FINAL PERFORMANCE REPORT

Federal Aid Grant No. F20AF10556 (T-117-M-1)

Restoring Oak/Hickory Forest and Woodland Habitats in the Cross Timbers and Blue River Watershed

October 1, 2020 - June 30, 2024

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State: Oklahoma **Grant Number:** F20AF10556 (T-117-M-1)

Grant Program: State Wildlife Grants

Grant Title: Restoring Oak/Hickory Forest and Woodland Habitats in the Cross Timbers and Blue River Watershed

Grant Period: October 1, 2020, - June 30, 2024

Principal Investigator: Haley Bloomquist, Blue Boggy Preserve Manager, The Nature Conservancy in Oklahoma

ABSTRACT:

The Nature Conservancy (TNC) has owned the Pontotoc Ridge Preserve (PRP), which lies within the Cross Timbers ecoregion, since 1994. The preserve encompasses approximately 3,000 acres of riparian forest, post/blackjack oak and hickory/oak woodland forests, and tallgrass prairie. These habitat types are rated as high priorities in the Oklahoma Comprehensive Wildlife Conservation Strategy, and the vegetation communities on the PRP provide significant intact habitat for at least 19 Species of Greatest Conservation Need (SGCN). The Cross Timbers ecosystem faces multiple threats from degradation due to urbanization, pollution, changes in fire regime, and invasive species. Funding from this State Wildlife Grant (SWG) supported restoration actions on the PRP from October 1, 2020, through June 30, 2024. The habitat restoration goals of this project were: 1) to return a consistent yet adaptive fire regime to the PRP and conduct prescribed burns on 1,525 acres, 2) to implement a forest / woodland selective thinning program to improve structural diversity on 350 acres, and 3) to institute an invasive species eradication program on 1,525 acres that focuses on the removal of non-native invaders that include, sericea lespedeza *(Lespedeza cuneata),* Johnson grass *(Sorghum halepense),* Chinese privet *(Ligustrum vulgare),* yellow bluestem *(Bothriochloa ischaemum)* and native, over-abundant trees including eastern redcedar *(Juniperus virginiana),* winged elm *(Ulmus alata),* and honey locust *(Gleditsia triacanthos).* The project focused on benefiting the 19 Species of Greatest Conservation Need that inhabit the PRP by improving cover and food resources for birds and nectaring insects, promoting vegetative heterogeneity through the removal of encroaching woody species and the eradication of invasive species. With this support, The Nature Conservancy was able to achieve and exceed the goals outlined in the project statement. Prescribed fire was applied to 2,516 acres, the structural diversity and species composition was enhanced on 391 acres of bottomland forest and upland oak-dominated woodlands, and invasive species eradication or control measures were implemented across 1,790 acres on the PRP.

BACKGROUND:

The Nature Conservancy's Pontotoc Ridge Preserve (PRP) is located in southern Pontotoc and northern Johnston counties Oklahoma, in an area of folded and faulted limestone and granite overlying the Arbuckle/Simpson Aquifer. The PRP and its surrounding landscape lie within the Cross Timbers ecoregion where the Conservancy has maintained a presence since 1994 when the PRP was established. The landscape and vegetation types of the nearly 3,000-acre Preserve are diverse and unique. Surveys conducted recently by the Oklahoma Biological Survey identified several vegetation types and classified one new vegetation association (Buthod 2019).

Bottomland Hardwood Forest occurs in the northern tier of the preserve making up approximately 700 acres. This plant community has been identified under the Oklahoma Comprehensive Wildlife Conservation Strategy as a Very High priority Conservation Landscape and supports the following Species of Greatest Conservation Need (SGCN) on the PRP: Prothonotary Warbler, Louisiana Waterthrush, Kentucky Warbler and American Woodcock. Post Oak / Blackjack Oak Woodlands occur sporadically throughout the western portion of the preserve and have been identified as a High Priority Conservation Landscape in the OCWCS. This community type supports the following SGCN: Northern Bobwhite, Painted Bunting, and Red-headed Woodpecker. Small Gravel-bottom Streams and Associated Riparian Forests, identified as High Priority Conservation Landscapes under the OCWCS, occur throughout Pontotoc Ridge, and the PRP's Tallgrass Prairie habitat supports several SGCN, including the Iowa Skipper and American Bumble Bee.

Fire is essential for maintaining native plant communities and wildlife habitat in the Cross Timbers region and most of the region's plant species are fire-adapted. Many of the region's native prairies and woodlands are out of balance because of fire suppression and woody encroachment over the past 120 years. Insufficient personnel capacity has resulted in an infrequent fire pattern on the PRP and has led to conditions that favor homogenization of forest communities and a reduction in the acreage of fire-dependent woodlands and prairies. Once an open woodland becomes a forest, the fuel type changes to tree leaf litter that produces a less intense burn during a fire, and a closed canopy condition prevents the production of large quantities of fine fuels. As a result, forests and woodlands become denser with an increasing abundance of mid-story and understory woody vegetation and a decreasing abundance of native grasses and forbs. In the absence of fire, eastern redcedar (*Juniperus virginiana)* has become more abundant on the Preserve and invasive forbs have increased in abundance. Similarly, winged elm (*Ulmus alata*), honey locust (*Gleditsia triacanthos*), Osage orange (*Maclura pomifera*), and Chinese privet, *(Ligustrum sinense)* have encroached into riparian forests, woodlands, and prairies on the Preserve.

Twenty-five years of infrequent and inconsistent prescribed fire have altered the composition of the native flora and fauna on the PRP and created conditions under which fire management and habitat restoration are more expensive and complex. Consequently, fire intensity in the forest is too low to kill established trees, and fire alone cannot restore closed-canopy forest to open woodlands. A more intensive and intentional management approach is required for habitat restoration.

OBJECTIVES:

Objective 1 (TRACS Strategy – Direct Habitat and Species Management):
Directly restore, enhance, create, or manage 3,400 acres by June 30, 2024.

Activity Tag 1:

- 1,525 acres of prescribed fire
  Target Species: Painted Bunting, Northern Bobwhite, American Burying Beetle, American Bumble Bee and Iowa Skipper
  Habitat: open-canopy oak woodlands and tallgrass prairie
- 1,525 acres of invasive species control – plants
  Target Species: Painted Bunting, Northern Bobwhite, American Burying Beetle, American Bumble Bee and Iowa Skipper
- 350 acres of forest stand management
  Target Species: Kentucky Warbler, Prothonotary Warbler, Louisiana Waterthrush and American Woodcock.
  Habitat: riparian forest and oak woodland

Sub-recipient Narrative Objectives:

1. Restore structural diversity of forests and riparian woodlands on 350 acres.
2. Minimize impacts of invasive species on native plant and animal diversity by reducing the potential recolonization of sericea lespedeza, winged elm, honey locust and Osage orange from 1,525 acres of surrounding habitat.

APPROACH:

1) Goal: 1,525 acres of prescribed fire and 3-4 miles of fire breaks.
We achieved the application of prescribed fire on 2,516 acres and installed four miles of fire breaks through mulching, cutting, and mowing.
Target Species: Painted Bunting, Northern Bobwhite, American Burying Beetle, American Bumble Bee, and Iowa Skipper.
Habitat: open-canopy oak woodlands and tallgrass prairie

During the life of the grant from October 1, 2020, through June 30, 2024, fire returned to the landscape of PRP. Through a partnership between TNC, the Bureau of Indian Affairs (BIA), and the Chickasaw Nation, prescribed fire operations were conducted on the PRP in 2021 and 2022. With this partnership, we were able to successfully implement prescribed burning on 1,591 acres. To prepare for these fire activities, TNC installed four miles of fire breaks with support from this grant's funding. Fire breaks were installed by hiring contractors to conduct forestry mulching while TNC staff used chainsaws to cut larger trees. No soil disturbance was required to complete the activities that were funded by this grant. An additional 12 miles of fire breaks were installed using the same methods but with private funding that was separate from this grant. Most of the privately-funded miles of fire breaks were installed along the PRP exterior property boundaries. In 2023, TNC deployed its internal North America Region Fire Team that provided a qualified burn boss and qualified fire crew members to assist the PRP. With this team, TNC was able to burn 925 acres in two tracts during the late growing season (before the first frost) in November 2023. This resulted in the overall total 2,516 acres of prescribed fire applied to the

PRP during the life of this grant. Figure 1 identifies the locations and extent of prescribed fire activities during the grant period. Figure 2 shows the effects of a 2021 dormant-season prescribed fire. Figures 3 and 4 capture the prescribed fire operations and the TNC fire crew on November 1, 2023.

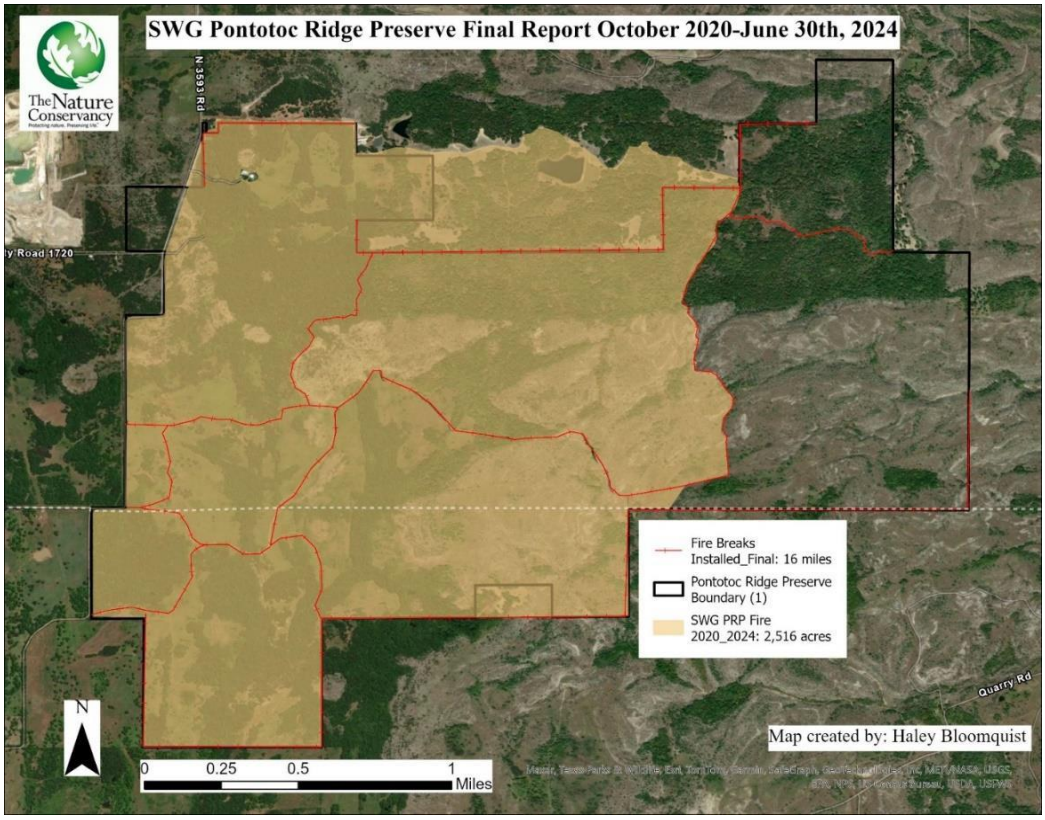

Figure 1. Locations of prescribed fire and installed fire breaks at Pontotoc Ridge Preserve.

Figure 2. July 2021 Photo of Prairie Blazing Star (Liatris pychnostachya) and Rattlesnake Master (Eryngium yuccifolium) in Field that Received Prescribed Fire in March of 2021.

Figure 3. One of Two SWG-funded Prescribed Burns (Snake Trap and Milkweed Units) November 1, 2023.

Figure 4. TNC North America Region Fire Crew on November 1, 2023

2) Goal: 1,525 acres of invasive species treatment

We achieved invasive species control treatments on 1,790 acres.

***Target species*:** Painted Bunting, Northern Bobwhite, American Burying Beetle, American Bumble Bee, and Iowa Skipper

Habitat: open-canopy oak woodlands and tallgrass prairie

The Nature Conservancy implemented an invasive species eradication program between October 1, 2020 and June 30, 2024 with financial support from this grant. The Nature Conservancy focused on fire-intolerant, over abundant native species (winged elm, honey locust, and eastern redcedar) and non-native, invasive species (sericea lespedeza, Johnson grass, Chinese privet, and yellow bluestem) on 1,790 acres across all habitat types (riparian/bottomland forest, and upland oak woodlands, and prairies) on the PRP. We used multiple treatment methods, including complete trunk cutting for eastern redcedar (Figure 5), forestry mulching, targeted herbicide applications of Triclopyr amine on tree stumps and wounds created though the hack-and-squirt technique (Figure 6), targeted foliar application of Triclopyr ester on sericea lespedeza, application of Aminopyralid directly on the freshly cut stumps or resprouting foliage of previously cut honey locusts and winged elms, application of Glyphosate directly on Chinese privet foliage, and foliar application of Imazapyr on yellow bluestem and Johnson grass. Herbicide applications were made on foot using a backpack sprayer in forested and in rocky locations, but on prairie sites that were not rocky, these applications were made from a UTV. Based on the phenology of each invasive species, the treatment timeframe varied. Sericea lespedeza was treated between April and mid-September, Johnson grass was treated in June and July, yellow bluestem was treated from June through September, privet treatments occurred between November and January, and the application of the hack-and-squirt technique on woody vegetation occurred between the months of July and November. The treatment of resprouting honey locust and winged elm occurred in the months from July through September via backpack sprayer. Figure 7 provides a map of the invasive species eradication efforts.

Figure 5. Eastern Redcedar Cutting Adjacent to Woodland Habitat on the Pontotoc Ridge Preserve

Figure 6. Hack-and-squirt Method Used on Chinese Privet

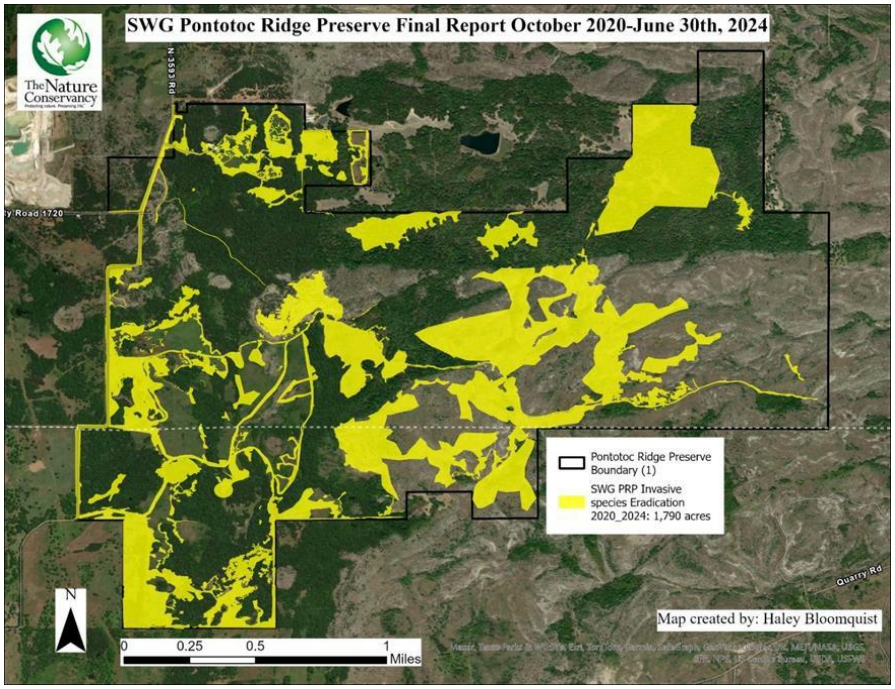

Figure 7. Locations of Invasive Species Eradication Activities Conducted on the Pontotoc Ridge Preserve.

3) Goal: 350 acres of forest stand management achieved

We achieved forest stand management (selective thinning) on 391 acres.

Target species: Kentucky Warbler, Prothonotary Warbler, Louisiana Waterthrush, and American Woodcock

Habitat: bottomland forest and oak woodland

Selective thinning occurred between October 1, 2020 and June 30, 2024 using the hack-and-squirt method within the bottomland forest and adjacent upland woodlands. The hack-and-squirt method involved using a hatchet to cut a notch in the targeted tree's trunk then using a one-quart bottle hand sprayer containing Triclopyr amine to apply the herbicide to the new wound on the trunk. Staff would walk through the bottomland forest and focus treatment on winged elm, honey locust, and Osage orange trees along the forest edge and within the interior. In 2021, we altered our approach based on a report from the Oklahoma Forestry Services, by shifting our focus to address canopy spacing and tree density. Staff prioritized opening the canopy by hack-and-squirting small diameter trees (12 inches or less in diameter) from the three undesirable species listed above that were competing for sunlight with the more desirable species (oak, walnut, pecan, and hickory trees). Opening the mid-story and canopy should encourage the growth of native grasses and forbs, which will increase the availability of ground-level fuels for prescribed fire and provide beneficial cover and food for birds and pollinators. Eastern Redcedars were removed by cutting the trunks directly with the hatchet. Along the edges of the woodlands, against grasslands or roads, a skid steer equipped with a hydraulic mulcher was used to remove dense patches of small winged elms, honey locusts, and eastern redcedars. The mulching work was accomplished by hiring a contractor. Figure 8 depicts the locations of the selective thinning treatments.

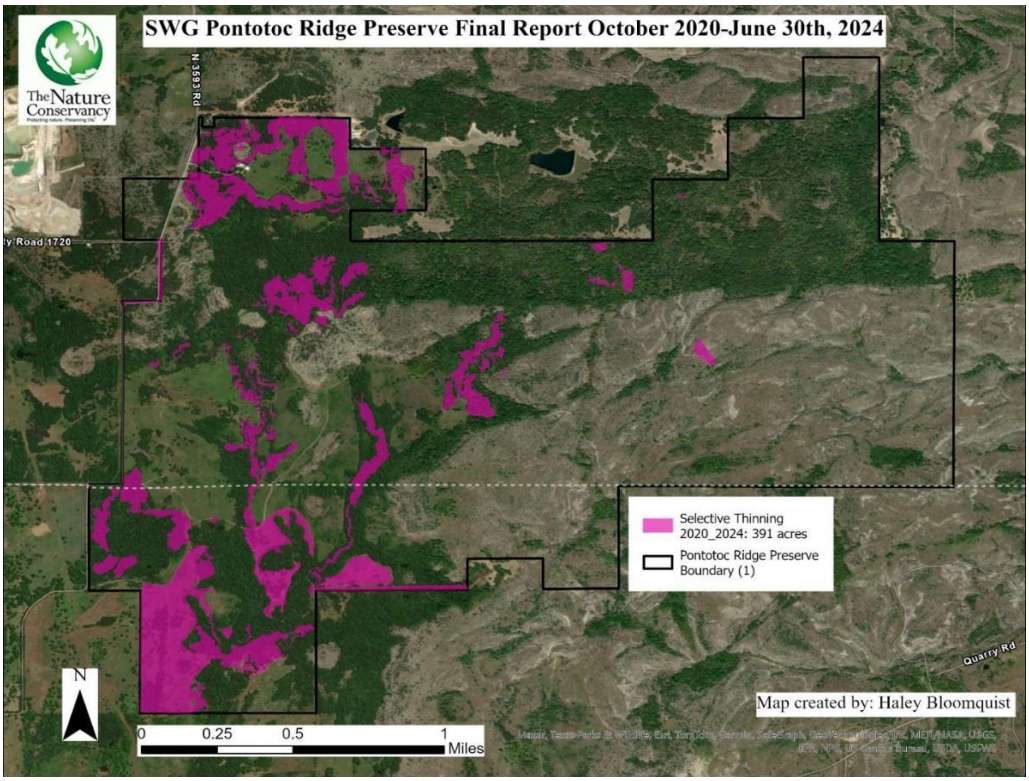

Figure 8. Locations of Selective Thinning Treatments Conducted on the Pontotoc Ridge Preserve.

Monitoring:

Measuring the changes in vegetation and wildlife populations in response to land management practices is often difficult to quantify and it was made more difficult because of internal staff changes during the life of the grant. We relied heavily on a series of photo points to show the differences in vegetation structure before and after our habitat improvement treatments, and we used our annual butterfly count as an indirect measurement of changes in herbaceous vegetation abundance and diversity (increased plant diversity should result in an increase in butterfly species diversity). Additionally, we implemented visual vegetation surveys along 8 transects as another approach to quantifying the changes in plant diversity and invasive species coverage.

In 2021, Oklahoma Forestry Services (OFS) conducted forestry stand management surveys on PRP to determine forest density and tree species composition. Two stands were identified and delineated (Figure 9), and recommendations were provided for the next 10-year period. The OFS determined that in Stand 1 the species composition was 21% post oak, 14% chinkapin oak, 12% green ash, 9% Shumard oak, 9% Osage-orange, 9% winged elm, 6% black hickory, 5% bur oak, and 3 % black oak trees. For Stand 1, the canopy is primarily closed with an average basal area of 73.78 ft^2/acre for all species, an average diameter at breast height (DBH) of 13 inches, and an average of 130 trees per acre over the 735 acres. In Stand 2, the species composition was 25% Osage orange, 15% pecan, 8% post oak, 8% slippery elm, 6% Shumard oak, 6% winged elm, 5% green ash, 3% blackjack oak, and 3% sugarberry trees. The canopy in Stand 2 was primarily closed with an average basal area of 63.26 ft^2/acre for all species, an average DBH of 13 inches, and an average of 126 trees per acre over the 340 acres.

The OFS composition analysis showed that the dominant tree species on the PRP were several species of oaks, Osage orange, and pecan. Other trees that occurred in both stands were winged elm, eastern redcedar, and honey locust, with some patches of Chinese privet shrubs in the understory. These species were the primary focus of our management for forest health and the forest's associated wildlife. The OFS recommended removal of eastern redcedars, except along the stream banks for mitigation of soil erosion, and the removal of all privet. These actions were undertaken and achieved during the life of this grant. Their recommendations also included the selective thinning of winged elms, honey locusts, and Osage orange trees, and the retention of mature Post Oaks (*Quercus stellata*), Chinkapin Oaks (*Q. muehlenbergii*), and Bur Oaks (*Q. macrocarpa*) as well as specific soft-mast-producing trees, such as Mexican Plum (*Prunus mexicana*), Rusty Blackhaw (*Viburnum rufidulum*), Chittamwood (*Sideroxylon lanuginosum*), Common Persimmon (*Diospyros virginiana*), and Red Mulberry (*Morus rubra*).

The Nature Conservancy has organized an ongoing butterfly survey since the PRP was established in the mid-1990s. These butterfly surveys are conducted between June and September and are repeated twice a year. Annual surveys were conducted during the grant period in 2021, 2022, and 2023, and the butterflies were recorded through visual observations in the field and the post-hoc identification of photographs taken during the surveys. To highlight some results, there were 147 individuals of 29 species recorded in 2021, including American Lady (*Vanessa virginiensis*), Monarch (*Danaus plexippus*), Arogos Skipper (*Atrytone arogos*) (Figure 10), Common Buckeye (*Junonia coenia*), and Little Wood-satyr (*Megisto cymela*). The 2022 butterfly surveys recorded 94 individuals of 23 species (no Arogos Skippers or Monarchs were observed), and in 2023 there were 446 individuals of 42 species (no Arogos skippers or

Monarchs were observed but there were sightings of three rare species – Confused Cloudywing, Harvester, and Long-tailed Skipper). Table 1 provides a list of the butterfly species that were documented during the PRP butterfly counts from 2021 through 2023. Variations in weather conditions, particularly seasonal rainfall, have a dramatic effect on butterfly populations and diversity; therefore, it wasn't possible to determine the relative effects of rainfall (especially in 2023) from the effects of our habitat treatments.

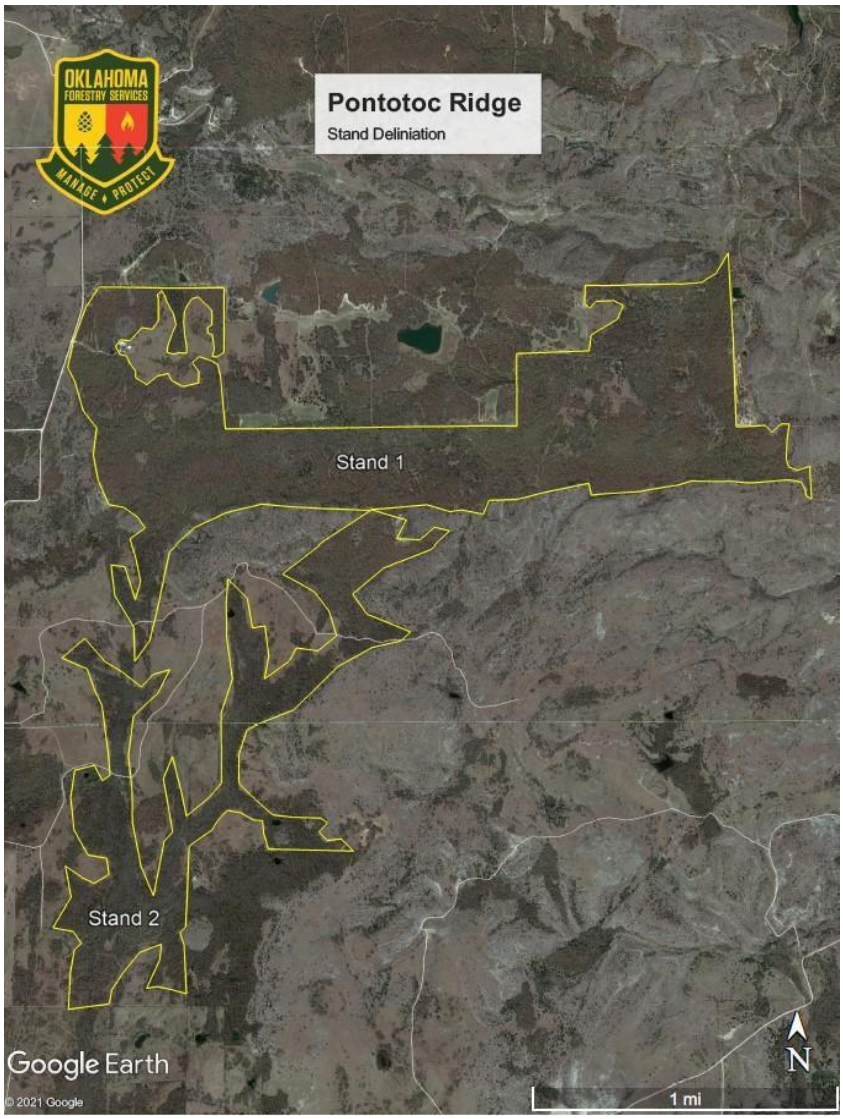

Figure 9. Forest Stand Management Units Used to Estimate Within-stand Tree Density and Species Composition on the Pontotoc Ridge Preserve.

*Table 1. Butterfly Species Recorded on Counts Completed in 2021, 2022, and 2023 on the Pontotoc Ridge Preserve (**indicate rare sightings)*

Pontotoc Ridge Preserve Butterfly Count	2021	2022	2023
American Lady *(Vanessa virginiensis)*	X		X
American Snout *(Libytheana carinenta)*	X	X	X
Arogos Skipper *(Atrytone arogos)*	X		
Black Swallowtail *(Papilio polyxenes)*			X
Checkered White *(Pontia protodice)*			X
Clouded Skipper *(Lerema accius)*		X	X
Common Buckeye *(Junonia coenia)*	X	X	X
Common Checkered-Skipper *(Pygus communis)*	X		X
Common Roadside Skipper *(Amblyscirtes vialis*	X	X	
Common Wood-Nymph *(Cercyonis pegala)*	X	X	X
**Confused Cloudywing *(Thorybes confusis)*			X
Dainty Sulphur *(Nathalis iole)*	X	X	X
Dun Skipper *(Euphyes vestris)*	X	X	X
Eastern Tailed-Blue *(Cupido comyntas)*	X	X	X
Eastern Tiger Swallowtail *(Papilio glaucus)*	X		X
Fiery Skipper *(Hylephila phyleus)*		X	X
Funereal Duskywing *(Erynnis funeralis)*			X
Gemmed Satyr *(Cyllopis gemma)*	X		
Giant Swallowtail *(Papilio cresphontes)*			X
Goatweed Leafwing *(Anaea andria)*	X		X
Grey Hairstreak *(Strymon melinus)*	X	X	X
Gulf Fritillary *(Dione vanillae)*			X
Hackberry Emperor *(Asterocampa celtis)*	X	X	X
**Harvester *(Feniseca tarquinius)*			X
Hoary Edge *(Achalarus lyciades)*			X
Horace's Duskywing *(Erynnis horatius)*	X		X
Little-Wood-satyr *(Megisto cymela)*	X		
Little Yellow *(Eurema lisa)*		X	X
**Long-tailed Skipper *(Urbanus proteus)*			X
Monarch *(Danaus plexippus)*	X	X	
Northern Cloudywing *(Thorybes pylades)*			X
Orange Sulphur *(Colias eurytheme)*	X	X	X
Painted Lady *(Vanessa cardui)*			X
Pearl Crescent *(Phycoides tharos)*	X		X
Pipevine Swallow *(Battus philenor)*	X		X
Queen *(Danaus glilippus)*			X
Question Mark *(Polygonia interrogationis)*	X		X
Reakirt's Blue *(Echinargus isola)*		X	X
Red Admiral *(Vanessa atalanta)*	X		X
Red-banded Hairstreak *(Calycopis cecrops)*	X	X	
Red-spotted Purple *(Limenitis arthemis)*			X
Sachem *(Atalopedes campestris)*		X	X
Silver-spotted Skipper *(Epargyreus clarus)*			X
Silvery Checkerspot *(Chlosyne nycteis)*	X		X
Sleepy Orange *(Eurema nicippe)*		X	
Southern-Broken-Dash *(Wallengrenia otho)*		X	
Southern Cloudywing *(Thorybes bathyllus)*	X	X	X
Summer Azure *(Celastrina neglecta)*	X		
Tawny Emperor *(Asterocampa clyton)*		X	X
Tawny-edge Skipper *(Polites themistocles)*	X	X	
Variegated Fritillary *(Euptoieta claudia)*	X	X	X
Wild Indigo Duskywing *(Erynnis baptisiae)*			X

Figure 10. Butterfly Milkweed with Arogos Skipper on the Pontotoc Ridge Preserve. Photo by Dr. Leah Dudley, East Central University.

A robust, two-year floristic survey was initially proposed for 2022 and 2023. Visual vegetation surveys were conducted by a contractor in 2022, but staffing changes at the PRP and contractor availability limited the data collection to that single year. Surveys were conducted along 8 transects across six broad habitat types (sparse vegetation, grassland vegetation, forested, disturbed/old field, shrubland, and herbaceous wetlands). Each transect followed a 100-meter measuring tape and vegetation data were collected at 5-meter intervals along the length of the transects (Figure 11). At each 5-meter increment, three different sized square plots ($0.01m^2$, $0.1m^2$, and $1m^2$) were placed along the left side of the measuring tape and every plant that occurred in each of the three plots was identified to species. This survey approach was designed to quantify a Floristic Quality Index (FQI) and a Coefficient of Conservatism (C-value) in response to habitat improvements and to measure vegetation diversity.

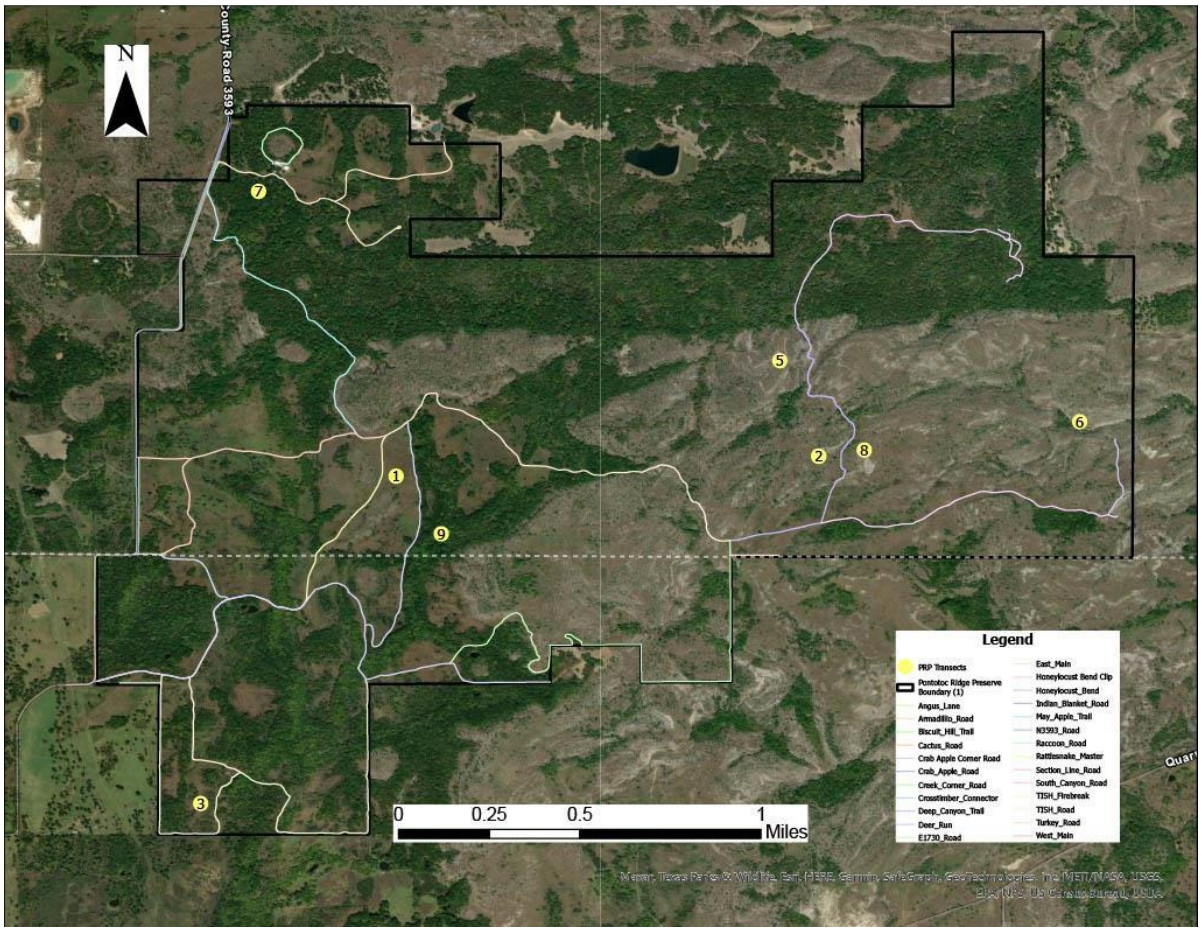

Figure 11. Visual Vegetation and Photo Monitoring Points for the Floristic Inventory Conducted at the Pontotoc Ridge Preserve

The approach of calculating FQIs and C-values has been used as a conservation practice to measure species richness, rarity, and ecosystem intactness for several habitats in multiple states (Spyreas 2019). The C-values may be grouped into four categories which correspond to their tolerance to anthropogenic disturbance. Non-native species are assigned a value of 0, weedy low-ranking species are assigned values of 1-3, plants with intermediate tolerance are assigned values of 4-7, and the highest-quality plants (most sensitive or highest conservation interest) are assigned values of 8-10 (McAvoy 2023). The results for the PRP indicate a mean C-value of 4.09 which falls in the intermediate rank. The FQI scale ranges from 0-100 and is calculated by multiplying the C-value by the square root of the total number of species in order to determine either its environmental stressors (disturbance) tolerance and/or to identify sites of high conservation value (Spyreas 2019). In 2022, the FQI average of 60.5 indicates that the PRP experienced substantial disturbances prior to the implementation of this SWG project such as fire suppression, drought, heavy grazing pressure, or limited application of best management practices (e.g., prescribed fire, mowing, controlled grazing). It also indicates that the conservation value of the current vegetation community is moderate for the 8 transects overall. The FQI and C-values for each transect are shown in Table 2.

Table 2. Total Number of Species, Coefficient of Conservation (C) and Floristic Quality Index

(FQI) Values for Vegetation Surveys Conducted at the Pontotoc Ridge Preserve in 2022.

Transect	Plot (S, M, L)	Total Number of Species	N with C Values	Mean C Value	FQI
1	S	16	14	3.36	12.56
1	M	35	31	3.97	22.09
1	L	59	51	3.88	27.73
2	S	18	15	4.53	17.56
2	M	36	26	4.12	20.98
2	L	63	47	4	27.42
3	S	31	24	3.67	17.96
3	M	57	47	3.49	23.92
3	L	86	72	3.64	30.88
5	S	23	20	4.2	18.78
5	M	36	30	4.4	24.1
5	L	68	52	4.08	29.4
6	S	19	16	4.94	19.75
6	M	35	28	4.54	24
6	L	58	45	4.4	29.52
7	S	14	13	3.54	12.76
7	M	27	24	3.38	16.53
7	L	54	49	3.37	23.57
8	S	19	14	5.64	21.11
8	M	30	20	5.1	22.81
8	L	46	30	4.6	25.2
9	S	14	14	3.43	12.83
9	M	22	22	3.36	15.78
9	L	35	34	3.92	22.81
Entire Area	S	108	90	4.22	40.06
Entire Area	M	182	146	3.92	47.34
Entire Area	L	275	219	4.09	60.55

No visual vegetation surveys were performed in 2023, but in 2024 TNC conducted a visual vegetation survey using the same methodology but focusing on the percent-cover of invasive species, rather than all species, along the same 8 transects. In Table 3, the percentage of cover for invasive species from the 2022 vegetation survey data are shown in comparison with the invasive species percentage of cover calculations from the 2024 survey. These data indicate that some level of habitat improvement occurred along transects 1, 3, 5, 6, 7, 8, and 9 as a result of the restoration methods we applied (prescribed fire, selective chemical treatment, and mechanical thinning) during this grant and the results are consistent with our goal of instituting an invasive species eradication program.

Table 3. Invasive Species Percentage of Coverage Comparison Between 2022 and 2024.

Transect	Habitat Type	2022 Invasive Species Percentage	2024 Invasive Species Percentage
1	big bluestem-switchgrass-gama grass herbaceous association	3.98	0.50
2	hairy grama-side oats grama vegetation	0.00	1.00
3	disturbed old field	16.88	7.50
5	seep muhly vegetation	1.43	0.00
6	shrubland association	0.65	0.25
7	bur oak, shumard oak, bitternut, hickory forest association	0.78	0.30
8	sparse vegetation	0.00	0.00
9	American elm, sugarberry, green ash, white ash forest association	2.98	1.50

DISCUSSION:

With the funding from this grant, TNC has been able to return a consistent yet adaptive fire regime to the PRP, implemented a forest/woodland selective thinning program to provide structural diversity to the Preserve's forest stands, and instituted an invasive species eradication program that focuses on the removal of non-native invasive species including sericea lespedeza, Johnson grass, Chinese privet, and yellow bluestem. Additionally, the footprint occupied by native but over-abundant woody species such as eastern redcedar, winged elm, and honey locust has been reduced. Originally, our collective restoration acreage goal was 3,400 acres in three treatment categories. However, as Figure 12 shows, we were able to achieve 4,439 acres of treatment across our three practice categories: prescribed fire, selective thinning, and invasive species eradication. In some areas, individual acres received multiple treatments (e.g. prescribed fire and invasive species eradication), and our total unique acres treated and improved under the grant were 2,208 acres.

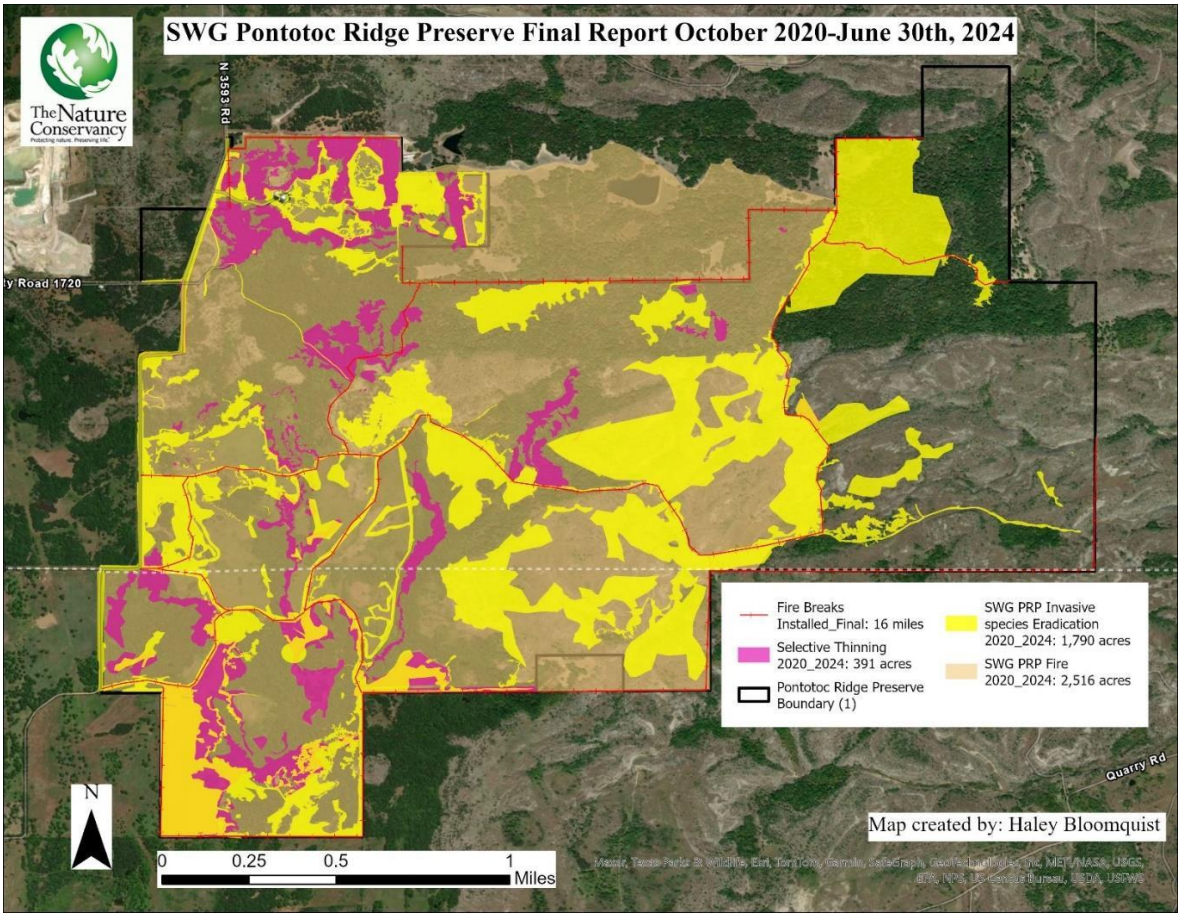

Figure 12. Total Acres Treated between 2020 and 2024 at the Pontotoc Ridge Preserve.

Species of Greatest Conservation Need (SGCN) Supported by Habitats at Pontotoc Ridge Preserve:

Extensive habitat improvements have occurred on 2,208 unique acres across in multiple habitat types on the Pontotoc Ridge Preserve and these have benefited 19 species that are recognized as Species of Greatest Conservation Need in Oklahoma (Table 4). Incorporating prescribed fire, improving habitat through invasive species eradication, and selective thinning programs have improved habitat conditions for these species in multiple ways. For example, woody encroachment by eastern redcedars in the prairie habitats have had a negative influence on SGCN such as the American Burying Beetle. The increase of eastern redcedar trees decreases the diversity of native forbs and grasses, which reduces the rodent abundance that the beetle is dependent on for its annual cycle of reproduction. Fire aids in increasing the species richness of both plants and small mammals and benefits the beetle (Ludwig, 2021).

Butterfly species are negatively affected by increased canopy closure in woodlands that is caused by woody encroachment. This reduces the abundance and diversity of herbaceous understory vegetation and affects plants that are important for nectaring and larval rearing. Butterflies benefit from management methods such as prescribed fire and selective thinning to provide a mosaic of the flora diversity (Tormanen 2020) and (Geest 2021). Similarly, the rotation

of prescribed fire aids in habitat connectivity for grassland and woodland bird species such as the Northern Bobwhite that requires short to mid-height vegetation structure for nesting and for traveling across the Preserve (Crosby, 2012). Our invasive species eradication program aids in habitat restoration by combating plants that are minimally not impacted by prescribed fire such as sericea lespedeza, yellow bluestem, and Johnson grass. Selective thinning aids in opening the dense canopy so that sunlight can stimulate native grass and forbs growth, and this increases food resources for wildlife such as the American Woodcock (Williamson 2010).

The Red-headed Woodpecker benefits from standing dead trees and the selective thinning produced by the hack-and-squirt method leaves standing snags that provides opportunities for the woodpecker to create nesting cavities (Bulluck, 2019). The PRP staff has collected anecdotal observations of SGCN that have benefitted from the habitat improvements supported by this grant. In the March of 2022, we observed 12 Northern Bobwhite using our largest burn unit of 1,067 acres. In February of 2024, two American Woodcocks and nine Red-headed Woodpeckers were observed in this same 1,067-acre burn unit.

Table 4. List of SGCN Present on the Pontotoc Ridge Preserve.

Springs, Caves, Karst, Streams		**Small Rivers/Oak Hickory Bottomland Hardwood Forest**		**Post Oak/Blackjack Oak/Hickory Woodland and Forest**		**Tallgrass Prairie**
Louisiana Waterthrush		Louisiana Waterthrush		American Woodcock		Bell's Vireo
Oklahoma Cave Amphipod		American Woodcock		Kentucky Warbler		Harris Sparrow
		Kentucky Warbler		Northern Bobwhite		LeConte's Sparrow
		Red-headed Woodpecker		Painted Bunting		Loggerhead Shrike
		Wood Thrush		Red-headed Woodpecker		Northern Bobwhite
		Prothonotary Warbler		American Bumble Bee		American Burying Beetle
				American Burying Beetle		Byssus Skipper
				Byssus Skipper		Iowa Skipper
				Scarlet Snake		

SIGNIFICANT DEVIATIONS:

There were no significant deviations to the scope and objectives of this grant, but we requested an extension to the grant's ending date to move it from September 30, 2022 to June 30, 2024. During the timeframe of the grant, the Covid-19 pandemic, limited staff resources, and weather challenges brought about by regional drought prevented us from executing all of our

prescribed fire goals. By extending the grant, TNC was able to complete the last prescribed burn in 2023 after the end of the drought.

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