0%	0%	-21%	-7%
51_1	4	-42%	-17%	0%	-11%
51_3	4	-28%	0%	6%	-1%
53_0	4	0%	10%	-18%	-3%
53_2	4	0%	10%	33%	13%
53_5	4	42%	12%	-21%	-1%
56_1	3	2%	0%	-3%	-1%
56_2	3	104%	-10%	-14%	-6%
62_12	3	122%	-9%	-21%	-1%
62_13	3	65%	0%	-20%	-5%
62_5	3	100%	0%	37%	19%
62_8	3	207%	-8%	23%	8%
63_1	3	21%	-17%	11%	10%
67_5	4	-28%	10%	-1%	-1%
7_1	4	126%	0%	14%	19%
7_10	3	103%	9%	2%	4%
7_15	3	-33%	-15%	0%	-5%
7_17	3	22%	-8%	-10%	-4%
7_18	3	100%	0%	-7%	1%
7_19	3	153%	-23%	-35%	-17%
70_2	4	-14%	-9%	-7%	-7%
70_4	4	-34%	-8%	13%	-2%
74_4	3	28%	0%	-24%	-6%
74_8	3	103%	0%	-2%	3%
8_0	4	132%	-9%	-11%	4%
8_1	4	42%	-15%	-20%	-9%
82_1	4	28%	0%	0%	4%
84_0	4	152%	-17%	0%	0%
88_2	4	-24%	-8%	13%	0%
9_14	3	51%	-9%	-29%	-8%
9_15	3	-41%	0%	-2%	-4%
90_2	3	18%	-9%	-21%	-10%

APPENDIX B: DETAILED RESULTS FROM WILDFLOWER MEADOWS ESTABLISHED BY ARDOT

Overall Habitat Scores

Plot	2021	2022	2023	2024
D2 White Hall	44.7	50.5		
D4 2017 I49 Massard	56.7	48.3		
D7 East Camden	47.2	51.4		
D7 El Dorado east	47.0	54.8		
D7 El Dorado west	44.8	51.4		
D7 Fordyce	47.6	56.7		
D9 Bear Creek Springs	47.2	50.7	53.3	
D9 Mountain Home a	46.5	48.9		
D9 Mountain Home b	48.5	51.6		
D9 Mountain Home c	52.4	61.9		
D9 US412 and Hwy23 NE	50.2	45.4	48.4	44.3
D9 US412 and Hwy23 NW	52.3	33.4	43.3	45.9
D9 US412 and Hwy23 SE	51.8	52.1	61.6	45.3
D9 US412 and Hwy23 SW	57.9	51.1	58.8	41.3
Greene County 2018	50.1			
Trumann OW 2019 sw	33.7			

Foraging Score

Plot	2021	2022	2023	2024
D2 White Hall	19.6	19.6		
D4 2017 I49 Massard	22.5	17.5		
D7 East Camden	19.4	19.6		
D7 El Dorado east	18.3	22.1		
D7 El Dorado west	17.5	19.6		
D7 Fordyce	13.5	19.6		
D9 Bear Creek Springs	19.4	21.9	21.9	
D9 Mountain Home a	19.6	20.0		
D9 Mountain Home b	22.1	23.8		
D9 Mountain Home c	22.5	22.5		
D9 US412 and Hwy23 NE	19.4	19.4	16.0	17.5
D9 US412 and Hwy23 NW	20.0	11.0	13.5	16.1
D9 US412 and Hwy23 SE	19.4	20.0	22.1	17.5
D9 US412 and Hwy23 SW	21.9	20.0	19.4	13.5
Greene County 2018	19.6			
Trumann OW 2019 sw	13.8			

APPENDIX C: TABLES OF CONSERVATION ACTIONS

Prelisting conservation Actions to Benefit the Monarch Butterfly

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400
Conservation Herbicide	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400
*Wildflower Area Establishment	27	3.5	21.75	1	0	7	1	41	
*Wildflower Area Maintenance, Site Prep, or Enhancement						2	42	72	48.5
10% Net Benefit Set-aside									
Credits Earned									
Baseline Plots Monitored	NA	NA	NA	NA	88	75	60	50	52
Wildflower Sites Monitored	NA	NA	NA	NA	17	14	5	4	2

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 17,352 acres of Monarch Butterfly habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Texas Frosted Elfin

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing									
Conservation Herbicide									
Wildflower Area Establishment*		3.5				3		41	
Wildflower Area Maintenance, Site Prep, or Enhancement*						1		72	32.5
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 4,4322 acres of Texas Frosted Elfin habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Irons Fork Burrowing Crayfish

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	356	356	356	356	356	356	356	356	356
Conservation Herbicide	356	356	356	356	356	356	356	356	356
Wildflower Area Establishment*									
Wildflower Area Maintenance, Site Prep, or Enhancement*									
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 593 acres of Irons Fork Burrowing Crayfish habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Ouachita Burrowing Crayfish

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	638	638	638	638	638	638	638	638	638
Conservation Herbicide	638	638	638	638	638	638	638	638	638
Wildflower Area Establishment*									
Wildflower Area Maintenance, Site Prep, or Enhancement*									
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 1,064 acres of Ouachita Burrowing Crayfish habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Slenderwrist Crayfish

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	304	304	304	304	304	304	304	304	304
Conservation Herbicide	304	304	304	304	304	304	304	304	304
Wildflower Area Establishment*									
Wildflower Area Maintenance, Site Prep, or Enhancement*									
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 507 acres of Slenderwrist Crayfish habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Bayou Bodcau Crayfish

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	522	522	522	522	522	522	522	522	522
Conservation Herbicide	522	522	522	522	522	522	522	522	522
Wildflower Area Establishment*									
Wildflower Area Maintenance, Site Prep, or Enhancement*									
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 871 acres of Bayou Bodcau Crayfish habitat estimated in the USFWS Conference Opinion.

Prelisting Conservation Actions to Benefit the Jefferson County Crayfish

Conservation Action	2017	2018	2019	2020	2021	2022	2023	2024	2025
Conservation Mowing	287	287	287	287	287	287	287	287	287
Conservation Herbicide	287	287	287	287	287	287	287	287	287
Wildflower Area Establishment*							1		
Wildflower Area Maintenance, Site Prep, or Enhancement*						1			
10% Net Benefit Set-aside									
Credits Earned									

** projects use federal funds*

Conservation mowing and herbicide acreage are based on a very conservative estimate that the standard conservation mowing practices are applied on 60% of the 479 acres of Jefferson County Crayfish habitat estimated in the USFWS Conference Opinion.