Title: TRANSITIONING AN OZARK OAK FOREST TO A WOODLAND HABITAT: AN EVALUATION & DEMONSTRATION OF WOODLAND MANAGEMENT

Project Summary

The primary goal of this project is to benefit species of conservation need associated with historical oak woodlands by increasing the extent of this habitat in the Ozark Highlands. To achieve this goal, a new woodland restoration project will be initiated near Batesville, AR to provide quality woodland habitat, yet also serve as a demonstration site for landowners and natural resource managers to learn about managed oak woodlands, which, in turn, will help promote woodland management on other lands. Woodland management objectives of this project are to create stand structures consistent with reconstructed historical oak woodlands, reduce the abundance of redcedar, promote a diverse ground flora of native woodland species, especially those known to benefit SGCN insects, and benefit fauna associated with oak woodland habitats, especially native insect pollinators. Periodic monitoring and evaluation of this project will be used to inform the restoration process as well as the development of woodland management recommendations and information transfer activities.

Project Leader

Matthew Olson, Assistant Professor, Arkansas Forest Resources Center, School of Forestry & Natural Resources, University of Arkansas-Monticello, 870-460-1790, olsonm@uamont.edu

Project Partners

Shaik Hossain, Program Associate, Arkansas Forest Resources Center, Division of Agriculture, University of Arkansas, 870-460-1948, hossain@uamont.edu

Kyle Cunningham, Assistant Professor, Arkansas Forest Resources Center, Division of Agriculture, University of Arkansas, 501-671-2145, kcunningham@uaex.edu

Christoph Stuhlinger, University Forester, Arkansas Forest Resources Center, Division of Agriculture, University of Arkansas, 870-460-1749, stuhlinger@uamont.edu

Project Budget

The total cost of this project is $85,945. We request $64,095 from State Wildlife Grant funds to help pay for project expenses. The remaining $21,850 will be covered by the University of Arkansas-Monticello.

Project Statement

Justification

Several lines of evidence suggest that woodlands once dominated landscapes of the Ozark Highlands (Hanberry et al. 2014a and 2014b, Foti 2004, Ladd 1991). Historically, fire was the primary process maintaining Ozarks woodlands (Ladd 1991, Nelson 2012). Fire suppression during the 20th century enabled increases in tree density, stand stocking, and canopy cover (i.e., densification) and is one of the major determinants of contemporary vegetation patterns in the Ozarks (Batek et al. 1999; Hanberry et al. 2012). These changes in structure represent a shift from open-canopied woodlands to closed-canopied forests (Hanberry et al. 2014a and 2014b). Densification and the emergence of forest conditions over the last century played out over a large extent in the Ozarks, from stand to landscape scales (Hanberry et al. 2012, Nelson 2012). As a result, open ecosystems (i.e., woodlands, savannas, and glades) maintained by frequent surface fires are at risk of being lost from landscapes of the Ozarks without management intervention to mitigate this trend. Fortunately, there are management options and programs to help landowners restore woodlands to Ozark landscapes.

Woodland management can yield multiple benefits to the conservation-minded landowner. Historically, woodlands supported a highly diverse biota and functioned as critical habitat for numerous species presently considered in need of conservation (Nelson 2012). Therefore, management actions that target historical woodland structures while restoring fire as an ecological process can greatly benefit native biodiversity, including species of conservation need. For example, management actions that promote a diverse herbaceous ground flora may also benefit SGCN insects that require woodland plant species for completing their life cycle. The frequent surface fires and xeric conditions of historical woodlands favored fire- and drought-tolerant vegetation, which may have conveyed a higher resistance and resilience to intense drought and regular fire than the forests that replaced them. Based on this premise, woodland restoration is increasingly viewed as a viable strategy for adapting landscapes to projected future climate and disturbance regimes (Hanberry et al. 2014a, Loudermilk et al. 2016). There are also short-term economic benefits associated with woodland management. The initial stage of transitioning a forest to a woodland may involve silvicultural thinning to reduce stand density, which could justify a timber sale that generates immediate revenue for the landowner. Therefore, not only would a thinning help accomplish woodland-based objectives, but it could also preclude early out-of-pocket expenses and provide funds for reinvestment in the restoration project.

From a regional conservation perspective, the goal of woodland restoration is to continue growing the spatial footprint of restored woodland natural communities. However, efforts should be taken to establish new projects on lands with the resources and ownership stability to ensure long-term commitment to woodland management, especially the need for repeated fire on a short interval. The highest return on investment in terms of restoration success is generally realized on certain site types and/or areas with historical woodland elements (e.g., higher ecological integrity), which is why some conservation agencies are now prioritizing restoration projects based on site classification and natural community status. Woodland restoration projects on appropriate site types and where land ownership is stable and interested in woodland management have a high probability of restoration success and, therefore, are a good investment.

This project will contribute to the growing acreage of restored woodland natural communities in the Ozark Highlands and provide habitat for species of conservation need

associated with woodlands (See Appendix A). Based on the site type, current vegetation, and ownership stability and commitment to conservation, this project is ideally located for achieving restoration success with a high likelihood of realizing a favorable conservation-based return on investment. Furthermore, this project will serve as a demonstration area for extension and outreach efforts promoting woodland management, which will encourage initiation of new woodland projects and help expand the footprint of managed woodland habitat in the Ozarks.

Purpose & Objectives

The primary purpose of this project is to increase the extent of oak woodland habitat in the Ozark Highlands in order to benefit species associated with this habitat type, especially species of conservation need (see Appendix A). A secondary purpose is to promote woodland management on other lands by using this project area as a woodland management demonstration site for landowners and natural resource managers to learn about managed oak woodlands. Specific objectives are to: 1) create a range of stand structures that are consistent with reconstructed historical ranges of variability of oak woodlands, 2) reduce the abundance of established redcedar and limit redcedar recruitment, 3) promote the development of a dense and diverse ground flora composed woodland species required by SGCN insects to complete their life cycle (see Appendix B), and 4) benefit wildlife species associated with oak woodland habitats, especially native insect pollinators.

Location

This project will be established at the Livestock & Forestry Research Station (LFRS) near Batesville, AR (see Appendix C for a map).The LFRS is owned and managed by the University of Arkansas-Division of Agriculture. The project site is located on the Springfield Plateau Subsection of the Ozark Highlands. The 100-acre project site is positioned on a south-facing slope of low productivity for forest growth. Vegetation at the sites is composed of scattered overstory oak (mainly post oak, white oak, & black oak) and a dense midstory of redcedar. The appropriate habitat type for this site is a dry oak woodland.

Approach

A network of monitoring plots will be installed across the project area for capturing ecological responses to treatments and evaluating the effectiveness of woodland management actions. Monitoring and evaluation will center on vegetation monitoring stations systematically located within the project site. Each station will capture all plant life forms using multiple, fixed-area plots spatially organized in a nested-plot design. Three inventories of monitoring stations will occur during the establishment phase of this project: 2018 (pre-treatment), 2019 (1st post-treatment), and 2020 (2nd post-treatment).

We will implement silvicultural thinning and prescribed fire to transition the project site's forest to an oak woodland. Thinning will target residual stand stocking levels representing the upper and lower limits of stocking in reconstructed historical oak woodlands of the Ozarks Highlands: 70% and 40%, respectively (Hanberry et al. 2014, Kabrick et al. 2014). Stocking reductions will be accomplished by a thinning-from-below targeting the removal of redcedar and fire-intolerant hardwood species. After the site has been thinned, we will implement a regime of repeated prescribed burning on a 2-3 year interval. The first thinning will take place in fall/winter of 2018-19 and first prescribed fire will be implemented in late winter of 2019. The long-term

plan is to thin when necessary and implement regular prescribed burning on a short cycle for the foreseeable future. Woodland management actions at this site may also use herbicide treatments.

Since several SGCN insects listed in Appendix A depend on certain species of ground flora for completing their life cycle, sampling crews will receive detailed training on the identification of plants known to benefit SGCN insects associated with dry oak woodland habitats (See Appendix B). We will also use a transect-based survey to periodically observe and identify insect pollinators visiting our project area during the growing season. Data on insect pollinator species and species groups will be collected to estimate relative abundances and the composition of the pollinator community. From this data, we will determine benefits of habitat improvements for insect pollinators. Crews will also be trained on identification of SGCN species listed in Appendix A. SGCN detections within the project area will be recorded.

Expected Results & Benefits

This project will result in the creation of a new oak woodland habitat. The target natural community type for the project site is a dry oak woodland; a priority habitat listed in Table 1 of the RFP. An oak woodland at the project site could provide quality habitat for numerous taxa and benefit SGCN associated with dry oak woodlands in the Ozarks, especially insect pollinators (see Appendices A & B). Not only will this project create a new oak woodland in the Ozarks, but it will oversee maintenance of this woodland through science-based, adaptive management. Periodic monitoring and evaluation will also result in learning opportunities during the restoration process that can inform the development of management recommendations and information transfer activities. An important result of this project will be the delivery of an outreach event at the project site promoting oak woodlands and natural community management. If this effort encourages landowners and managers to practice woodland management, that means the spatial footprint of managed woodlands will increase. This could benefit woodland restoration efforts for biodiversity conservation in Arkansas and increase the extent of suitable habitat for SGCN linked to these imperiled ecosystems. Although the plan is to create an oak woodland and maintain it for the foreseeable future, the project team is committed to habitat treatments and monitoring over the next decade (2018-2028).

Budget

The total cost of this project is $85,945 (See table below). Salary is the main expense of this project, which will help support a Program Associate (Dr. Shaik Hossain) to coordinate project activities and hire field technicians to assist with post-treatment monitoring in 2019 and 2020 and project maintenance. We request $64,095 from State Wildlife Grant funds to help pay for this project.

Item	**Cost ($)**		**Funding source**	**Contribution ($)**
Salary	40,478		AGFC – USFWS	64,095
Supplies/Equipment	4,393		Univ. of Arkansas	21,850
Travel	9,897			
Workshop	1,000			
Prescribed burning	2,500			
University overhead	27,677			
Total project cost	**85,945**			

Qualifications

Matthew Olson – Dr. Olson (Ph.D. Forest Resources – Univ. of Maine) is a research silviculturist with knowledge and experience applying silvicultural tools for restoring woodland natural communities in the Ozarks. While employed with the Missouri Department of Conservation (MDC), he coordinated two long-term projects on MDC land: one with the goal of restoring historical woodlands and another addressing a variety of natural community-based objectives, including woodland habitats. Dr. Olson worked closely with several colleagues on developing silvicultural guidelines for meeting woodland management targets for the Missouri Ozarks. Dr. Olson has co-authored several papers and delivered numerous presentations on woodland ecology and management.

Shaik Hossain – Dr. Hossain (Ph.D. Forestry – Univ. of Toronto) is an ecologist by training, with a particular research interest in quantitative forest ecology. He also has vested interests in forest restoration ecology. During his postdoctoral tenure at the University of Guelph Canada, he worked in a project examining the range shift potentials of native and exotic tree species as part of a large-scale restoration project in one of the largest remaining old growth red pine forests in North America. He plans to expand upon his knowledge and skills in restoring degraded woodlands particularly those with high biodiversity values, namely woodlands in the Ozark Highlands. Dr. Hossain has experience coordinating and managing several research projects both in the northern and southern forest types. Dr. Hossain has several peer-reviewed publications in forest ecology and management.

Kyle Cunningham – Dr. Cunningham (Ph.D. Applied Science/Bioscience – Univ. of Arkansas-Little Rock) is a research and Extension forester with knowledge and experience working with oak restoration in the Ozark highland region. Over his fourteen year career with the University of Arkansas – Division of Agriculture, Dr. Cunningham has conducted multiple natural oak studies exploring stand compositional changes from prescribed fire, herbicides, and mechanical thinning. Dr. Cunningham has also conducted multiple forestland owner/manager educational programs related to natural oak restoration efforts in this region. Dr. Cunningham has authored multiple papers in the area of hardwood management and ecology.

Christoph Stuhlinger – Mr. Stuhlinger (M.S. Forestry – Louisiana State Univ.) is University Forester for the University of Arkansas-Division of Agriculture. He oversees forest management activities on Division lands around Arkansas, and assists with forestry research and extension activities. He has more than 30 years' experience in forestry in Maryland and Arkansas.

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Appendix A: List of SGCN associated with dry oak and pine woodland habitats that could benefit from this project. Information for this table comes from the 2015 revised list of SGCN for Arkansas.

Common Name	**Scientific Name**	**Taxa**	**Priority Score**
Fourche Mountain salamander	*Plethodon fourchensis*	Amphibian	46
Kiamichi slimy salamander	*Plethodon kiamichi*	Amphibian	50
Rich Mountain Salamander	*Plethodon ouachitae*	Amphibian	38
Eastern whip-poor-will	*Antrostomus vociferus*	Bird	19
Northern bobwhite	*Colinus virginianus*	Bird	19
Purple finch	*Haemorhous purpureus*	Bird	19
Bewick's wren	*Thyromanes bewickii*	Bird	29
Bell's roadside-skipper	*Amblyscirtes belli*	Insect	21
Linda's roadside-skipper	*Amblyscirtes linda*	Insect	38
Golden-banded skipper	*Autochton cellus*	Insect	21
Northern metalmark	*Calephelis borealis*	Insect	23
Texas frosted elfin	*Callophrys irus hadros*	Insect	42
Outis skipper	*Cogia outis*	Insect	23
Monarch	*Danaus plexippus*	Insect	15
Beetle	*Derops divalis*	Insect	23
Baltimore checkerspot	*Euphydryas phaeton ozarkae*	Insect	27
Leonard's skipper	*Hesperia leonardus*	Insect	19
Meske's skipper	*Hesperia meskei*	Insect	29
Cobweb skipper	*Hesperia metea*	Insect	19
American burying beetle	*Nicrophorus americanus*	Insect	42
Rattlesnake-master borer moth	*Papaipema eryngii*	Insect	65
Oak hairstreak	*Satyrium favonius ontario*	Insect	19
Indiana phlox moth	*Schinia indiana*	Insect	38
Ozark big-eared bat	*Corynorhinus townsendii ingens*	Mammal	80
Eastern small-footed bat	*Myotis leibii*	Mammal	27
Indiana bat	*Myotis sodalis*	Mammal	62
Eastern spotted skunk	*Spilogale putorius*	Mammal	21
Western diamond-backed rattlesnake	*Crotalus atrox*	Reptile	17

Appendix B: Table of SGCN insects and their associated plant species. Sampling crews will receive training on the identification of both SGCN insects and plant species listed below.

SGCN Insect	**Associated Plant Species**
Bell's roadside-skipper	Indian woodoats
Linda's roadside-skipper	woodoats spp.
Northern metalmark	yellow ragwort, orange milkweed, black-eyed Susan, daisy or fleabane spp.
Texas frosted elfin	wild indigo spp.
Monarch	milkweeds
Baltimore checkerspot	smooth false foxglove, milkweeds, spreading dogbane
Leonard's skipper	little bluestem
Meske's skipper	little bluestem
Cobweb skipper	big bluestem, little bluestem
Rattlesnake-master borer moth	rattlesnake master
Oak hairstreak	oak spp.
Indiana phlox moth	downy phlox

Appendix C: Maps showing landscape context (top) of the project site (outlined yellow) and zoomed-in image of the 100-ac project area (bottom) located on the University of Arkansas-Division of Agriculture's Livestock & Forestry Research Station near Batesville, AR.