

Ozark Plateau National Wildlife Refuge

*Comprehensive Conservation Plan
and Environmental Assessment*

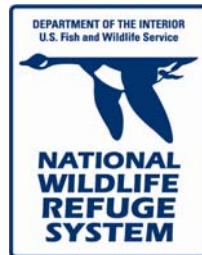
September 2013





U.S. Fish and Wildlife Service Mission Statement

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.



National Wildlife Refuge System Mission Statement

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

-National Wildlife Refuge System Improvement Act of 1997

Comprehensive conservation plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 1306
Albuquerque, New Mexico 87103



Dear Reader:

The U.S. Fish and Wildlife Service is pleased to provide you with a copy of the Final Comprehensive Conservation Plan (CCP) and Finding of No Significant Impact (FONSI) for Ozark Plateau National Wildlife Refuge in northeastern Oklahoma. This CCP identifies the role that the Refuge will play in support of the mission of the U.S. Fish and Wildlife Service (Service) and National Wildlife Refuge System. It provides long-term guidance to the refuge's management programs and activities.

The CCP was developed by an interdisciplinary planning team, which evaluated two management alternatives and chose Alternative B as the proposed action. The Service believes this management action is a positive step in conserving and managing the refuge's fish and wildlife resources.

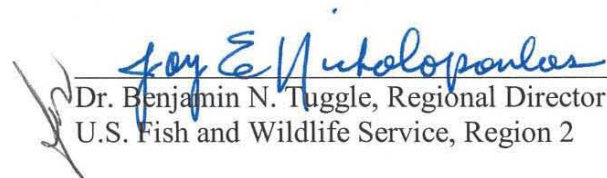
The Service would like to thank you for participating in the planning process. Comments you submitted helped us prepare a better plan for the future of the Refuge.

Additional copies of this CCP may be obtained by contacting the Ozark Plateau National Wildlife Refuge, 16602 County Road 465, Colcord, OK 74338. The CCP is also available on the Service's Internet website as follows:

<http://www.fws.gov/southwest/refuges/Plan/planindex.html>

Thank you for your continued support and interest in our fish and wildlife conservation efforts.

Sincerely,


Dr. Benjamin N. Tuggle, Regional Director
U.S. Fish and Wildlife Service, Region 2

SEP 16 2013

Date

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**COMPREHENSIVE CONSERVATION PLAN AND ENVIRONMENTAL
ASSESSMENT**

***OZARK PLATEAU NATIONAL
WILDLIFE REFUGE***

Adair, Cherokee, Craig, Delaware, Mayes, Ottawa, and Sequoyah Counties, Oklahoma

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COMPREHENSIVE CONSERVATION PLAN APPROVAL

For

Ozark Plateau National Wildlife Refuge,

Adair, Cherokee, Craig, Delaware, Mayes, Ottawa, and Sequoyah Counties, Oklahoma

The attached Comprehensive Conservation Plan for the Ozark Plateau National Wildlife Refuge has been prepared by Regional Office and Refuge staff. The contents and format are found to be in compliance with Service Policy on the preparation of Comprehensive Conservation Plans, and is hereby submitted for approval.

Submitted by:



Sarah Catchot, Natural Resource Planner
U.S. Fish and Wildlife Service, Region 2

03/22/13

Date

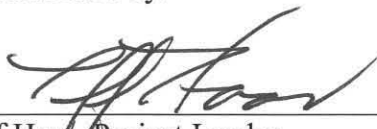


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Concurrence by:



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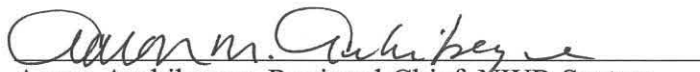
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Approved by:



Dr. Benjamin N. Tuggle, Regional Director
U.S. Fish and Wildlife Service, Region 2

9/12/13

Date

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Ozark Plateau National Wildlife Refuge

“Our Vision of the Future”

Fifteen thousand acres of Ozark native mature oak-hickory and oak-hickory-pine forests the green, gently rolling hills of the Ozark Plateau National Wildlife Refuge. Hidden below the green canopy lie karst substrate with rocky outcroppings, cliffs, and caves. Protected from future development this continuous forest acts as a purification system, recharging the land with clean water.

Descending into the canopy, Ozark big-eared bats maneuver precisely, quickly, and effortlessly. Gliding through the open tunnels created by the interwoven canopy and the forest floor below, the bats silently stalk the plentiful supply of moths and other insects which the healthy forest has provided. Like the rugged terrain on which they stand, large native oaks and hickories appear rough and gnarled, their outstretched limbs providing safety and security to the many nesting interior forest migratory birds. Fires periodically cleanse the forest of invasive species and dense shrub understory, leaving the old trees scarred and the soil primed for new growth. Grasses and wildflowers sprout and give color to the blackened landscape. Natural springs seep up from the porous karst substrate, feeding the creeks and streams with clear, fresh natural water, free of the effects of human contaminants.

The forest floor is abundant with life. Salamanders and snakes lie protected under stones and fallen limbs, box turtles graze lazily on mayapples, and tree frogs croak nearby. From a rock outcrop, an unseen cave mouth exhales a cool wind. Carved by water and time, each cave is a unique underground labyrinth of passages, healthy, hidden and undisturbed. Caves serve as the home to a myriad of underground dwellers, including colonies of bats that expertly navigate the maze. In their wake, the bats deposit guano, essential energy in a lightless world. Under colonies of grey bats, fresh guano piles give the appearance of a slowly shifting cave floor as the teaming larvae of flies and beetles churn. In clear, shallow underground streams and pools, colorless cavefish, cave crayfish, isopods, and amphipods move about leisurely, while orange and black salamanders hurriedly scurry out of sight.

The Refuge understands the threats to the ecoregion and acts to be truly successful in its mission to preserve and protect the Ozarks ecosystem, and recover the federally listed threatened and endangered Ozark cave species, and other unique resources. The Refuge cannot achieve its mission by itself, and therefore forms strong partnerships, the key to success. The Refuge acts as a good neighbor in cooperation with numerous surrounding private landowners, tribes, conservation organizations, and agencies. Biologists are busy monitoring cave and forest resources and implementing strategic habitat conservation in the Ozark landscape to help the Refuge better manage for future generations.

School and youth groups, conservation organizations, private individuals, and representatives from tribes and numerous agencies use the Mary & Murray Looney Education & Research Center just outside a small town. They are seeking information and are welcomed by friendly, knowledgeable volunteers and staff who explain the recreational and educational opportunities for visitors. Children and adults walk the narrow, primitive hiking trails through forests and along winding streams. People actively participate in hands-on discussions about cave and karst resources and other Ozark forest assets such as Neotropical songbirds, healing herbs, and edible plants near the cozy, rustic education cabin. Local caver volunteers assist with cave mapping and management. Also university students study and conduct research on important surface and subterranean resources. During their time at the Refuge, visitors slow down and free themselves from the pressures and activities of human society. Visitors leave the Refuge with a lasting connection with nature and appreciation for the beauty and ecological importance of Ozarks caves, creatures, forests and waters.

CHAPTER 1: INTRODUCTION

This document is a Comprehensive Conservation Plan (CCP) designed to guide management of Ozark Plateau National Wildlife Refuge (Refuge or NWR) for the next fifteen years. The CCP provides a description of the desired future conditions and long-range guidance to accomplish the purposes for which the Refuge was established. The CCP and accompanying Environmental Assessment (EA) address U.S. Fish & Wildlife Service (Service) legal mandates, policies, goals, and National Environmental Policy Act (NEPA) compliance. The EA (Appendix A) presents two alternatives for habitat and wildlife management, visitor services, and facilities management that consider issues and opportunities on the Refuge. It also identifies, describes, and compares the consequences (or impacts) of implementing the two management alternatives (including current management) on the physical, biological, and human environments described in the CCP. The final CCP will be developed through modifications made after the internal review, state and tribal review, and finally public review process and will replace current management direction when it is completed.

The CCP is divided into five chapters. *Chapter 1: Introduction* provides information about why the Service is developing this CCP, a brief overview of the Refuge including its establishment, authorizing legislation, and description of its purposes and information on the National Wildlife Refuge System (Refuge System, System) and the laws, policies, and guidance that sets the stage for management direction. *Chapter 2: The Planning Process* explains the process used to develop the CCP consistent with planning requirements. *Chapter 3: Refuge Resources and Current Management* explains the landscape setting; physical, biological, and socio-economic environment; and the current management programs on the Refuge. *Chapter 4: Management Direction* describes the goals, objectives, and strategies for future management within the next 15 years (Proposed Alternative in EA). Finally, *Chapter 5: Plan Implementation and Monitoring* describes the various tools the Refuge will use to implement the management direction presented in this CCP.

1.1 Purpose and Need for the CCP

The purpose of comprehensive conservation planning is to provide long-range guidance for the management of national wildlife refuges, as mandated by the National Wildlife Refuge Improvement Act of 1997 (Improvement Act). The CCP will enhance the management of Ozark Plateau National Wildlife Refuge by:

- providing a clear statement of direction for the future management of the Refuge
- providing long-term continuity in Refuge management
- communicating the Service's management priorities for the Refuge to their partners, neighbors, visitors, and the general public

- providing an opportunity for the public to help shape the future management of the Refuge
- ensuring that management programs on the Refuge are consistent with the mandates of the Refuge System and the purposes for which the Refuge was established
- ensuring that the management of the Refuge is consistent with Federal, State, and local plans
- providing a basis for budget requests to support the Refuge's needs for staffing, operations, maintenance, and capital improvements

The CCP is needed to provide guidance and rationale for management actions and will be used by the Refuge Manager and staff as a reference document when developing work plans, step-down plans, and when making management decisions. Through the development of goals, objectives, and strategies (Chapter 4), this CCP describes how the Refuge contributes to the overall mission of the National Wildlife Refuge System, fulfills the purposes designated for the Refuge, and outlines working with partners to achieve conservation at a landscape level. The CCP is needed to provide a vision for the Refuge and to provide management direction for furthering scientific research, inventorying and monitoring, protection, restoration, maintenance, and management of compatible public uses of Refuge resources for the next 15 years.

The Federal Cave Resources Protection Act of 1988-Public Law 100-691 (16 U.S.C. 4301 et seq. 102 Stat. 4546) established requirements for the management and protection of caves and their resources on Federal lands, including allowing the land managing agencies to maintain confidentiality of cave locations, and requiring permits for any removal or collecting activities in caves on Federal lands. Numerous caves and considerable surrounding upland and riparian forest used as buffer zones, foraging habitat, and protection of ground water recharge areas, have been lost to urban, agricultural, and industrial development. Reservoir development, highways, power line and pipeline right-of-way construction, and cave commercialization also impact these resources. As population growth and development increases in the Ozarks, the threat of human disturbance increases. Because of the sensitive nature of cave resources accidental and intentional human disturbance is becoming one of the largest threats to these resources. Therefore, this CCP is also needed to ensure that the Refuge continues to conserve fish, wildlife, and cave habitat in the face of human development, climate change, and related stressors.

The goals developed for the Refuge during this planning process include the following:

➤ **Goal 1: Landscape-level Context**

Collaborate with multiple partners to implement Strategic Habitat Conservation on a landscape-level in order to prevent extinction and recover federally listed threatened and endangered Ozark cave species as well as prevent the need for listing other Ozark species of concern.

➤ **Goal 2: Wildlife Habitat & Population Management**

Protect, enhance, conserve and restore Ozark natural caves, springs, streams, aquifers, wetlands, watersheds, forests, and groundwater recharge areas to prevent extinction and recover federally listed cave species as well as prevent the need for listing other native species including migratory birds and other species of concern in the Ozarks to promote natural species diversity on a landscape-level.

➤ **Goal 3: Visitor Services**

Provide safe, high quality, compatible, wildlife dependent use opportunities for visitors, students, and nearby residents, to give them an understanding of the importance and value of Ozark cave, spring, aquifer, stream, wetland, watershed, groundwater recharge area, and forest wildlife habitat conservation efforts.

➤ **Goal 4: Refuge Infrastructure & Administration**

Provide administrative support and appropriate facilities required to ensure that Refuge goals and objectives are met through effective landscape conservation management of Ozark habitats, fish and wildlife, and visitor services and for the primary purpose of preventing extinction and recovering federally listed threatened and endangered Ozark cave species.

By preparing this CCP, documenting our goals and objectives, and involving our partners and the public in the process, we can gain a better understanding of the issues and possible solutions from all sides. Sustaining the nation's fish and wildlife resources is a task that can be accomplished only through the combined efforts of governments, businesses, organizations, and citizens. This CCP will help explain how the Ozark Plateau NWR fits into the larger landscape and what our role is in protecting our natural resources for present and future generations.

1.2 Refuge Overview: History of Establishment, Acquisition, and Management

1.2.1 Refuge Establishing Authorities and Purpose(s)

National wildlife refuges are established under a variety of legislative acts and administrative orders and authorities. These orders and authorities include one or more specific purposes for which the refuge lands are acquired. The purposes are of key importance in refuge planning, and are the foundation for management decisions. The purposes of a refuge are specified in, or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.

By law, refuges are to be managed to achieve their purposes, and unless otherwise indicated by the establishing document the following rules apply:

- Purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and their habitats take precedence over other management and administration purposes.
- When in conflict, the purpose of an individual refuge may supersede the Refuge System mission.
- Where a refuge has multiple purposes related to fish, wildlife, and plant conservation, the more specific purpose will take precedence in instances of conflict.
- When an additional unit is acquired under a different authority than that used to establish the original unit, the addition takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the addition

The establishing authorities for the Ozark Plateau NWR include:

- Endangered Species Act of 1973 (16 U.S.C. subsection 1534, as amended) “...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...or (B) plants which are listed as endangered species or threatened species...”

Other authorities for land acquisition and related purposes of the Ozark Plateau NWR include:

- Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742(b)(1)) “...for the development, advancement, management, conservation, and protection of fish and wildlife resources ...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude.”
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715d) “...for use as an inviolate sanctuary ...for any other management purposes ...for migratory birds.”

- Federal Cave Resources Protection Act of 1988 (Pub. L. 100-691, Sec. 2, Nov. 18, 1988, 102 Stat. 4546.).
- Land and Water Conservation Fund Act of 1965, as amended (16 U.S.C. 460l-4 through 11), (land acquisition fund source).

The Ozark Plateau NWR purpose(s) of establishment (1986) is to:

- Prevent the extinction and aid in recovery of federally listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds; and
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.



The Refuge was established to protect and recover species like the Ozark big-eared bat. (Credit: Shea Hammond)

1.2.2 History of the Refuge

The Endangered Species Act of 1973, as amended (Federal Register, Vol. 44, No. 232, Friday, November 30, 1979) gave the Service the responsibility to prevent extinction of federally listed threatened and endangered species and assure their recovery. Four eastern Oklahoma Ozark cave species were listed as federally threatened or endangered during the 1960's, 70's, and 80's. These include:

- Indiana bat, originally listed as endangered under the Endangered Species Preservation Act of 1966 and currently listed as endangered under the Endangered Species Act of November 30, 1973;
- Gray bat, listed as endangered on April 28, 1976;
- Ozark big-eared bat, listed as endangered on November 30, 1979;
- Ozark cavefish, listed as a threatened on December 3, 1984.

The recovery plans approved by the Service for all four species identify long-term habitat protection and management through acquisition of land and conservation easements as priority tasks necessary to recover these species. The National Wildlife Refuge System is the Service's land management division provides long-term habitat protection and management necessary to fulfill the Service's responsibilities identified under the Endangered Species Act to recover these

species. To accomplish this, the Service acquired the first tract for federally listed Ozark cave species recovery in 1985 and the Ozark Plateau National Wildlife Refuge was officially established on April 1, 1986 as a satellite refuge of Sequoyah National Wildlife Refuge. The first tract acquired was 80 acres surrounding cave AD-10, still a major Ozark big-eared bat maternity cave and hibernacula. The Refuge was first called Oklahoma Bat Caves National Wildlife Refuge, but the name was changed in 1995 to reflect the actual landscape or ecosystem approach to management and implementation of Strategic Habitat Conservation, which benefits numerous Ozark fish and wildlife resources. Since the Southwest Region (Region 2) of the Service has the lead for recovering the Ozark big-eared bat, whose distribution is mostly in the Ozarks of eastern Oklahoma (with a few found in western Arkansas), establishment of the Ozark Plateau NWR was an important step towards recovery for the species.



Refuge cave (OT-13). (Credit: Steve Hensley)

In addition, the Federal Cave Resources Protection Act was passed in 1988 (Pub. L. 100-691, Sec. 2, Nov. 18, 1988, 102 Stat. 4546.). This Act further increased the importance and need for the Refuge because it required the Service, as well as all other federal agencies, to identify all significant caves on federal lands as invaluable and irreplaceable parts of the Nation's natural heritage. It also indicated that these caves are threatened due to improper use, increased recreational demand, urban

spread, and a lack of protection. The Act emphasized the need for partnering on a landscape level because it required the Service to secure, protect, and preserve significant caves and their natural resources and foster increased cooperation and exchange of information for scientific, educational, and recreational purposes.

Ozark Plateau National Wildlife Refuge's establishment was only possible through a joint effort of a number of partners including private individuals and landowners, private conservation and caving organizations, universities, tribes, and municipal, county, state and federal agencies. These included private landowners, The Nature Conservancy, Land Legacy, Trust for Public Land, Oklahoma Natural Heritage Inventory, Oklahoma Natural History Museum, National Speleological Society (Tulsa Regional Oklahoma Grotto, Central Oklahoma Grotto, Buffalo River Grotto, Boston Mountain Grotto, Middle Ozark Lower Earth Society), Oklahoma State University, University of Oklahoma, Northeastern State University, Southeastern Oklahoma State University, University of Central Oklahoma, Rogers University, University of Arkansas, Arkansas State University, University of Missouri, Southwest Missouri State University, Arkansas Game and Fish Commission, Oklahoma Department of Wildlife Conservation, Missouri Department of Conservation, Cherokee Nation, Eastern Shawnee Nation, Miami Nation, Modoc Nation, Osage Nation, Peoria Nation, Quapaw Nation, Seneca Cayuga Nation, Wyandotte Nation, U.S. Forest Service Natural Resource Conservation Service, and National Park Service. These individuals, organizations, and agencies have worked together and coordinated efforts among three states and three Service Regions over the past twenty years to protect the fish and wildlife resources in the Ozarks.



*Establishment of the Refuge was a joint effort among many partners.
(Credit: rivannadesigns.com)*



The Nature Conservancy (TNC) played a major role in Ozark Plateau NWR's establishment. TNC worked with landowners, cavers, other conservation organizations, universities, and the Service and other agencies to help identify priority areas and implemented a major effort to acquire funding for acquisition. They were instrumental in acquiring a direct appropriation, with the help of Congressman Mike Synar, from the Land and Water Conservation Fund to acquire the first tracts in the 1980's and worked with The Wilderness Society for additional Land and Water Conservation Funds in the early 1990's. TNC initially acquired most of tracts and eventually sold them to the Refuge as the Service was able to work through its realty process. Other partners playing major roles in acquisition of the Refuge were Land Legacy, National Speleological Society (Tulsa Regional Oklahoma Grotto), Oklahoma Department of Wildlife Conservation, Cherokee Nation, and a number of volunteers and private landowners who were truly concerned about protecting natural resources in the Ozarks. The National Speleological Society and their local chapter, the Tulsa Regional Oklahoma Grotto, also held land for the Service to allow time for completion of the realty process.



In addition, a portion of the Refuge was acquired to offset impacts to federally listed endangered gray bats and threatened Ozark cavefish and migratory birds from past lead and zinc mining in northeast Oklahoma, southwest Missouri, and southeast Kansas at one of the oldest and largest Superfund sites in the nation, the Tri-State (Tar Creek) Superfund Site. The impacts from the mining were identified during one of the early Natural Resources Damage Assessments for this Superfund Site. In its July 2000 Final Partial Restoration Plan that addressed injuries to migratory birds and threatened and endangered species (gray bat and Ozark cavefish) from releases of hazardous chemicals from abandoned lead and zinc mining activities at the Superfund Site in Ottawa County, the Service outlined a plan for partial compensation to the public. The plan includes acquisition and protection of a gray bat maternity cave and a potential Ozark cavefish site in Ottawa County, as well as additional gray bat and cavefish habitat in Ottawa and Adair Counties.

On February 9, 2005, the U. S. Fish and Wildlife Service approved the NEPA compliance documents including an Environmental Assessment, Land Protection Plan, and Conceptual Management Plan to expand the Ozark Plateau NWR. These took into consideration comments from the public on the draft documents and from public meetings and a public hearing. Ozark Plateau NWR was approved to acquire additional land or easements from willing sellers and donors, up to 15,000 acres in Adair, Delaware, Ottawa, Cherokee, Craig, Mayes, and Sequoyah Counties, Oklahoma. These tracts will generally be forested tracts that will protect valuable foraging areas and movement corridors for the federally listed endangered bats, as well as watersheds and ground water recharge areas important for maintaining surface and ground water quality for the federally listed threatened Ozark cavefish. In addition, sites will take into consideration appropriate geological formations including caves, springs, aquifers, losing and gaining streams, sinkholes, buffs and talus cracks. Expansion of the Refuge has also provided additional opportunities for various outdoor recreational activities, environmental education, interpretation, and scientific research.

1.2.3 Ozark Plateau NWR Management Units

As of 2012, Ozark Plateau NWR consists of nine management units in Adair, Cherokee, Delaware, and Ottawa Counties, totaling 4,093.35 acres. This includes 3,572.35 acres in fee title, 162 acres in purchased management easements from private landowners and TNC, and 359 acres in management agreements with the Cherokee Nation and City of Tulsa (see Table 1-1).

Table 1-1. Ozark Plateau National Wildlife Refuge Area (Acres) by County and Tract Type
March 2, 2012; (Acres based on abstract data)

| | Fee-Title Tracts (acres) | Conservation Easement Tracts (acres) | Conservation Agreement Tracts (acres) |
|---|--|---|--|
| Adair County | Sally Bull Hollow (2,280) Gittin' Down Mtn. (480) Liver (90) 2,850 acres | Gittin' Down Mtn. (TNC / 90) Varmint (Cole / 60) Joens (Joens / 12) 162 acres | Liver (Cherokee Nation / 120) 120 acres |
| Cherokee County | Potter (189) 189 acres | n/a | n/a |
| Craig County | n/a | n/a | n/a |
| Delaware County | Mary & Murray Looney (95) Beck (Krause) (360) 455 acres | n/a | Lake Eucha (City of Tulsa / 239) 239 acres |
| Mayes County | n/a | n/a | n/a |
| Ottawa County | Boy Scout (78.35) 78.35 acres | n/a | n/a |
| Sequoyah County | n/a | n/a | n/a |
| TOTAL | 3,572.35 acres | 162 acres | 359 acres |
| Total land managed by Ozark Plateau National Wildlife Refuge (2012) = 4,093.35 acres | | | |

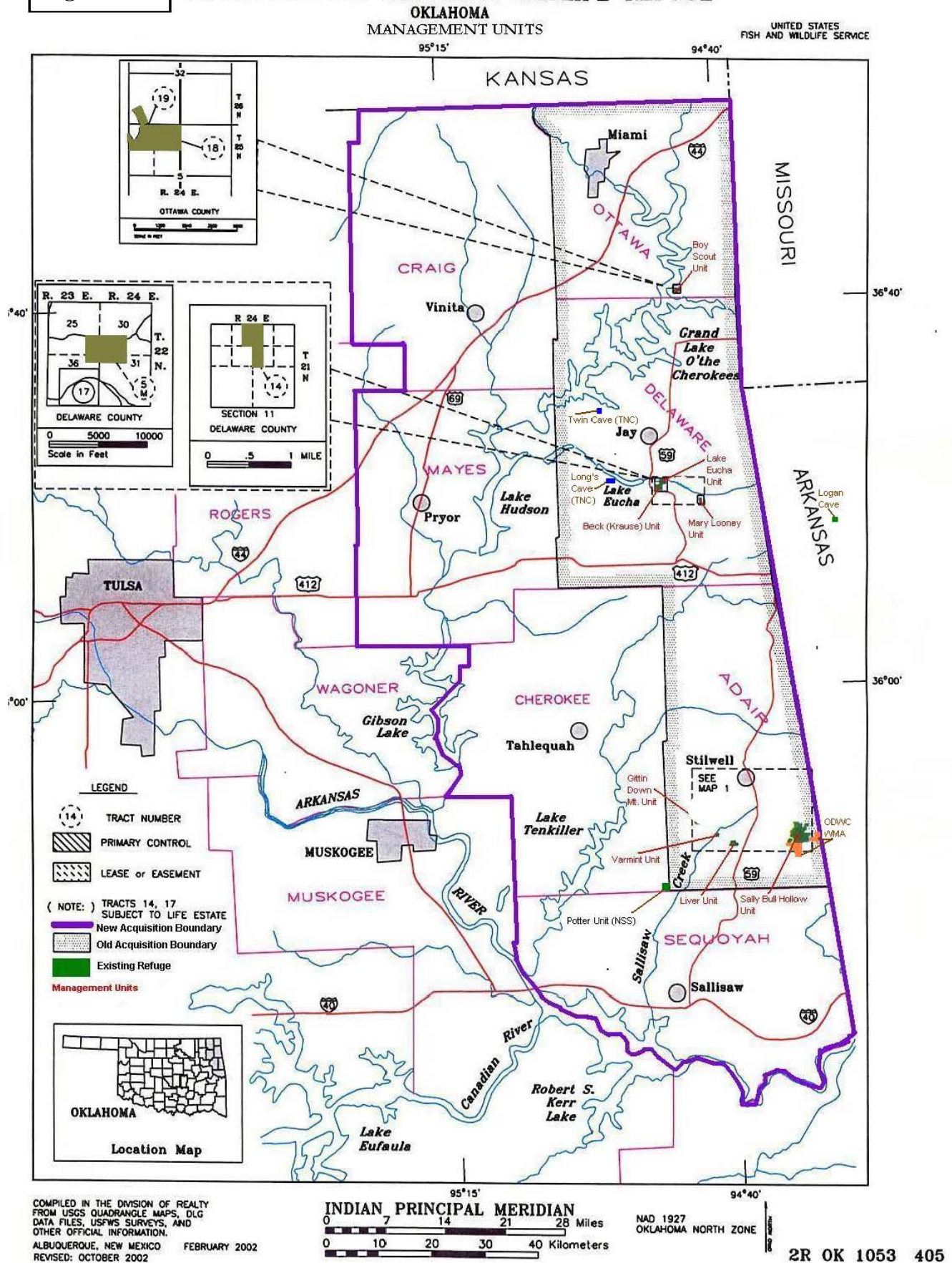
Management units of Ozark Plateau NWR are identified, acquired, and/or managed based upon impact to federally listed threatened or endangered Ozark cave species, including cave habitat, groundwater recharge areas, foraging areas, and movement corridors important to these species as well as other species of concern. In addition, Ozark Plateau NWR's management units play a role in conserving continuous tracts of mature oak-hickory or oak-hickory-pine Ozark forest, beneficial to nesting and migrating Neotropical birds as well as cave species. The following are the nine different management units of the Refuge discussed throughout this CCP: Alvin Arthur Beck (Beck), Boy Scout, Gittin Down Mountain, Lake Eucha, Liver, Mary and Murray Looney, Mutt Potter (Potter), Sally Bull Hollow, and Varmint (see Figure 1-1).



*Overlooking the Sally Bull Hollow Unit in fall.
(Credit: Steve Hensley)*

Figure 1-1

OZARK PLATEAU NATIONAL WILDLIFE REFUGE



Beck Unit

The Beck Unit is a 360- acre area made up continuous mature oak-hickory-pine upland forest along bluffs overlooking Spavinaw Creek with sloughs and wetlands in the bottom used by nesting and migratory Neotropical birds and as foraging areas and movement corridors by endangered bat species. A large spring is on the Unit that may provide cavefish and cave crayfish habitat. Also, the Beck Unit controls runoff into Spavinaw Creek and a portion of the ground water recharge for caves on the Lake Eucha Unit. There are 25 acres of pasture and 17 acres of native prairie, and 318 acres of oak-hickory-pine forest.

Boy Scout Unit

This is a 78-acre fee title area of mature oak-hickory-pine upland forest and a small area of oak-hickory bottomland forest with sloughs and wetlands. There also is a major gray bat maternity cave with 10,000 to 15,000 gray bats raising their young there in the summer. The area is also used by nesting and migratory Neotropical birds and as a foraging area and movement corridor by endangered gray bats. It is on an arm of Grand Lake of the Cherokee, on the Grand River, which provides foraging for the endangered gray bats.

Gittin Down Mountain Unit

This Unit consists of 480 acres in fee title plus a 90-acre conservation easement with TNC. It contains a major gray bat maternity cave, with over 20,000 bats during the summer; and other caves used by both gray and Ozark big-eared endangered bat species. Also, it adjoins 20 acres owned by the NSS that contains the largest known Ozark big-eared bat hibernaculum with generally over 300 bats during the winter. The area contains a continuous stand of high quality mature Ozark oak-hickory upland forest used by nesting and migratory Neotropical birds and foraging endangered bats.



AD14 cave entrance in winter. (Credit: Steve Hensley)

Lake Eucha Unit (Eucha Unit)

There are 239 acres on the upper end of Lake Eucha along Spavinaw Creek managed through an easement with the City of Tulsa. It is made up of mature oak-hickory-pine upland forest and oak-hickory bottomland forest with sloughs and wetlands and small areas of old field. These areas are used by nesting and migratory Neotropical birds and as a foraging area and movement corridor by endangered Ozark big-eared bats and gray bats. There is a major cave on the Unit with possible historic Ozark big-eared bat use. Also it includes a portion of Spavinaw Creek, a

clear rocky bottom Ozark smallmouth bass stream used for water supply by the City of Tulsa and as foraging habitat by the gray bats.

Liver Unit

This Unit consists of 90 acres in fee title and 120 acres managed through a conservation agreement with the Cherokee Nation. It is covered by high quality continuous mature Ozark oak-hickory upland forest on steep hill sides. This forest provides excellent habitat for nesting and migratory Neotropical birds and foraging endangered Ozark big-eared bats and gray bats. Also, it contains one of the largest known federally listed endangered Ozark big-eared bat maternity caves with generally around 300 bats. This cave is also a major Ozark big-eared bat hibernaculum.

Mary & Murray Looney Unit (Looney Unit)

This management Unit encompasses 95 acres in fee title on Spavinaw Creek in Delaware County about three miles north of Colcord, Oklahoma. The area contains a major gray bat maternity cave, used by 15,000 to 20,000 gray bats during the summer and also used by the federally threatened Ozark cavefish and species of concern cave crayfish. The stream departing the cave enters Spavinaw Creek, a clear rocky bottom Ozark smallmouth bass stream used for water supply by the City of Tulsa and as foraging habitat by the gray bats. Mature high quality oak-hickory bottomland and oak-hickory-pine upland forest with sloughs and wetlands in the bottom used by nesting and migratory Neotropical songbirds and waterfowl and as a foraging area and movement corridor by migratory bald eagles and federally endangered gray bats.



*Refuge staff at Mary & Murray Looney's historic cabin.
(Credit: Shea Hammond)*

This Unit is significant because the Mary & Murray Looney family that owned the land and cabins prior to donating them to the Refuge were honored by the National Speleological Survey for their great contributions to the local caving community including starting the Central Oklahoma Grotto chapter of NSS. Mary Looney, considered to be “the Mother of Oklahoma caving”, founded the first private cave reserve to be established in the United States, now known to be the Mary & Murray Looney Unit of Ozark Plateau NWR (Graening, 2011). In addition to protecting and preserving the

caves and surrounding habitat on this Unit, and in accordance with Service guidance on “Connecting People with Nature”, the Looney Unit is also used as a place to provide education and scientific research opportunities. The Looney family's historical cabin home was renovated

through a Maintenance Action Team Project with maintenance personnel from five Oklahoma National Wildlife Refuges, to be utilized as an education and research center (called the Mary & Murray Looney Education & Research Center, a.k.a. the MMLERC), as well as the current Refuge Headquarters site. The MMLERC offers a space to provide educational programming focusing on environmental awareness and conservation of wildlife and other resources in the Ozarks. It also provides a base for scientific research and training for conservation organizations, schools, universities, Tribal Nations, and state and federal agencies in addition to high-quality, interpretive experiences for local children and families.

Potter Unit

The Potter Unit of the Ozark Plateau NWR consists of 189 acres of exceptional high quality mature oak-hickory-pine upland forest and narrow bands of mature bottomland hardwood along two small rocky bottom intermittent streams and three small man-made impoundments. It is in the southeast corner of Cherokee County and adjoins the Oklahoma Department of Wildlife Conservation's Cookson Wildlife Management Area to the north. There are two caves on the tract used by federally listed endangered Ozark big-eared bats and gray bats plus numerous other Ozark cave, forest, and stream species ranging from about 200 species of migratory birds and diverse reptile and amphibian populations to outstanding deer and turkey populations. There is a natural



*Crystal Cave stream flows on the Potter Unit.
(Credit: Steve Hensley)*

bridge across one of the streams on the property, indicating the entire valley had been a cave at one time and has collapsed. One of the caves on the property is a very important major Ozark big-eared bat cave and contains about 1,500 feet of mapped passage. This cave was once used for commercial cave tours in the 1920's and 30's and the area was a popular tourist attraction-with an old rock dam providing a swimming area and dances taking place in a large cave room near its entrance. In addition, the old historic wagon road between Sallisaw and Tahlequah cross the property, with remains of old rock bridge abutments. Also several archeological sites are found on the property. Because of the sensitive nature of the important Ozark big-eared bat caves and the exceptional natural resources on this Unit and the federally endangered bat's lack of ability to tolerate human disturbance, the Unit is only open to scientific purposes by prior arrangement with the Refuge.



Sally Bull Hollow Unit of the Ozark Plateau National Wildlife Refuge. (Credit: Shea Hammond)

Sally Bull Hollow Unit

The Unit encompasses 2,280 acres in fee title of high quality continuous mature Ozark oak-hickory upland forest on steep hill sides with numerous bluff faces. There are also narrow high quality oak-hickory bottomland forest, and intermittent rocky bottom Ozark streams used by nesting and migratory Neotropical birds and foraging endangered bats. Numerous important Ozark big-eared bat and gray bat caves are found on this Unit. It also contains the largest known cave in Oklahoma, with almost 9 miles of mapped passage. It is within the Lee Creek drainage basin, an Oklahoma State scenic river, with high gradient, spring fed tributaries. The area of the cave is underlain by Mississippian and Pennsylvanian age sedimentary rocks. The AD-14 Cave complex has developed in the Pitkin formation (Mississippian). The cave system is capped by a sandstone of the Hale formation (Pennsylvanian) and is underlain by the Fayetteville formation (predominately shales). The cave is geologically isolated from other caves in eastern Oklahoma therefore enhancing the probability for unique fauna.

Varmint Unit

This is a 60-acre easement with a private landowner. It is dominated by high quality continuous mature Ozark oak-hickory upland forest on steep hill sides used by nesting and migratory

Neotropical birds and foraging endangered bats. It contains a major federally listed endangered Ozark big-eared bat maternity cave that is also used as an Ozark big-eared bat hibernaculum and adjoins Cherokee Nation land with a very important cave also used as a maternity site for these bats.

1.3 Planning Context

The Ozark Plateau National Wildlife Refuge is part of a national system of more than 550 refuges. The U.S. Fish and Wildlife Service places an emphasis on managing individual refuges in a manner that reflects the National Wildlife Refuge System mission. As a result, the CCP must contribute to meeting the overall system mission and goals.



1.3.1 The U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service is the principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service has a primary responsibility to manage and protect Federal trust species, which includes migratory birds, threatened species, endangered species, inter-jurisdictional fish, marine mammals, and other species of concern. In addition to the National Wildlife Refuge System the Service also operates national fish hatcheries, fishery resource offices, and Ecological Services field stations. The Service

enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, administers the Endangered Species Act, conserves and restores wildlife habitat such as wetlands, and helps Native American tribal governments and foreign governments with their conservation efforts. It also oversees the Federal Assistance Program, which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to State fish and wildlife agencies.

The mission of the U.S. Fish and Wildlife Service is:

“working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people”

1.3.2 The National Wildlife Refuge System

The National Wildlife Refuge System (Refuge System, System, NWRs) is the only existing system of federally owned lands managed chiefly for the conservation of wildlife. Founded in 1903 by President Theodore Roosevelt with the designation of Pelican Island as a refuge for brown pelicans, the Refuge System consists of over 97 million acres in over 551 refuges and 38

wetland management districts in all 50 states and U.S. territories. National wildlife refuges host a tremendous variety of plants and animals supported by a variety of habitats from arctic tundra and prairie grasslands to subtropical estuaries. Most national wildlife refuges are strategically located along major bird migration corridors ensuring that ducks, geese, and songbirds have rest stops on their annual migrations. Many refuges are integral to the protection and survival of plant and animal species listed as endangered. The Refuge System is the world's largest collection of lands and waters set aside specifically for the conservation of wildlife and ecosystem protection (see Figure 1-2).



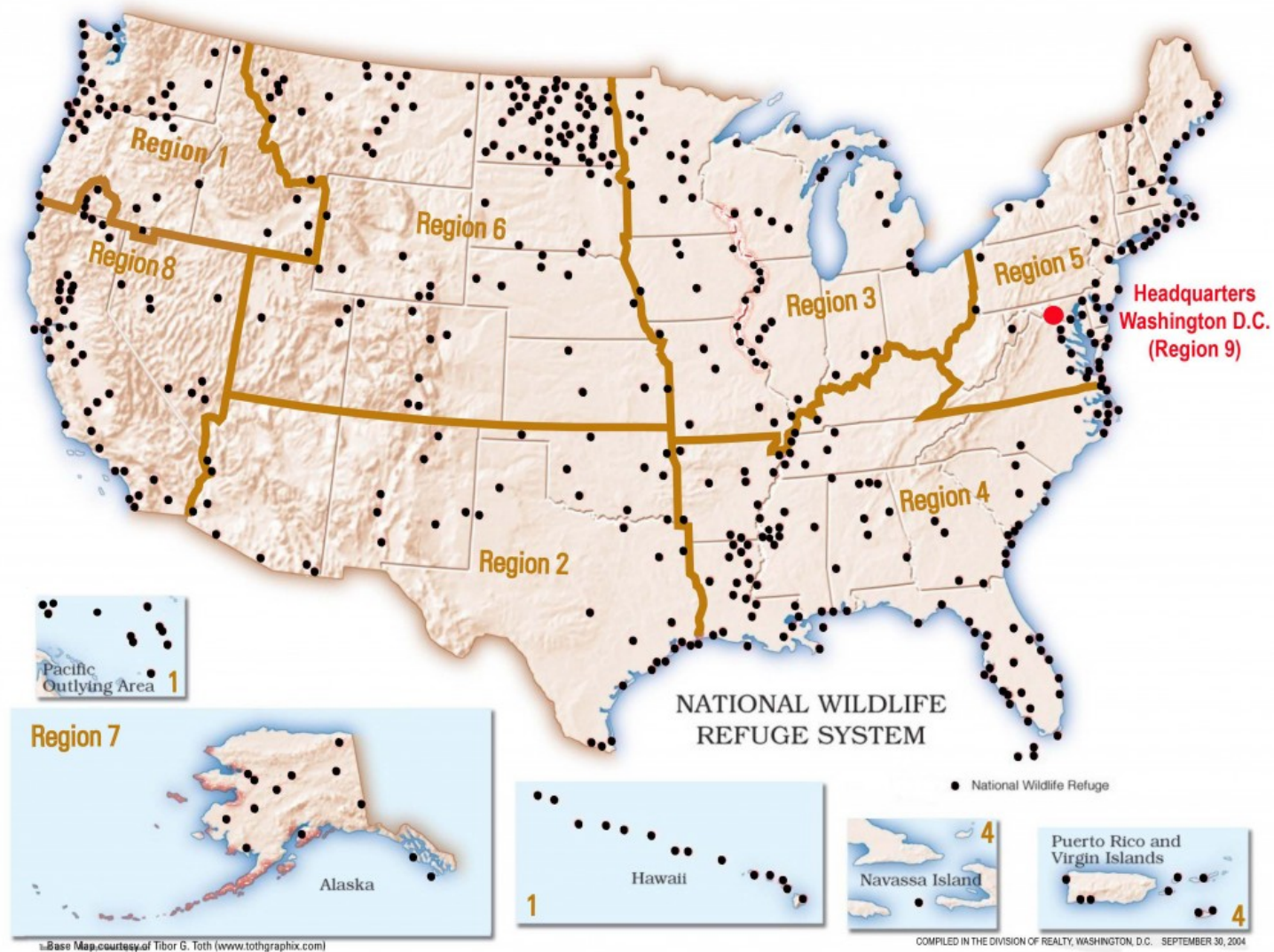
The mission of the Refuge System is:

“to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Improvement Act of 1997, Public Law 105-57).

The goals of the Refuge System are to:

- conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered;
- develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges;
- conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts;
- provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); and
- foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

Figure 1-2. National Wildlife Refuge System.



1.3.2.1 Legal and Policy Guidance

Refuge management and administrative activities are dictated, in large part, by the legislation that created the unit and its purposes and goals. However, other laws, regulations, and policies also guide management. The Refuge is guided by the mission and goals of the Refuge System, Service Policy, Federal laws and executive orders, and international treaties. A complete list of the laws, policies, treaties and executive orders that pertain to the conservation and protection of natural and cultural resources on national wildlife refuges is provided in Appendix G.

Key laws and policies directly related to comprehensive conservation planning are discussed below.

National Wildlife Refuge System Improvement Act of 1997

The National Wildlife Refuge System Administration Act, as amended, states that each refuge shall be managed to fulfill both the mission of the Refuge System and the purposes for which the individual refuge was established. It also requires that any use of a refuge be a compatible use—a use that will not materially interfere with nor detract from, in the sound professional judgment of the refuge manager, fulfillment of the mission of the Refuge System or the purposes of the Refuge.

The 1997 amendments to the National Wildlife Refuge System Administration Act of 1966 identified a number of principles to guide management of the Refuge System. They include the following:

- Conserve fish, wildlife, and plants, and their habitats within the System
- Maintain the biological integrity, diversity, and environmental health of the System
- Coordinate, interact, and cooperate with adjacent landowners and State fish and wildlife agencies
- Maintain adequate water quantity and quality to meet Refuge and System purposes and acquire necessary water rights
- Maintain hunting, fishing, wildlife observation, wildlife photography, interpretation, and environmental education as the priority general public uses of the System
- Provide opportunities for compatible priority wildlife-dependent public uses with the System
- Provide enhanced consideration for priority wildlife-dependent public uses over the other general public uses in planning and management
- Provide increased opportunities for families to experience priority general public uses, especially traditional outdoor activities such as fishing and hunting
- Monitor the status and trends of fish, wildlife, and plants in each refuge

The Improvement Act establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a comprehensive conservation plan for

each refuge by the year 2012; and provides guidelines and directives for the administration and management of all areas in the Refuge System, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

To maintain the health of individual refuges, and the National Wildlife Refuge System as a whole, managers must anticipate future conditions. Managers must endeavor to avoid adverse impacts and take positive actions to conserve and protect refuge resources. Effective management also depends on acknowledging resource relationships and acknowledging that refuges are parts of larger ecosystems. Refuge managers work together with partners—including other Refuges, Federal and State agencies, Tribal Nations, Native American organizations and entities, nongovernmental organizations and individuals—to protect, conserve, enhance, or restore all native fish, wildlife, plants, and their habitats.

Appropriate Use Policy

This policy describes the initial decision process the refuge manager follows when first considering whether to allow a proposed use on a refuge. The refuge manager must find a use appropriate before undertaking a compatibility review of the use. An appropriate use as defined by the Appropriate Use Policy (603 FW 1 of the Service Manual) is a proposed or existing use on a refuge that meets at least one of the following four conditions:

- The use is a wildlife-dependent recreational use as identified in the Improvement Act.
- The use contributes to the fulfilling of the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
- The use involves the take of fish and wildlife under State regulations.
- The use has been found to be appropriate as specified in Section 1.11 (603 FW 1 of the Service Manual).

Chapter 5 of this CCP includes additional information on appropriateness of refuge uses.

Compatibility Policy

Lands within the Refuge System are different from other multiple use public lands in that they are closed to all public uses unless specifically and legally opened. The Improvement Act states, “... the Secretary shall not initiate or permit a new use of a Refuge or expand, renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety.”

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2 of the Service Manual) that includes guidelines for determining if a use proposed on a national wildlife refuge is compatible with the purposes for which the refuge was established. A

compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge. Sound professional judgment is defined as a finding, determination, or decision that is consistent with the principles of sound fish and wildlife management and administration, available science and resources (funding, personnel, facilities, and other infrastructure), and applicable laws.

The Service strives to provide priority public uses when they are compatible. If financial resources are not available to design, operate, and maintain a priority use, the refuge manager will take reasonable steps to obtain outside assistance from the State and other conservation interests.

Additional information regarding Compatibility Determinations (CDs) is provided in Chapter 5 and the CDs prepared in association with this CCP are provided in Appendix B.

Biological Integrity, Diversity, and Environmental Health Policy

The Improvement Act directs the Service to “ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained for the benefit of present and future generations of Americans.” To implement this directive, the Service has issued the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3 of the Service Manual), which provides policy for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health of the Refuge System. The policy is an additional directive for refuge managers to follow while achieving the refuge purpose(s) and Refuge System mission. It provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuge and associated ecosystems. Further, it provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions and restore lost or severely degraded components where appropriate and in concert with refuge purposes and the Refuge System mission. When evaluating the appropriate management direction for refuges, refuge managers will use sound professional judgment to determine their refuges’ contribution to biological integrity, diversity, and environmental health at multiple landscape scales.

1.3.3 Landscape Level Context

1.3.3.1 Climate Change

Department of the Interior Secretarial Order 3226 states that “there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making... This Order ensures that climate change impacts are taken

into account in connection with Departmental planning decision making”. Additionally, it calls for the incorporation of climate change into long-term planning documents such as this CCP.

The U.N. Intergovernmental Panel on Climate Change (IPCC) reports that the increase of carbon dioxide (CO₂) within the earth’s atmosphere is causing more extreme changes to the Earth’s climates, such as record high temperatures, variations in precipitation, sea level rise, and atmospheric circulation changes, among others (Hegerl, et al., 2007). The IPCC also concludes that substantial climate changes will cause major shifts in ecosystem structure and function, species’ ecological interactions, and species’ geographical ranges. These projected changes have enormous implications for management of fish, wildlife, and their habitats around the world.

The U.S. Department of Energy’s *Carbon Sequestration Research and Development* defines carbon sequestration as “...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere”. Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this CCP would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the refuge. This in turn contributes positively to efforts to mitigate human-induced global climate change. Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts - grasslands, forests, wetlands, tundra, and desert - are effective both in preventing carbon emission and acting as a biological “scrubber” of atmospheric CO₂. The Department of Energy report’s conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere. One Service activity in particular - prescribed burning - releases CO₂ directly into the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Boutton *et al.* 2006).

The Service’s strategic approach to climate change will emphasize three strategies that are often used to describe responses to climate change- Adaptation, Mitigation, and Education. *Adaptation* is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. It refers to the management actions we take to reduce the impacts of climate change – reactive and anticipatory. *Mitigation* is human intervention to reduce the sources or enhance the sinks of greenhouse gases. It involves our agency’s “carbon footprint” by using less energy, consuming fewer materials, and altering land management practices, such as water pumping and feed/production. Mitigation is also achieved through terrestrial carbon sequestration. *Education* is helping people learn and discover, thereby creating awareness and empathy, and ultimately leading to changes in human behavior. It is a fundamental conservation tool and a public service responsibility. In the context of climate change, education means helping Service employees,

our national and international partner, and constituencies (e.g. the public, Congress) understand that climate change is real and happening now; it threatens fish and wildlife resources we have come to value; and each of us can do something meaningful to reduce the threats.

Climate change could have a number of possible effects on the Refuge in addition to a general temperature increase, including: reduced rainfall and surface water supplies, deterioration of water quality, decreased habitat availability for many species, changes in vegetation communities, modification of migratory bird patterns, loss of breeding grounds for ducks and other waterfowl, loss of some species along with the introduction of new species, and significant increases in energy costs. Possible effects were a substantive consideration in the development of the objectives and strategies in this CCP (see Chapter 4: Goal 1, Objective 4). Implementation of all the strategies for monitoring and surveys will emphasize identification and analysis of the effects of climate change on the various habitats and species. Also, implementation of all strategies will emphasize energy conservation and/or use of alternative energy source when feasible.

1.3.3.2 National Plans and Initiatives

USFWS Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change (2010)

The U.S. Fish and Wildlife Service climate change strategy establishes a basic framework within which the Service will work as part of the larger conservation community to help ensure the sustainability of fish, wildlife, plants and habitats in the face of accelerating climate change. The plan is implemented through a dynamic action plan that details specific steps the Service will take during the next five years to implement the Strategic Plan. The plan focuses on three key strategies to addressing climate change: Adaptation, Mitigation, and Engagement. For the Service, adaptation is planned, science-based management actions that we take to help reduce the impacts of climate change on fish, wildlife, and their habitats. Mitigation involves reducing our “carbon footprint” by using less energy, consuming fewer materials, and appropriately altering our land management practices. Mitigation is also achieved through biological carbon sequestration, the process in which CO₂ from the atmosphere is taken up by plants through photosynthesis and stored as carbon in tree trunks, branches and roots. Engagement involves reaching out to Service employees; local, national and international partners in the public and private sectors; key constituencies and stakeholders; and everyday citizens to join forces and seek solutions to the challenges to fish and wildlife conservation posed by climate change.

Partners in Flight North American Landbird Conservation Plan

Partners in Flight (PIF) is a cooperative effort involving partnerships among private individuals, philanthropic foundations, conservation groups, professional organizations, industry, the academic community, and local, State, and Federal government agencies. Partners in Flight was created in 1990 in response to growing concerns about declining populations of many land bird

species and to emphasize the conservation of birds not covered by existing conservation initiatives. Bird conservation plans, are developed in each region to identify species and habitats most in need of conservation, to establish objectives and strategies to provide needed conservation, to establish objectives and strategies to provide needed conservation activities, and to implement and monitor progress on the plans.

PIF North American Landbird Conservation Plan

This plan summarizes the conservation status of landbirds across North America, illustrating broad patterns based on comprehensive, biologically-based species assessment. The plan identifies species most in need of attention at the continental scale, recognizing the additional species will need attention in each region and outlines ways in which continental scale issues and objectives relate to regional conservation efforts. The plan identifies 100 landbird species that warrant inclusion on the Partners In Flight Watch List due to a combination of threats to their habitats, declining populations, small population sizes, or limited distributions. Nationwide, 28 species require immediate action to protect small remaining populations, and 44 are in need of management to reverse long-term declines. Additional information on this plan can be found at http://www.pwrc.usgs.gov/pif/cont_plan/. Ozark Plateau NWR occurs within PIF Physiographic Area #19, the Ozark/Ouachitas as summarized below (in section 1.3.3.3). Additional information can also be found at http://www.blm.gov/wildlife/pl_19sum.htm.

1.3.3.3 Regional Plans and Initiatives

North American Bird Conservation Initiative: Bird Conservation Region Descriptions (2000)

The purpose of the North American Bird Conservation Initiative (NABCI) is to ensure the long-term health of North America's native bird populations by increasing the effectiveness of existing and new bird conservation initiatives, enhancing coordination among the initiatives, and fostering greater cooperation among the continent's three national governments and their people. In 1999, the U.S. NABCI approved a framework for delineating ecologically-based planning, implementation, and evaluation units for cooperative bird conservation in the U.S. and Canada known as Bird Conservation Regions (BCRs). Bird Conservation Regions are ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. Ozark Plateau NWR is located within BCR 24 (Central Hardwoods). The entire area is dominated by an oak-hickory deciduous forest inhabited by interior forest species, such as cerulean warbler, worm-eating warbler, and Louisiana waterthrush. The region includes some of the most extensive forests in the middle of the continent and is probably a source for populations of these birds for many surrounding areas. Among early succession birds, this is the last major stronghold of the eastern Bewick's wren. Restoration of prairie, glade, and barren habitat is a conservation priority. Although wood ducks are the primary breeding waterfowl, the region holds more significance for waterfowl as a migratory staging area. The floodplains of the river systems exhibit a diversity of habitats (e.g., floodplain forests, emergent wetlands, and submerged aquatic beds), all of which are utilized by migrating waterfowl. Large concentrations

of waterfowl, including mallard, lesser scaup, and canvasback, are common during both spring and fall migration. Threats to the habitats of the region include agricultural conversion of floodplain habitats and urbanization.

TNC Ozarks Ecoregional Conservation Assessment

The Ozarks ecoregion encompasses nearly 34 million acres in parts of Missouri, Arkansas, Oklahoma, Illinois, and a small corner of Kansas. Along with the Ouachita region to the south, the Ozarks form the only significant highland region in mid-continental North America. Parts of this region have been continually exposed for at least 225 million years. Because of high habitat diversity and antiquity of the landscape, Ozark biota are characterized by an unusually high level of species disjunctions and endemism, with more than 160 endemic species documented from the ecoregion. (Ozarks Ecoregional Conservation Assessment, The Nature Conservancy, November 2003)

Partners In Flight Bird Conservation Plan for the Ozark/Ouachitas

The Refuge is located in the Ozark/Ouachita physiographic area, which is largely blanketed by oak-hickory, oak-pine and pine forest ecosystems. Many bird species of Partners in Flight (PIF) conservation priority have centers of abundance in this region. For example, relative abundance data from the Breeding Bird Survey (BBS) indicate that the physiographic area supports over 30% of the world's breeding population of Whip-poor-wills, over 15% of the world's Kentucky warblers and summer tanagers, and over 10% of the worm-eating warblers, yellow-billed cuckoos, and Acadian flycatchers. Conservation efforts in the physiographic area have a proportionately greater ability to impact such species as declines or increases in areas with large percentages of a species global population have a greater effect on their global abundance than if similar rates of increase or decline occur where there are fewer individuals. Further, the reproductive success of forest-breeding birds in the Ozark/Ouachitas appears to be above that needed to sustain local populations, and offspring from birds breeding in the physiographic area may be the sources of individuals that colonize other geographic areas where reproductive rates of forest birds are extremely low. Research in the midwest has shown that such "source-sink" dynamics result primarily from the effects of high levels of brood parasitism and nest predation in areas where forest fragments fall below a size of approximately 4,000 hectares (10,000 acres) or where forest coverage across broad landscapes falls below 70%. Therefore, maintaining the forested landscapes needed to support source populations of forest birds is probably the single most important contribution that the Ozark Plateau NWR can make to the conservation of non-game birds.

1.3.3.4 State and Local Plans and Initiatives

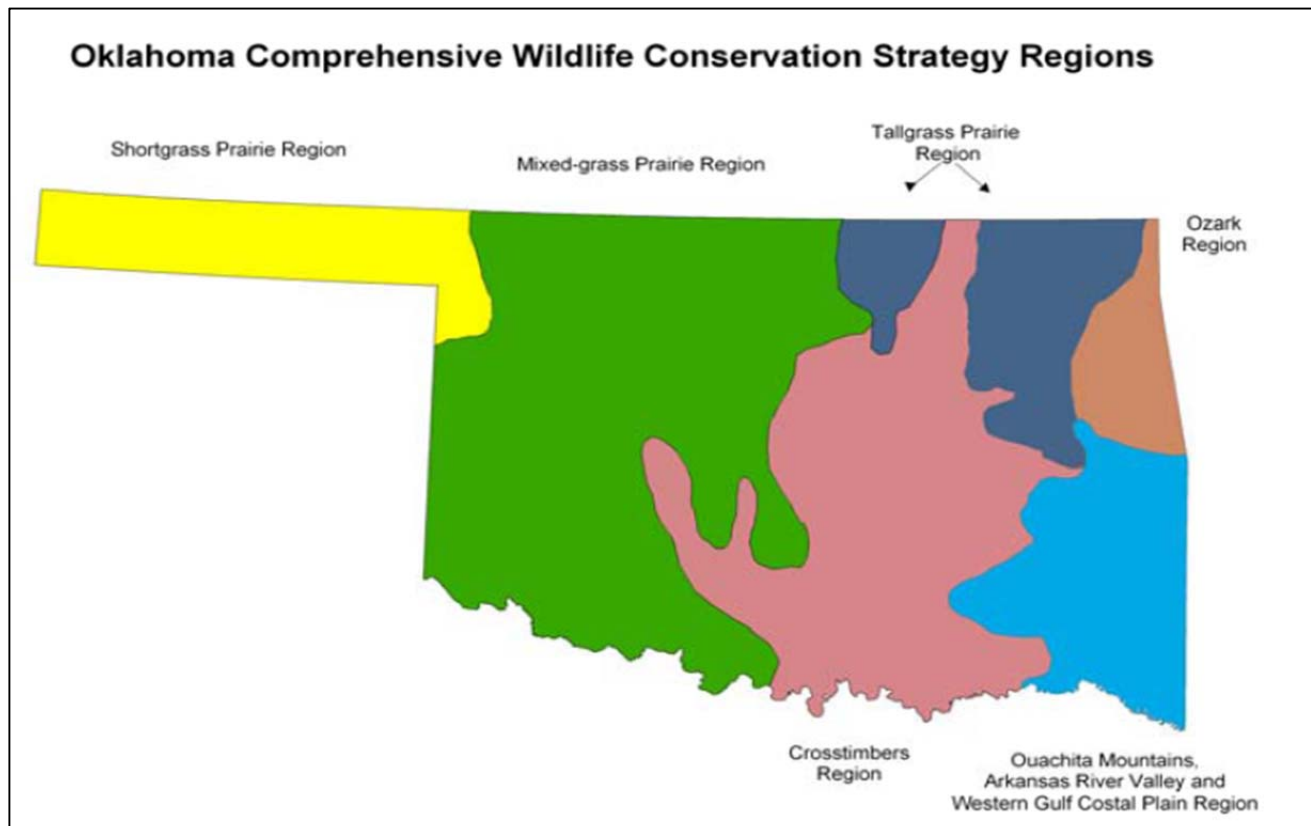
Oklahoma Comprehensive Wildlife Conservation Strategy (2006)

The wildlife action plan is required to assess the condition of the state's wildlife and habitats, identify the problems they face, and outline the actions that are needed for long term

conservation. The strategy identifies a variety of actions aimed at preventing wildlife from declining to the point of becoming endangered. By focusing on conserving the natural lands and clean waters that provide habitat for wildlife, the strategy has important benefits for wildlife and people. In addition to specific conservation projects and actions, the strategy describes many ways we can educate the public and private landowners about effective conservation practices.

For purposes of the Comprehensive Wildlife Conservation Strategy, the State of Oklahoma has been divided into six large regions (Short Grass Prairie Region; Mixed-grass Prairie Region; Tallgrass Prairie Region; Crosstimbers Region; Ouachita Mountain; Arkansas River Valley and Western Gulf Coastal Plain Region; and Ozark Region) (see Figure 1-3). Each of these regions encompasses one to three of Bailey's Sections and one to three of Omernik's Ecoregions. The authors of the plan attempted to reconcile the differences between the ecological regions proposed by Bailey / USFS with those proposed by Omernik / EPA by grouping together similar regions. In so doing, they believe that the Conservation Strategy can be applied by agencies using either ecological classification system. Additionally, these regions are similar to the Bird Conservation Regions recently developed under the North American Bird Conservation Initiative. The Bird Conservation Regions were adapted from Omernik's classification system and are used widely by the U.S. Fish and Wildlife Service, Joint Ventures and other conservation partners.

Figure 1-3. Oklahoma Comprehensive Wildlife Conservation Strategy Regions



The Refuge is primarily located within the Ozark Region, which is often referred to as the Ozark Highlands. This region encompasses all or portions of six counties in northeastern Oklahoma: Ottawa, Delaware, Mayes, Cherokee, Adair, and Sequoyah. It is equivalent to the Ozark Highlands and the Boston Mountains in both Bailey's and Omernik's ecological classification systems.

1.3.3.5 Other Refuge Plans

Ozark Plateau National Wildlife Refuge Expansion Environmental Assessment, Land Protection Plan, and Conceptual Management Plan (2005)

The plan enhanced habitat protection in a seven-county area (Adair, Cherokee, Craig, Delaware, Mayes, Ottawa and Sequoyah) of northeast Oklahoma by expanding the acquisition boundary by up to 15,000 acres total. This plan protects caves and critical cave watersheds for endangered species, forest habitat for resident and Neotropical migratory birds, and the natural biological diversity values.

1.3.3.6 Species-specific Plans and Initiatives

Ozark Big-Eared Bat Revised Recovery Plan (1995)

On November 30, 1979 the Ozark big-eared bat (*Plecotus townsendii ingens* [Handley]) was listed as endangered under the Endangered Species Act of 1973, as amended (Federal Register, Vol. 44, No. 232, Friday, November 30, 1979). Considerable progress has been made on recovery tasks for the Ozark big-eared bat since 1984. In order to update biological information and management techniques and identify important new recovery tasks, the original recovery plan was revised in 1995. The Revised Recovery Plan presents an ecosystem approach to recovering the Ozark big-eared bat. Not only have the tasks presented in the plan benefitted the Ozark big-eared bat, but they have protected a number of other Ozark cave and surface fish and wildlife resources. In addition, there was an approved 5-year Review of the Ozark big-eared bat in 2008.

Gray Bat Recovery Plan (1982)

This plan was designed to provide decision makers with an orderly set of events which, when carried to a successful completion, would lead to the recovery of the gray bat species. The plan established priorities for protection and management of caves, public education, and monitoring procedures. Most recently, in 2009, the latest five-year review was completed for this recovery plan and overall this species is recovering, and numbers have increased significantly in many areas. This species' range has expanded in some areas (e.g., Georgia, Indiana, and Kansas) and gray bats are using many caves on the Refuge that were not known prior to the completion of the 1982 Recovery Plan.

Ozark Cavefish Revised Recovery Plan (1989)

The Ozark Cavefish is one of the most cave adapted vertebrates known, and this specialization to the cave environment exposes the species to the negative effects of cave disturbances and may limit its ability to recover from even minor perturbations. This, combined with the shrinking of its known range, was the basis for the species being recognized as threatened in 1984. The Refuge has based much of its cave, aquifer, ground water recharge area, watershed, and forest resources management in efforts to protect this vulnerable fish species.

1.3.3.7 Coordination with the State of Oklahoma, Tribal Nations, and Other Entities

The Service is required to consult and coordinate with affected private landowners, state conservation agencies, Tribal Nations, and other local and federal agencies. The Service is required to ensure effective coordination, interaction, and cooperation in a timely and effective manner with the State and tribes during the course of acquiring and managing refuges. Under the Refuge Administration Act of 1966 and 43 CFR 24, the Director and the Secretary's designee is required to ensure the Refuge System regulations and management plans are to the extent practicable, consistent with State laws, regulations, and management plans. As such, the Service will ensure this CCP complements the State of Oklahoma's, Cherokee Nation's, and other Tribal Nations' efforts to conserve fish and wildlife and their habitats, as well as increase support for the Refuge System's conservation efforts by also working together with nongovernmental organizations and the public (see Chapter 2, pages 2-2 through 2-3 for the dates and locations of scoping meetings with the public, ODWC, and the Cherokee Nation).

This CCP recognizes that both the Service and the ODWC have authority and responsibilities for management of fish and wildlife species on the Refuge. The State's, Cherokee Nation's, and other Tribal Nations' participation throughout this planning process are essential to developing an effective comprehensive conservation plan for Ozark Plateau NWR. By finding common objectives, partners can support one another's conservation goals on the larger landscape scale.

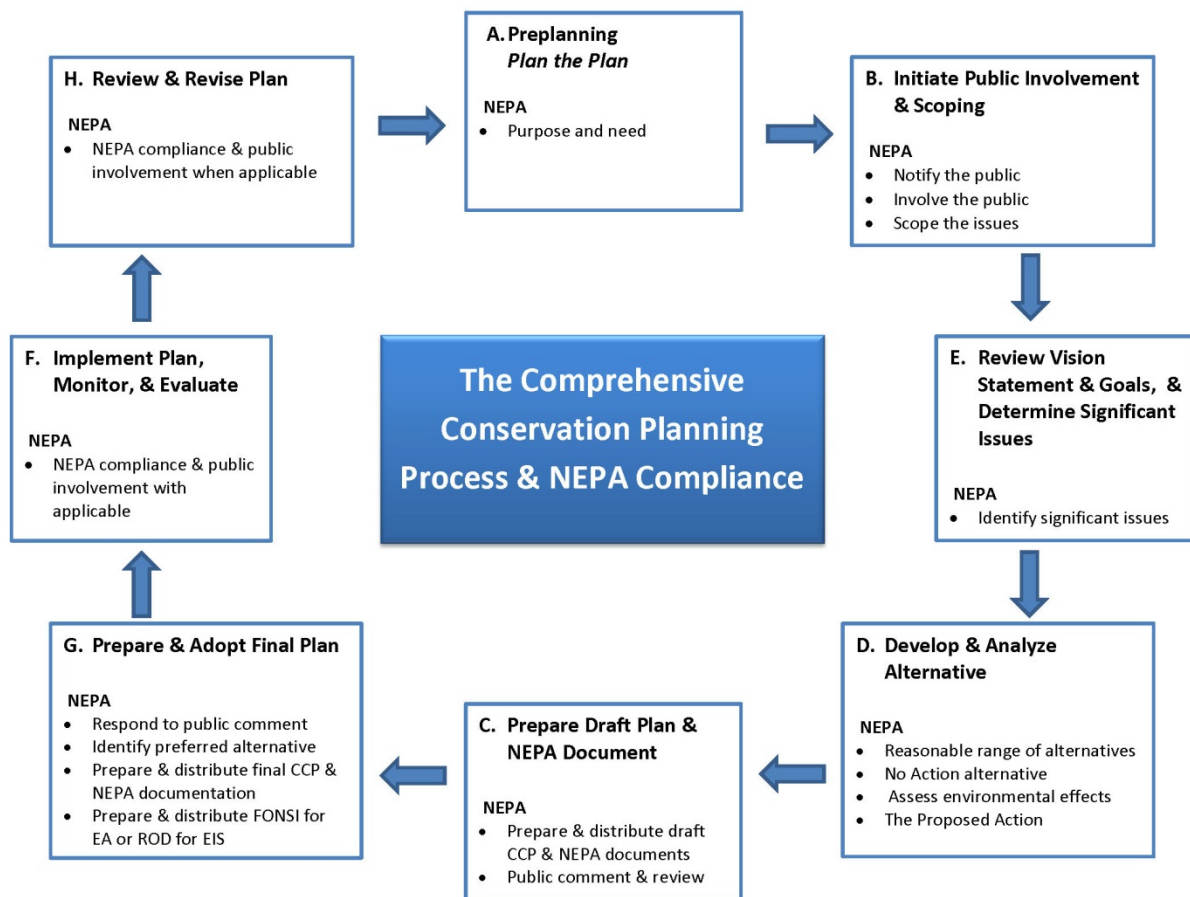
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Chapter 2: The Planning Process

This CCP complies with the requirements of the Refuge Improvement Act of 1997 and the National Environmental Policy Act (NEPA). Refuge planning policy also guided the process and development of the CCP, as outlined in Part 602, Chapters 1, 3, and 4 of the Service Manual. Service policy, the Improvement Act, and NEPA provide specific guidance for the planning process, such as seeking public involvement in the preparation of the Environmental Assessment (EA). The development and analysis of a reasonable management alternative within the EA includes a “no action” alternative that reflects current conditions and management strategies on the Refuge.

Figure 2-1 shows the steps in the CCP planning process in a linear cycle. The following sections (2.1-2.8) provide additional detail on individual steps in the planning process.

Figure 2-1. The Comprehensive Conservation Planning Process



2.1 Preplanning

The Service completed the following preplanning tasks prior to formally initiating the development of this CCP, in order to support planning activities:

- Established an interdisciplinary interagency planning team
- Identified Refuge purpose, history, and establishing authority
- Identified all relevant laws, regulations, and policies that would have to be considered during the development of the CCP
- Identified purpose and need for the CCP to make sure all issues are adequately addressed
- Identified planning area and resource data needs

2.2 Initiate Public Involvement and Scoping

The formal planning process begins with the scoping period, which involves a thorough assessment of issues, concerns, opinions, thoughts, ideas, concepts, and visions for the Refuge. Formal scoping began with publication of a notice of intent to prepare a CCP and EA, which was published in the *Federal Register* on June 19, 1998 (Volume 63, Number 118, pp. 33693-33694).

After publication of “Planning Update #1” in November 2009, three public open house scoping meetings were held, as advertised in the update and local newspapers, in December (Table 2-1). The first meeting was held in the central part of the Refuge boundary expansion area, in Tahlequah, Oklahoma, at the Cherokee Nation Tribal Headquarters building, from 6:30 to 8:00pm on December 1st, 2009. The next evening, the second meeting was held near the southern units of the Refuge in Stilwell, from 6:30 to 8:00pm. The third meeting was held near the northern units in Jay at the Delaware County Library at also from 6:30 to 8:00pm on December 8th. Comments were accepted through January 4, 2010.

Table 2-1. Location, Attendance, and Dates of Public Meetings

| Meeting Location | Attendance | Meeting Date |
|--|------------|----------------------------|
| Cherokee Nation Headquarters. Tahlequah, OK | 17 | Tuesday, December 1, 2009 |
| Stilwell Senior Center. Stilwell, OK | 9 | Thursday, December 3, 2009 |
| Delaware County Library. Jay, OK | 9 | Tuesday, December 8, 2009 |

The *Planning Update #1* was also sent to the State Oklahoma Department of Wildlife Conservation as well as seven Native American Tribes on October 27, 2009. Both the State and all affected Tribes were invited to meet one-on-one with the Refuge. After attending one of the three public open house meetings, the Cherokee Nation Environmental Protection Commission indicated a desire to meet bilaterally with the Planning Team and a meeting was held at the Cherokee Nation Headquarters and Administration complex on March 3, 2010 to review issues and preliminary alternatives concerning the tribe’s perspective. The following day, the core

planning team met with the Oklahoma Department of Wildlife Conservation (ODWC) staff at the Porter Office in Oklahoma on March 4, 2010, also to review issues and preliminary alternatives concerning the State's perspective.

2.3 Determine Issues

To determine the issues being addressed in the CCP, the planning team reviewed the concerns identified by the public (individuals, conservation organizations) along with management concerns identified by Refuge staff and those submitted by city and county officials, the State of Oklahoma, Tribal Nations, and Federal agencies. Planning issues are those issues for which multiple approaches to resolving the issue will be evaluated as part of the planning process.



*Public scoping meeting at Stilwell Senior Center.
(Credit: Mark Sprick)*

Collectively, all stakeholders voiced a wide range of issues, concerns, and opportunities during the planning process. Table 2-2 summarizes what issues were brought up during scoping and which stakeholder was concerned with them. Seven planning **issue categories** were identified for consideration during the development of this CCP:

- | | | |
|-----------------------|----------------------|------------------|
| • landscape-level | • public use | • facilities & |
| • habitat management | opportunities | infrastructure |
| • wildlife management | • cultural resources | • administration |

Understanding the root of the issue and discussing these issues in detail helped the Refuge to reflect and consider a variety of viable solutions that can be implemented in the future management of the Refuge. Sections 2.3.1 – 2.3.7 describe each issue in detail and how it relates to the Ozark Plateau National Wildlife Refuge. Appendix A, the *Environmental Assessment*, displays the potential consequences and/or benefits of implementing different management alternatives to address these issues. Chapter 4: Management Direction outlines specific objectives and strategies describing how the Refuge proposes to address these issues within the next 15 years.

Table 2-2. Issues identified and discussed during scoping

| Issue | Public | Local | State | Tribal | Federal | USFWS |
|--|--------|-------|-------|--------|---------|-------|
| Landscape-level | | | | | | |
| Ozark habitat loss | X | | X | X | | X |
| Habitat fragmentation | X | | X | X | | X |
| Land acquisition | X | X | | | X | X |
| Water quality & quantity | X | X | X | X | | X |
| Landscape-level partnerships | X | | X | X | X | X |
| Climate change | X | | | | X | X |
| Wind energy farms | | | | | | X |
| Habitat Management | | | | | | |
| Cave habitat degradation by unauthorized visitors | X | | X | X | | X |
| Cave gate vandalism | | | | | | X |
| Lack of detailed scientific habitat/cave information | | | X | | | X |
| Invasive species | X | | X | X | | X |
| Prescribed fire | | | X | X | | X |
| Wildlife Management | | | | | | |
| White-nose syndrome | | | X | X | X | X |
| Recovery of federally-listed Ozark cave species | X | | X | X | | X |
| Disturbance to cave species by unauthorized visitors | X | | X | X | | X |
| Monitoring and research | X | | X | X | X | X |
| Public Use Opportunities | | | | | | |
| Environmental education | X | X | X | X | X | X |
| Bird watching | X | | | X | | X |
| Photography | X | | | | | X |
| Hunting | X | | X | X | | X |
| Hunting/trapping ed. | X | | X | X | | X |
| Public outreach | X | | | | | X |
| Cultural Resources | | | | | | |
| Archeological sites protection ¹ | | | X | X | | X |
| Historic sites protection ² | | | X | X | | X |
| Survey and inventories | X | | X | X | | X |
| Native American tribal partnerships | X | | X | X | X | X |
| Facilities & Infrastructure | | | | | | |
| Refuge Headquarters | | | | | | X |
| Adequate facilities and roads | | | | | | X |
| Refuge housing | | | | | | X |
| Administration | | | | | | |
| Funding and staffing | X | | | | | X |

Notes:

1 – Pre-Cherokee Nation period (prior to 1838).

2 – Post-Cherokee Nation period (1838 to the present).

2.3.1 Landscape-level Issues

Ozark Habitat Loss & Fragmentation

Some timber harvesting in the region involves the clearing of forested areas and converts them to cattle and other agricultural uses, resulting in the loss of mature tree forests, increasing understory growth, increasing water runoff, and decreasing groundwater recharge. Mining operations near the Refuge remove trees and reduce habitat for bat foraging and other species. Current and projected agricultural uses on the landscape result in a patchwork mosaic of open rangelands, further fragmenting the Ozark forests. The region is also experiencing increasing road and right-of-way construction and other infrastructure development.



Aerial view shows three North Tulsa projects. (Credit: Tulsa City-County Library) (Photo: Austin Hellwig, 1987)

The construction of reservoirs over the years has resulted in the loss of some Ozark caves and riparian forests in the ecoregion. Some caves near the reservoirs are flooded periodically, depending on rainfall and lake levels because of hydropower generation and flood control operations, making them inaccessible and uninhabitable by bats. Land acquisition could prevent similar negative effects from occurring in the future.

Ozark habitat loss and fragmentation due to development and encroachment was the primary concern among the public, the State, tribal members, and Refuge staff during scoping. Many suggested that maintaining or improving relationships with surrounding landowners and tribes could help counteract this issue - through communication and agreements to cooperatively perform sustainable land management practices for habitat and wildlife conservation in the Ozarks. The State also recommended that the Refuge look into acquiring as much land as possible (in fee title, easements, or other means) before land prices increase again.

Climate Change

Data provided by Climate Wizard (www.climatewizard.org, accessed June 2010) indicates that within the area of the Refuge the temperature is expected to warm by about 5 degrees F, while moisture is anticipated to decrease between now and 2050. Changes in climate in and around caves may affect their suitability for different bat species (Newson et al., 2009). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for



Climate change on the horizon.
(Credit: USFWS)

bats (Newson et al., 2009). It has also been observed on the Refuge that there are temporal variations on migration and birthing of Ozark big-eared bats and gray bats, however, more literature is needed to document this. Warmer and drier conditions may affect surface and groundwater availability, fire regimes, and shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area. Because of the unprecedented scope of affected landscapes, the Service must work together with other private landowner partners, local state, tribal, and federal governments, and Landscape Conservation Cooperatives (LCCs) to develop landscape-level strategies for understanding and responding to climate change impacts.

The Refuge and the public would like to know more about how climate change is affecting the Ozark Plateau's habitats and species (currently and in the future). Monitoring climate change in relation to habitat and wildlife changes could be useful so that the Refuge may best adapt management appropriately for the benefit of Ozark resources.

Surface and Groundwater Quality & Quantity

In the northern part of the Refuge acquisition area, abandoned lead and zinc mines including the Tri-State Superfund Site (the former Tar Creek Superfund Site expanded to include areas in Oklahoma, Missouri, and Kansas), have contaminated surface and groundwater resources. Increasing deforestation and conversion to urban and agricultural land uses in the region is also increasing the volume of water run-off and decreasing the capability of the watershed to filter this run-off. Unfiltered water contains a



Toxic water from mine waste at Tri-state Superfund Site.
(Credit: Steve Hensley)

higher volume of both contaminants and nutrients, such as nitrogen, phosphorus, metals, pesticides, pharmaceuticals, and plasticizers.

Habitat degradation and pollution due to these agricultural and mining activities and development pose serious risks not only to the groundwater quality but are primary threats to aquatic cave fauna such as the threatened Ozark cavefish (Crunkilton, 1984; Culver et al, 2000; Graening and Brown, 2003; USFWS, 2010). The karst environments (i.e. an area of limestone that is marked by caves, sinkholes, springs, and other features and that has special drainage characteristics due to limestone's greater solubility) in which the cavefish occur, are highly vulnerable to groundwater pollution. Contaminated surface water can enter the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (i.e. a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. These karst features provide for only minimal natural filtration processes. Once underground, the subterranean network of caves and conduits also allow for additional rapid water movement. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances (Green et al. 2006).

In addition, the quantity of surface and groundwater of the aquifer surrounding the Refuge is being affected by agriculture and increasing urbanization. These wet karst environments that provide habitat for cavefish and cave crayfish dwell in the same groundwater tapped by wells for local water supply. Spavinaw Creek Basin provides the water supply for the City of Tulsa. Impervious surfaces and man-made drainage systems are preventing surface water to seep through the ground and recharge the aquifer in the natural manner that it used to. There has also been an increase in water consumption due to an increasing population in growing urban areas nearby. These contributing factors are lowering surface and groundwater levels, which consequently affect subterranean and aquatic habitats and their respective species on the Refuge and surrounding areas.

The public, the State, tribal members, and the Refuge expressed high concerns regarding the degradation of surface and groundwater quality. One representative of the Seneca-Cayuga Tribe of Oklahoma stated that the "tribe's livelihood is tied to Grand Lake and that water quality and maintaining healthy wetlands is crucial to their former reservation lands".



Little brown bat; fungus on wing membrane. (Credit: Ryan von Linden/ NY Dept. of Environmental Conservation)

White-nose Syndrome (WNS)

Conservation organizations, the State of Oklahoma, Tribal Nations, the Refuge, and other federal agencies are extremely concerned with White-nose syndrome (WNS), a disease caused by the fungus *Geomyces destructans*, which is responsible for unprecedented mortality in cave-hibernating bats in the northeastern and central U.S and eastern Canada (Lorch et al, 2011). This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a

considerable threat to cave-hibernating bats throughout North America. More than 5 million hibernating bats have died since 2007 (Froschauer, 2012). Biologists with state and federal agencies and organizations across the country are still trying to figure out how to minimize the spread and impacts of the disease and recover impacted populations. To date, seven bat species are known to be affected by the disease: the little brown bat *M. lucifugus*, eastern small-footed bat *M. leibii*, Indiana bat *M. sodalis*, northern long-eared bat *M. septentrionalis*, big brown bat *Eptesicus fuscus*, gray bat *M. grisescens*, and the tri-colored bat *Perimyotis subflavus*. Four of these species, the northern long-eared, big brown, gray, and tri-colored bat occur on the Refuge. Although the fungus *Geomyces destructans* was found on a cave *myotis* in northwestern Oklahoma in 2010, the disease WNS has not yet been documented on the Refuge. However, scientists predict that WNS will continue to spread, making it even more critical to address the issue in the future management direction.

Wind Energy Farms

The Refuge is concerned about the impacts of wind energy farms on migration routes because they cause mortality in migratory bird and bat species due to direct strikes and barotrauma from turbine blades (Johnson et al, 2002). Energy farms also increase habitat fragmentation with the construction of large fields of turbine towers and the networks of connecting power line infrastructure. These wind energy farms could be placed astride bat and bird migration corridors. Knowledge of specific migratory routes would be beneficial during early planning stages of development projects in order to minimize the impacts to migratory species.



Wind turbine. (Credit: Scott Detrow/ stateimpact.npr.org)

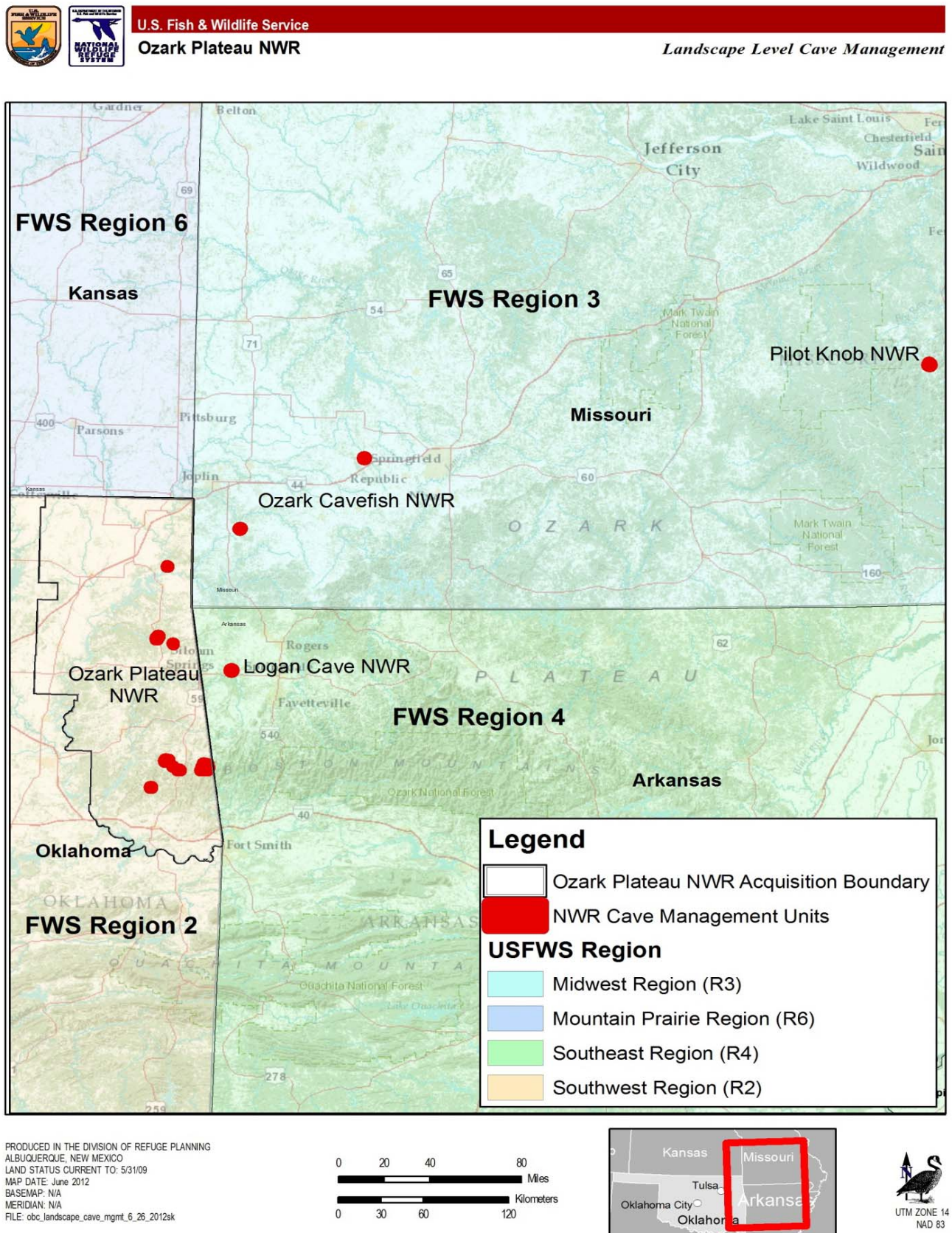
Species Cross Political and Regional Boundaries

Ozark Plateau NWR has a unique conservation location because the Refuge lies in northeast Oklahoma amidst surrounding state borders of Missouri, Arkansas, and Kansas, which correspond to the Service Regions 2, 3, 4, and 6 (see Figure 2-2). The distribution of the federally listed threatened and endangered Ozark cave species (Ozark big-eared bat, gray bat, Indiana bat, and Ozark cavefish) that Ozark Plateau NWR was established to protect and recover, cross several State and Service regional boundaries. Steps have been made within its own Region (2) to implement Strategic Habitat Conservation. Aside from building and maintaining strong partnerships across the landscape-level with various landowners, conservation organizations, cities, universities, state, tribal and other federal agencies, in 2005, Ozark Plateau NWR was authorized to expand its acquisition area from about 3,000 acres up to 15,000 acres in seven counties in northeast Oklahoma of Service Region 2. These partnerships and acquisition of land and conservation easements from willing sellers has lead the Refuge one step further in accomplishing conservation objectives. However, to fully implement the recovery tasks of protecting essential habitat as identified in the recovery plans for the Ozark big-eared bat (1995), gray bat (1982), Indiana bat (2009), Ozark cavefish (1989), and Ozark cave crayfish (1986), it will be necessary to expand beyond the approved acquisition area or develop new acquisition areas across State and Service regional boundaries into Arkansas, Missouri, and Kansas.

Currently, Logan Cave NWR in northwest Arkansas protects an important federally listed gray bat, Ozark cavefish, and Ozark cave crayfish cave and is managed as a satellite of Holla Bend NWR, in Region 4 of the Service. Similarly, Cavefish NWR in southwest Missouri was established to protect the federally listed Ozark cavefish and Pilot Knob NWR in south central Missouri was established to protect an important federally listed Indiana bat hibernaculum; both are managed as satellites of Mingo NWR in Region 3 of the Service. Management of these satellite cave refuges is challenging due to a lack of dedicated staff and funding as well as unique wildlife and habitat needs. Consequently, over a number of years there has been a cooperative effort among Holla Bend NWR, Mingo NWR, and Ozark Plateau NWR to work together to plan and implement Strategic Habitat Conservation cave and karst management practices on a landscape level on and surrounding these refuges. This cooperation has been beneficial for accomplishing some recovery tasks for Ozark federally listed cave species through adaptive management; however no formal management agreement is currently in place to ensure that it continues.

Because Ozark Plateau NWR's authorized purpose is to prevent extinction of federally listed Ozark cave species, help assure their recovery, prevent the need for listing additional species, and because the Refuge has dedicated funds and staff with experience in cave and karst management, it would be most effective for Ozark Plateau NWR to manage Logan Cave, Cavefish, and Pilot Knob NWRs as additional management units across state and regional boundaries. However, Strategic Habitat Conservation could also be accomplished across state

Figure 2-2. Cave management coordination opportunities at the landscape-level.



and regional borders by establishing refuges similar to Ozark Plateau NWR in Regions 3 and 4. Details on management logistics on such a large landscape scale regarding staffing and funding may initially be bureaucratically challenging, however, coordination efforts across these Service Regions should prove more effective at protecting and recovering Ozark cave wildlife species.

2.3.2 Habitat Management Issues

Degradation of Cave, Stream, and Forest Habitat

Early descriptions of the Ozark region of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). However, since European settlement, suppression of the natural fire regime has led to overcrowded forest conditions. In addition, many fragments of forest were cut for commercial logging. As a result, today's remaining forest areas mostly consist of exceedingly high densities of even-aged stands with an excessive fuel load and a lack of well-developed understory.



*Family operation of early logging (circa 1800s).
(Credit: Oklahoma Forestry Services, 2007)*

Current conditions not only lead to unnatural and uncontrollable wildfires, but they are also not ideal for native vegetation and wildlife to thrive as they once had. Forest habitat restoration measures (such as prescribed fire, thinning, native planting, etc.) that mimic the historic fire regime and maintain a natural mosaic of plant communities representative of the ecosystem will reduce the risk of unplanned, high-intensity wildfires while also supporting a greater diversity of native flora and fauna. Ozark big-eared bats and gray bats depend on an open, regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) as important flight corridors and foraging habitat. Large continuous stands of mature Ozark forest are also essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that must nest some distance from an edge. The forest also plays an important role in preventing degradation of water quality in caves used by the Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish.

Degradation of habitat and water quality has been identified as a major threat to aquatic cave species (USFWS Cavefish 5-year Review, 2010). Conventional agriculture run-off and increasing urban development result in decreased quantity of surface and groundwater of the aquifer as well as contaminated surface water, which freely enters groundwater with limited

natural filtration in areas of karst topography such as in the Ozarks, adversely affecting cavefish, cave crayfish, and other species. (See also 2.3.1 *Surface and Groundwater Quality & Quantity*).

Human disturbance and vandalism are the leading factors in the degradation of cave habitats and decline in bat populations. In recent years, people have vandalized cave gates, destroyed and removed cave formations, modified passageways, littered, graffitied, and damaged the caves with smoke from fires. The Refuge routinely repairs cave gates about three or four times per year due to vandalism and unauthorized entry. Disturbance of hibernating bats causes the loss of critical fat stores and increases the probability of starvation during winter, while disturbance at maternity roosts can result in a loss of young (Tuttle, 1979). Protection of caves from human disturbance and destruction are identified as the most important recovery need of the three federally listed cave species known to occur on the Refuge (USFWS Ozark big-eared Bat Recovery Plan, 1995 ; USFWS Gray Bat Recovery Plan, 1982 ; USFWS Ozark Cavefish Recovery Plan, 1989).

Similarly to Ozark habitat loss and fragmentation, degradation of cave, stream, and forest habitat were some of the highest concerns that the public, the State, and tribal members had during scoping. One member of the public commented that the most important role of the Refuge is to protect these habitats.

Lack of Detailed, Scientific Cave Habitat Data

The State and the Refuge would like to know more information on cave, and forest/surface habitat requirements and feeding/foraging ecology of federally-listed bats, cavefish, and other cave-dwelling organisms (see 2.3.3 Wildlife Management Issues). Cherokee Nation members expressed that caves and the land they are located on are very valuable resources to the tribe and suggest that the Refuge coordinate with them to continue mapping caves.



Invasive, tall fescue. (Credit: J. Miller at invasive.org, 2003)

Invasive Flora

Non-native invasive plants alter natural habitat conditions, which consequently affect native wildlife species. Evaluation of invasive and exotic plants that are detrimental to native flora and fauna species and maintenance of natural biodiversity is very important to the Refuge for the overall health and function of natural ecosystems within the Ozarks. Some non-native invasive species that may outcompete and displace native plants within hardwood forests and/or riparian areas of the Refuge include: *Sericea lespedeza*, tall fescue, Chinese privet, Japanese honeysuckle, Johnson grass, kudzu, beefsteak plant, Nepalese browntop, mimosa trees, among others. A vegetation survey from 2003 found that 8.7% of all plant species occurring on the

Sally Bull Hollow Unit of the Refuge were non-native flora (Hayes). A new survey is needed to reassess how this has changed as well a baseline assessment of non-native species occurring on all other Refuge Units. These invasive plant species may have some effect on bats' prey, including moths and other insects; however, no research has been done on this. Songbirds and migratory birds depend on native plants, shrubs, and trees for nesting, perching, and hosting a multitude of insects for prey. Consequently, non-native invasive flora also affects bird niches. In addition, exotic tree pathogens are affecting native Ozark chinquapin and flowering dogwood, which may also be altering forest structure and diversity.

Invasive flora was an issue that the public and the State felt should be addressed.

Fire Management

As mentioned above, early descriptions of the Ozark regions of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). However, since settlement, loss of the natural fire regime has resulted in overcrowded forest conditions. This has left remaining forested areas in an over-abundance of mostly even-age stands of oak-hickory and oak-hickory-pine forest. Ozark big-eared bats and gray bats depend on an open, regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) as important flight corridors and foraging habitat. Therefore, mimicking the natural fire regime would benefit these species as well as migratory interior forest nesting birds. The Refuge currently has a Fire Management Plan; however only for two of its nine management units.

The public, the State, and Tribal Nations expressed that they would like to see more well-managed prescribed burns used as a management tool in the forested areas on the Refuge. The State and Tribal Nations want to coordinate with the Refuge to do a number of controlled burns simultaneously.

2.3.3 Wildlife Management Issues

Threatened and Endangered (T&E) Species and Species of Concern

The Refuge was established to prevent the extinction and recovery of federally listed Ozark cave species, which include the Ozark big-eared bat (*Corynorhinus townsendii ingens*), gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and Ozark cavefish (*Amblyopsis rosea*). The Refuge also currently protects nine species of concern to prevent the need for future listing. There are nine species of concern on the Refuge, including the Oklahoma cave crayfish (*Cambarus tartar*) and Delaware County cave crayfish (*Cambarus subterraneus*). Currently, there is little known about these Ozark cave species: their habitat requirements, genetics, effects of climate change, and how white-nose syndrome (WNS) will affect entire cave ecosystems. The Refuge would like to address scientific knowledge gaps regarding forest, surface, and cave habitat requirements and breeding ecology of cave species occurring on the landscape level to

better assess and manage for their needs. The State is also concerned with insufficient knowledge regarding these species.

Ozark Big-eared Bat & Gray Bat

The Ozark big-eared bat is endemic to the Ozark Highlands and Boston Mountains Ecoregions (Omernik, 1987) where it occurs in oak-hickory hardwood forests (Clark, 1991; Leslie and Clark, 2002; and U.S. Fish and Wildlife Service, 1995). The Ozark Highlands Ecoregion is under considerable development pressure and is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area.

For example, the human population of Washington and Benton County, Arkansas, and Adair and Cherokee Counties, Oklahoma, increased 39.0 percent, 59.0 percent, 14.2 percent, and 24.9 percent, respectively, from 1990 to 2000. Over the same period, the human population within the states of Oklahoma and Arkansas, and within the United States increased by only 9.7 percent, 13.7 percent, and 13.2 percent respectively (U.S. Census Bureau, 2001). The Oklahoma Department of Commerce (ODOC) projects the human population of Adair and Cherokee counties, Oklahoma, to grow by about 35 percent over the next 23 years (ODOC, 2002).



Ozark big-eared bat. (Credit: Shea Hammond)

Vandalism and unauthorized human activity at maternity roosts and hibernacula still occur even at gated and signed caves, prohibiting entry. Therefore, human disturbance remain a serious threat. The disparity between summer and winter counts indicates there likely are more caves of importance to the Ozark big-eared bat of which the bat conservation community is not yet aware.



Vandalized cave at Ozark Plateau NWR. (Credit: Shea Hammond)

A prerequisite to protecting these sites is knowledge of their location, so the need to continue search efforts for unknown Ozark big-eared bat caves continues. Current and future human population growth and development within the Ozark big-eared bat's range will result in the loss and fragmentation of foraging habitat. In addition to protecting the caves used by the Ozark big-eared bat, it will become increasingly important to protect and restore foraging habitat around these caves as development

pressures increase in the future (Leslie and Clark, 2002; Wethington et al., 1996).

Degradation of foraging habitat, protective flight corridors, and food resources also presents a major threat to the gray bat. Gray bats feed primarily on aquatic insects in riparian areas and over rivers, streams, and other water bodies. Gray bats also utilize forested areas for protection from predators such as screech owls as they travel between caves and foraging sites.

Deforestation of wooded tracts and riparian zones in the vicinity of maternity caves (gray bats are known to forage up to 12 km from a summer cave) due to development and agricultural activities negatively impacts gray bats by reducing available foraging habitat and the wooded flight corridors that provide protection from predators (LaVal et al., 1977; USFWS, 1982).

Practices that result in increased pollution, turbidity and siltation in waterways over which gray bats forage, such as development and agricultural activities and the clearing of woody riparian zones, can be detrimental by reducing the local abundance of important prey, especially species sensitive to aquatic pollution such as mayflies, caddisflies, and stoneflies (Tuttle, 1979; USFWS, 1982). In addition, natural flooding and impoundment of waterways has resulted in temporary impacts to some caves and the complete submersion and loss of other important cave sites (Barbour and Davis, 1969; LaVal et al., 1977; Tuttle, 1979). Natural and man-made flooding remains a threat at some gray bat sites.

Although additional essential caves have been discovered and protected since the time of listing the Ozark big-eared bat and gray bat, not all known caves have been afforded some form of protection (e.g., a cave gate/grill, signs, fee-title purchase, conservation easement, landowner agreements, etc).

Climate change could have a significant impact on all temperate region bats, including the Ozark big-eared bat and gray bat species. Projected changes in climate could impact bats by adversely affecting their food supply and the internal roosting temperature of caves (Bogan, 2003). The Ozark big-eared bat preys on a wide diversity of moth species, but most of the moth species are dependent upon woody forest plants as a host. Climate change may affect the Ozark big-eared bat by impacting plant resources which could alter the timing and abundance of moth prey. Ozark big-eared bats have specific cave microclimate requirements. Only those caves with appropriate microclimates are used as maternity roosts and hibernacula. Changes in the internal roosting temperature of caves may change the suitability of certain caves. Changes in food resources and cave microclimates may affect hibernation periods, and the birth and survival of pups.

The fungus associated with WNS recently has been found (spring 2010) in close proximity to the range of the Ozark big-eared bat (northwestern Oklahoma and Missouri). WNS threatens to spread to the range of the Ozark big-eared bat in the near future. Should WNS move into the range of the Ozark big-eared bat, the potential impact could be severe due to the high mortality

rate of affected bats to date, and the small population size and limited distribution of the Ozark big-eared bat. Subsequently, the fungus associated with WNS was in fact documented on gray bats in Missouri (spring 2010).

Mortality attributable to WNS has not occurred in any gray bat populations to date. However, the discovery of the fungus on gray bats is cause for concern. A large percentage of the gray bat population hibernates in a limited

number of caves. Mortality rates reported from hibernacula in the northeastern United States are unprecedented (e.g., 90% mortality in affected caves and over 1,000,000 bats estimated to have died due to WNS). Therefore, should gray bats develop WNS, disease transmission could occur rapidly and the resulting impacts could be severe.



*White-nose syndrome affected bats, New York.
(publicbroadcasting.net)*

Ozark Cavefish

The construction of impoundments historically may have impacted the Ozark cavefish (Graening et al. 2009). Several caves within the Spavinaw Creek Basin of Oklahoma, the current range of the cavefish in Oklahoma, were completely inundated by the construction of Lake Eucha (Looney, 1972). Several impoundments constructed in Arkansas and Missouri on the White River inundated extensive cave systems that occur within the range of the cavefish (Graening et al., 2009).

Habitat degradation and pollution due to agricultural activities and development currently are considered primary threats to the Ozark cavefish. The karst environments (i.e., a landscape underlain with limestone that is marked by caves, sinkholes, springs, and other features and has special drainage characteristics due to the greater solubility of limestone) in which the cavefish occur are highly vulnerable to groundwater pollution. Water enters the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (i.e., a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances.

Agriculture is considered the primary threat within the recharge zone (i.e., areas involved with input of water into the cave system) of 17 out of 35 active sites (David Kampwerth, Service Recovery lead, pers. comm.). Various agricultural activities can threaten groundwater quality (Aley and Aley, 1997). Chemicals and fertilizers that are applied on agricultural lands can rapidly infiltrate groundwater and cave systems during rain events due to the karst topography of the Ozark Highlands. As forested areas are harvested or lands are converted from forest to pasture, valuable canopy cover for ground temperature regulation and soil moisture retention is lost. In 1968, 59% of the Logan Cave recharge zone was forested. By 1987 the amount of forested land was about 43%, representing a 17% decrease (David Kampwerth, Service Recovery lead, pers. comm.).

Confined animal feeding operations (CAFOs) also are believed to pose a threat (Aley and Aley, 1999). Metals and other contaminants pass through poultry and other livestock and can reach groundwater through land application of wastes. Aley and Aley (1999) identified CAFOs as the greatest threat within the recharge area of Long's, McGee's, and Engelbrecht Caves in Oklahoma. CAFOs also are believed to be a threat to the water quality of Cave Springs Cave and Logan Cave in Arkansas (Graening and Brown, 2003). The 11 square mile recharge zone of Logan Cave alone contains approximately 50 hog and poultry facilities (Aley and Aley, 1987).

Urbanization and development are considered primary threats within the recharge areas of 17 cavefish caves (David Kampwerth, Service Recovery lead, pers. comm.). As development and associated impervious surfaces (e.g., roads, parking lots, etc.) increase, areas that otherwise would allow natural infiltration and percolation are lost or significantly diminished. Increased groundwater withdrawals for home, community, and agricultural use also can deplete groundwater and limits available habitat.

Unauthorized human entry also continues to be a threat at protected sites and at sites with no protection measures in place. Gates/fences have been vandalized with evidence of recent human access. Use at ungated caves is occurring based on evidence such as new paint, foot prints, and writing found during biannual monitoring surveys. Human entry causes increased turbidity decreasing cavefish sensory ability. Unauthorized human entry also increases the potential for direct trampling of individuals, and can interrupt feeding and breeding behaviors.



Wood thrush family. (Credit: Phil W./
“it’slaterthanyouthink” of flickr.com, 2012)

Migratory and Resident Bird Species

Maintaining continuous stands for interior forest Neotropical nesting birds continues to be a concern for the Refuge, primarily due to the loss of Ozark habitat and fragmentation as discussed in habitat issues (see Section 2.3.2). The Refuge implements the protection and management recommendations of the Central Hardwood Bird Conservation Region (www.partnersinflight.org). The Refuge is located on the western edge of the Ozarks Ecoregion and near the eastern edge of the Tallgrass Prairie Ecoregion, resulting in a “crossover” of eastern and western bird species found on the Refuge.

The public and organizations suggested that the Refuge establish a continuing monitoring program to keep track of migratory and resident bird population trends and changes.

Resident Non-T&E Species

Non-T&E bat species are found on the Refuge but the Refuge is just beginning to collect information on these species. With WNS as a threat, this information could be valuable in identifying the impacts to non-T&E bat species and assist in efforts to address WNS. Also, the Refuge is concerned about collecting information on other cave species, especially with the threat of WNS potentially resulting in a large decline of bat species that provide a major energy source for a number of cave fauna.

Invasive Fauna Species and Pest Management

The Refuge is concerned about the increasing number of feral hogs, an exotic fauna species that has been found to forage in oak-hickory or oak-hickory-pine forest on and around the Refuge. Feral hogs compete with native wildlife and destroy habitat used by native species. In addition, they damage riparian habitat and reduce bank stabilization in bottomlands. Feral hogs are currently found on the Sally Bull Hollow Unit in Adair County and moving north toward Delaware and Ottawa Counties, within the Refuge’s acquisition area as well as near where four units of the Refuge. Feral hog hunting occurs year round on private, State and Tribal lands, however, currently, the Refuge does not allow any hunting. The Refuge would like to permit hunting of nuisance feral hogs, pending the development of a Hunt Plan (after Sally Bull Hollow Unit has been surveyed and marked) and/or an Integrated Pest Management Plan. In addition, the Refuge recognizes that feral cats prey on bats and migratory birds. Feral cats are currently found on most Refuge units, although the Refuge does not currently document feral cat occurrences. The Refuge is also concerned about the hothouse millipede, another exotic species abundantly occurring on the Refuge. Hothouse millipede may compete with native cave species as consumers of limited energy sources within caves. This species should be studied further to

assess its impacts on cave species. Introduced predatory fish in Ozark streams, such as trout, compete with native fish and may also compete with and forage on cavefish and cave crayfish and other precious aquatic species. The State is also concerned with invasive exotic animal species on and around the Refuge.

2.3.4 Public Use Opportunities Issues

Public Outreach

The public commented that Ozark Plateau NWR does not provide much public information regarding their Refuge. However, now that the Mary & Murray Looney Education & Research Center (MMLERC) is being renovated, the Refuge is working on improving outreach efforts.

Hunting

Currently, the Refuge does not allow hunting. Prior to opening up any Refuge land units for hunting, the Refuge would need to survey and mark the appropriate boundaries. During scoping, members of the public and the State (ODWC) expressed interest in having the Refuge open up hunting of Oklahoma state game species (including deer, turkey, squirrels, quail, and rabbits), in accordance with State regulations. The ODWC requested specifically that the Refuge explore hunting opportunities on the Sally Bull Hollow Unit because it is adjacent to state-managed hunting area, Ozark Plateau Wildlife Management Area, and that they have consistent regulations. They also suggested that wildlife observation and photography not be permitted during hunting season on that Unit. ODWC is interested in the recent (2010) increase in black bears in Northeastern Oklahoma (since the public also has an interest in hunting them) and suggested that if any black bears occur on the Refuge in the future, that they be documented.



“Bagged turkey” (Credit: ODWC Hunting Gallery, 2012)

Fishing

The Refuge does not currently have any land units with fishing opportunities. Nevertheless, there is a conservation agreement with the City of Tulsa and ODWC to co-manage the Eucha Unit (approximately 130 acres) of Ozark Plateau NWR, in which the City and State manage recreational fishing on the upper end of Lake Eucha/Spavinaw Creek, while the Refuge manages the Unit’s cave resources.

Environmental Education

Increased urbanization in northwest Arkansas and in northeast Oklahoma is having detrimental effects on the Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. Many people from these areas are also unaware of the large and delicate cave (subterranean) ecosystems, groundwater aquifers, and native wildlife species that lie underneath their feet as well as how they are connected to Ozark springs, streams, and forests, and other karst resources. Environmental education (EE) programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and understand the importance of their local ecosystems, and be able to pass on that knowledge to future generations.

In addition, during scoping, the public and members of Tribal Nations expressed a high level of interest in having more EE programs on the Refuge. Specifically, tribes would like to be more involved in sharing native knowledge through environmental education and interpretation programs on the Refuge including trapping, survival skills, identification and medicinal uses of culturally significant trees, plants, and wildlife in relation to various Tribal Nations in the four-states area. The Cherokee Nation specifically requested that traditional foods (or native foods) are served at the MMLERC in environmental education programs, especially those catered to tribal youth.



Ozark Tracker Society (EE) program at the MMLERC. (Credit: Shea Hammond, 2010)

Interpretation

As described above, increased urbanization in northwest Arkansas and in northeastern Oklahoma is having detrimental effects on natural resources of Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. In addition, many people from these increasing urban areas do not get many opportunities to connect to nature and are also unaware of the large and delicate caves and groundwater aquifers (subterranean) ecosystems and native wildlife species that lie underneath their feet. Interpretation programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and get a sense of the importance of their local Ozark ecosystems, and be able to share that experience with future generations.



*Fallen tree & fungi spores.
(Credit: Shea Hammond)*

Various Native American Nations would like to be more involved in sharing native knowledge through both environmental education and interpretation programs on the Refuge including trapping, survival skills, identification and medicinal uses of culturally significant trees, plants, and wildlife in relation to various Tribal Nations in the four-states area. The Cherokee Nation specifically requested that Ozark Plateau NWR install interpretive plant placards next to culturally-significant “Cherokee plants”, both in English and in the Cherokee language.



Future bat prey? (Credit: USFWS)

Wildlife Observation & Photography

During scoping there were no publicly-expressed opinions regarding wildlife observation and photography on Ozark Plateau NWR. However, the Refuge would like to offer more opportunities for this wildlife-dependent use by providing more nature trails and possibly having some photography blinds in appropriate areas.

Nature Trails and Overlooks

Hiking trails are not adequate for the current number of people visiting the Refuge for EE and interpretation programs, let alone the amount of those anticipated in the future. Establishing more trails will make it safer for people to walk and will prevent damage to soils and vegetation. The trail from MMLERC to the pavilion is a paved path that has deteriorated and needs to be repaved. The path from the parking area to the MMLERC also needs to be an improved gravel

walkway, approximately 3-feet wide, designed for heavy foot traffic. The remaining trails will be “primitive”. Creating and maintaining “primitive” trails will provide a basic pathway within its natural surroundings, without involving much heavy trail construction or maintenance.

In addition, establishing overlook areas and photography blinds will provide additional opportunities for visitors to connect with nature.



*Taking a winter walk at sunset in search for wildlife tracks.
(Credit: Sarah Catchot)*

Public Use Signs and Interpretive Displays

The Refuge does not currently have any public signs posted, except for at the entrances of caves stating that they are closed to the public. The Refuge does not post any public signs that are not deemed absolutely necessary in order to maintain discretion of their unit locations and to keep cave locations confidential (as required by the Federal Cave Resources Protection Act).

Nevertheless, signage on the Refuge will need to be improved throughout the lifetime of this CCP as needed, especially to accommodate the increase of EE programs at the MMLERC.

Many visitors get lost when visiting the Refuge and signage could help orient them. However, the Refuge does not want to post these signs until the MMLERC is completely secured (alarm system, permanent staffing, safes, etc.). Other interpretive signage on Refuge nature trails could also provide a higher quality experience for EE and/or interpretation programs.

Wood Harvesting

In order for the Refuge to manage for a healthy forest for wildlife needs, some thinning and fuel reduction actions must be conducted, such as after ice or wind storms and forest management.

The Refuge does not have the staffing or funding available to perform these necessary management activities including the removal of downed-trees.

ATV Use

The State was concerned about enforcing laws regarding illegal use of ATVs on State-managed lands and on Refuge lands. The Refuge is also concerned about illegal ATV use; at present it has not become a problem but potentially could in the future.

Boundaries

The Refuge must identify and mark their boundaries in order to know their physical limitations between adjacent private, tribal, or public lands for performing management activities.

Currently, there are over 36 miles of unit boundaries with a total of over 4 miles of fencing and 11 gates that are maintained and repaired by Refuge staff. Only two of the Refuge Units have been completely surveyed and marked. The table below (Table 2-3) shows an assessment of current Refuge boundary needs and infrastructure to maintain.

| Refuge Unit | Boundary | Surveyed? | Marked? | Fencing? | Gates? |
|----------------------|-----------|-----------|---------|----------|--------|
| Looney | >1.37 mi. | X | X | X | 2 |
| Liver | 3.14 mi. | X | X | - | 1 |
| Potter | 3.09 mi. | X | X | - | 1 |
| Sally Bull Hollow | 15.42 mi. | - | - | - | 4 |
| Gittin Down Mountain | 3.87 mi. | - | - | - | - |
| Varmint | 1.24 mi. | - | - | - | - |
| Boy Scout | 1.93 mi. | - | - | - | 1 |
| Beck | 2.99 mi. | - | - | X | 3 |
| Eucha | 2.51 mi. | - | - | - | - |

Table 2-3. Refuge Boundary Assessment

2.3.5 Cultural Resources Issues

Historical Sites

There are several historical sites on Ozark Plateau NWR. For example, there is a wagon trail between Sallisaw and Tahlequah, which runs through the Potter Unit, as evidenced by old bridge abutments. This trail was main thoroughfare for local travelers, prior to the development of roads and highways. Crystal Cave on the Potter Unit was a commercial cave used for local



Beautiful stone spear point from 9,000 – 6,000 B.P., Found in Oklahoma. (Credit: ancientresource.com)

dances in the 1920s. There is an old rock dam on the Potter Unit that was constructed to provide swimming opportunities dating back to pre-1916. In addition, cabins and infrastructure on the Mary & Murray Looney Unit have historical significance to the caving community in the Ozarks because they were used by many caving experts to explore the first private cave preserve, January-Stansberry Cave, which was later donated to the Refuge (Graening, 2011).

Archeological and Paleontological Sites

Short-faced bear, tapir, and dire wolf remains have been discovered in or around Refuge caves. Arrowheads, spear points, grinding stones, and other Native American tools probably used by the Caddo and Osage Tribes during pre-settlement times and/or by tribes after

they were relocated to Oklahoma, have been found on and near the Refuge. With the help of its partners, the Refuge would like to learn more about these known sites and discover additional historical, archeological, and/or paleontological sites to better understand the history of the land and its people and animals.

2.3.6 Facilities & Infrastructure Issues

Mary & Murray Looney Education & Research Center (MMLERC)

The current MMLERC and its associated facilities need improvement. Originally, this cabin was used as a private summer resort in the early 1950s. Due to the cabin's antiquity, the design is inefficient, the building materials have deteriorated, and standards have subsequently changed overtime. The Mary & Murray Looney cabin had been abandoned for at least 10 years prior to Refuge restoration efforts. During this time, the interior and exterior of the building and the surrounding grounds have deteriorated. Initial renovation has already taken place inside the main MMLERC building, through a Maintenance Action Project, so that it functions adequately for the Refuge Headquarters, housing for staff, volunteers, and/or guests, along with hosting multiple EE programs. Additional restoration, however, is still required to make the building more energy-efficient, water conservation-friendly, more accessible to handicap visitors, more secure, as well as to ensure adequacy of plumbing and electrical systems. The MMLERC's concrete grounds and walkways must also be repaired for safety. And lastly, the pavilion structure needs to be renovated in order for it to be utilized as part of the MMLERC.



Mary & Murray Looney Education & Research Center (MMLERC). (Credit: Shea Hammond)

Access Roads

To get to the MMLERC, there is a MMLERC public access drive, which is currently 0.25-miles, unpaved and unimproved (dirt/rock), with a gate.

There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available near the maintenance shop, next to the Guess House (150 yards). However, many people that access these roads drive up on the side of the road over vegetation, also causing soil to erode, in order to have two cars pass one another. In addition, road and parking area surfaces need to be improved with gravel to allow for a better established parking area, which will prevent visitors from parking in the grass, on the side of the road, and will help control soil erosion. In addition, Refuge staff needs a wider access road to the Beck Unit shop in turn-around area for Staff vehicles and trailers.

Refuge Headquarters Site

Currently, there are three full-time Refuge staff members, one Wounded Warrior, one Student Conservation Association (SCA) intern, and one part-time Student Career Experience Program (SCEP) student. Refuge Headquarters is currently located at the MMLERC, which provides only one office and the facility is primarily used for EE and interpretation programs. Due to limitations on office space at these headquarters, each of these staff members works out of either the Oklahoma Ecological Services Field Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR. Due to the lack of a centralized Headquarters space, management coordination challenging. This situation also increases staff travel time, decreasing actual work time. In anticipation of land acquisition in the near future, a centralized Refuge headquarters would help accommodate the potential increase in staff.

Maintenance Shops and Service Buildings

Current maintenance facilities are inadequate. The Refuge needs additional maintenance facilities in order to store and maintain Refuge vehicles, supplies, and equipment used for management operations. In addition, it is important that the Refuge have adequate decontamination sites for staff caving equipment in accordance with the Service's WNS decontamination guidance.

Refuge Housing

The MMLERC only provides one bedroom used by volunteers, researchers, interns, educators, Refuge staff, and other guests. There is also a house on the Mary & Murray Looney Unit formerly owned by Guess family known as the "Guess House" that provides housing for the one Refuge staff member through a rental agreement. In addition, there are small cabins on private lands near the Potter Unit that may be available on a limited basis for Refuge volunteers, researchers, interns, educators, and Refuge staff. However, use of these would require landowner notification and may not always be vacant. The Refuge would like to provide more housing opportunities for the current number and future increase of volunteers and partners. Additional housing to accommodate an increase in Refuge staff will also be needed.



*Refuge housing (the Guess House).
(Credit: Shea Hammond)*

2.3.7 Refuge Administration Issues

Funding and Staffing

Tribal members and Refuge staff agree that a lack of staffing and funding is one of the Refuge's primary issues.

Volunteers/Friends Program

Currently, the Refuge does not have an official Friends group established. An official Friends group could play a major role in outreach, land acquisition, environmental education and interpretation programs, wildlife monitoring, informing and involving the community, as well as fundraising for Refuge projects.

2.4 Develop and Analyze Alternatives

The practice of developing management alternatives as a part of the planning process is derived from the NEPA. This act requires federal agencies to consider the impacts of proposed actions and to develop a reasonable range of alternatives to those actions. Alternatives are “different sets of objectives and strategies or means of achieving refuge purposes and goals, helping to fulfill the Refuge System mission, and resolving issues” (602 FW 1 of the Service Manual). The planning team developed a range of alternatives that respond to the significant planning issues and eliminated alternatives that did not meet Refuge purposes or that were outside the Service's ability to implement. The environmental consequences of the alternatives were analyzed and the results are presented in Chapter 4 of the EA (Appendix A). These alternatives meet the Refuge's purposes and goals and comply with the Service and Refuge System mission.

2.5 Prepare Draft CCP and EA

The CCP and EA were prepared concurrently. An analysis of the potential impacts of implementing each alternative was prepared. The Draft CCP/EA is first submitted for internal review, then submitted to the State and Tribal Nations for review, followed by public review and comment. This Draft CCP/EA is released to the public for a 30-day review period. The public was notified of the release with a notice of availability in the Federal Register as well as through local media outlets.

2.6 Prepare and Adopt Final CCP

Comments received on this Draft CCP/EA will be incorporated where appropriate and perhaps result in modifications to the proposed action or selection of one of the alternatives. The alternative that is ultimately selected will be the basis for the Final CCP. The Final CCP will provide an appendix with the response to comments received during the public review and will replace current management direction after the decision document is signed (see section 1.6, Decision to be Made, of Appendix A of the Environmental Assessment).

2.7 Implement CCP, Monitor, and Evaluate

The Final CCP will provide management direction for the Refuge over the coming 15-year period. It will guide the development of more detailed step-down management plans for specific resource areas and will be the basis for the annual budgeting process for Refuge operations and maintenance (Chapter 5). Most importantly, it lays out the general approach to managing habitat, wildlife, and people at the Refuge that will direct day-to-day decision-making and actions.

A critical component of management is monitoring and measuring resources and social conditions to make sure that progress is being made toward meeting goals. Monitoring also detects new problems, issues, or opportunities that should be addressed. The Refuge is using an adaptive management approach, which means that information gained from monitoring is used to evaluate and, as needed, to modify Refuge objectives and strategies.

2.8 Review and Revise CCP

Agency policy directs that the CCP be reviewed annually to assess the need for changes. The CCP will be revised when significant new information becomes available, ecological conditions change, or the need to do so is identified during the annual review. If major changes are proposed, public meetings may be held, or new environmental assessments and environmental impact statements may be necessary. Consultation with appropriate State and Tribal agencies would occur at least every 15 years.

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Chapter 3: Refuge Resources & Current Management

This chapter provides a detailed description of the Refuge and its resources including its habitat, the species that occur there, how these habitat and species are managed, and the recreational opportunities it offers. The chapter is divided into six major sections: 3.1 Landscape Setting; 3.2 Physical Environment; 3.3 Biological Environment; 3.4 Socioeconomic Environment; 3.5 Archeological, Cultural, and Historical Resources; and 3.6 Current Management and Administration.



Overlooking the Sally Bull Hollow Unit. (Credit: Steve Hensley, 1992)

3.1 Landscape Setting

Ozark Plateau National Wildlife Refuge (NWR) is located in eastern Oklahoma along the southwest edge of the Ozark Plateau and Boston Mountains near the Arkansas, Kansas, and Missouri borders. The Refuge is in a region of karst topography, eroded to form steep hills, incised valleys, and prominent bluffs. Much of the drainage is underground resulting in a number of caves and springs. In addition, the clear rocky bottom streams, ground water aquifers and recharge areas, wetlands, and large stands of oak-hickory and oak-hickory-pine forest support a diverse array of plant and animal life that not only are endemic to the Ozark Plateau, but are sometimes unique to each cave or spring because of their isolation from one another. Ozark Plateau NWR is a prime example of the need to implement Strategic Habitat Conservation on a landscape level in order to achieve the Refuge's purpose(s) of:

- Preventing extinction and aiding in recovery of federally-listed endangered and threatened Ozark cave species;
- Reducing the need for future listing of species of concern in the Ozarks;
- Protecting large continuous stands of Ozark forest essential to interior forest nesting migratory birds; and

- Providing important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

Ozark Plateau NWR presently consists of nine management units, totaling 4,093 acres, in four counties in the Ozarks of eastern Oklahoma near the borders of four states (Arkansas, Kansas, Missouri, and Oklahoma) and four Fish and Wildlife Service regions (2, 3, 4, and 6). Political boundaries mean little to the trust fish and wildlife resources Ozark Plateau NWR was established to protect and manage, so it is extremely important that the Refuge operate on a landscape-level across state and regional boundaries (see Chapter 2, Figure 2-2 for a landscape-level map of the area).

3.1.1 Strategic Habitat Conservation and Landscape Conservation Cooperative

Strategic Habitat Conservation (SHC) is a way of thinking and doing business that requires the Service to set biological goals for priority species. It allows for making strategic decisions, and encourages constant reassessment and improvement of actions. These are critical steps in dealing with a range of landscape-scale resource threats such as urban development, invasive species, and water scarcity--all magnified by accelerating climate change.

SHC incorporates five key principles in an ongoing process that changes and evolves:

- Biological Planning (setting targets)
- Conservation Design (developing a plan to meet the goals)
- Conservation Delivery (implementing the plan)
- Monitoring and Adaptive Management (measuring success and improving results)
- Research (increasing our understanding)

To ensure that science entities are strategically placed, the Service and U.S. Geological Survey (USGS) have developed a national geographic framework for implementing SHC at landscape scales. The framework provides a platform upon which the Service can work with partners to connect project- and site-specific efforts to larger biological goals and outcomes across the continent.

The framework serves as a base geography for Landscape Conservation Cooperatives (LCCs), which are management-science partnerships between the Service, other federal agencies, states, tribes, NGOs, universities, and other entities. These partnerships inform and assist integrated resource management actions by addressing climate change and other stressors within and across landscapes. LCCs are fundamental units of planning and science capable of carrying out the functional elements of SHC. The framework for a landscape level planning approach is described in Chapter 4: Goal 1.



<http://gcpolcc.org/>

Ozark Plateau NWR is located within the Interior Highlands subunit of the Gulf Coast Plain and Ozarks Landscape Conservation Cooperative (GCPOLCC), which will facilitate conservation planning and design across a highly diverse region in southeastern North America that extends for 180 million acres from the mountain tops of the Ozark, Boston and Ouachita ranges, to the pine savanna and prairies of the West and East Coastal Plains, and down into the swamps,

bayous and alluvial bottomlands of the Mississippi Alluvial Valley. This area consists mainly of the Lower Mississippi River Valley Joint Venture. The Mississippi River bisects the region. The Ozark Plateau NWR takes an active role in the Ozark Partnership (<http://ozarks.cr.usgs.gov/>) that more specifically focuses on the Ozarks to help sustain the biologically rich, nationally-significant natural resources of the Ozarks. The Ozark Partnership's aim is to improve effectiveness and efficiency of science and management through the cooperative work of state, tribal, federal and NGOs that conduct natural resource research and management in the Ozarks. It also welcomes private citizens and landowners. Some of the steps being taken include:

- working cooperatively in geographic locations on topics of mutual interest
- sharing research methods and monitoring protocols
- expanding applicability of results
- sharing products, tools, and information

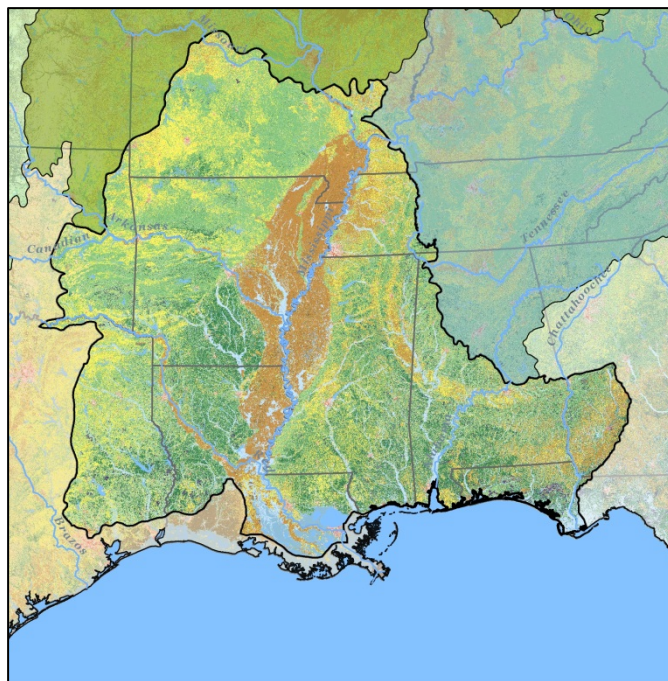


Figure 3-1. Gulf Coastal Plains & Ozarks LCC

The Ozark Partnership and GCPOLCC will be working closely with the USGS's Climate Response Centers. There will be conservation science partnerships among the Service, federal agencies, states, tribes, NGOs, universities and other entities. What's more, they will be fundamental units of planning and science capacity that will help us carry out the functional elements of SHC (i.e. biological planning, conservation design, conservation delivery, monitoring and research), filling existing gaps in our science capacity, and ultimately informing our response to accelerating climate change and other stresses.

3.1.2 Ecoregion Setting

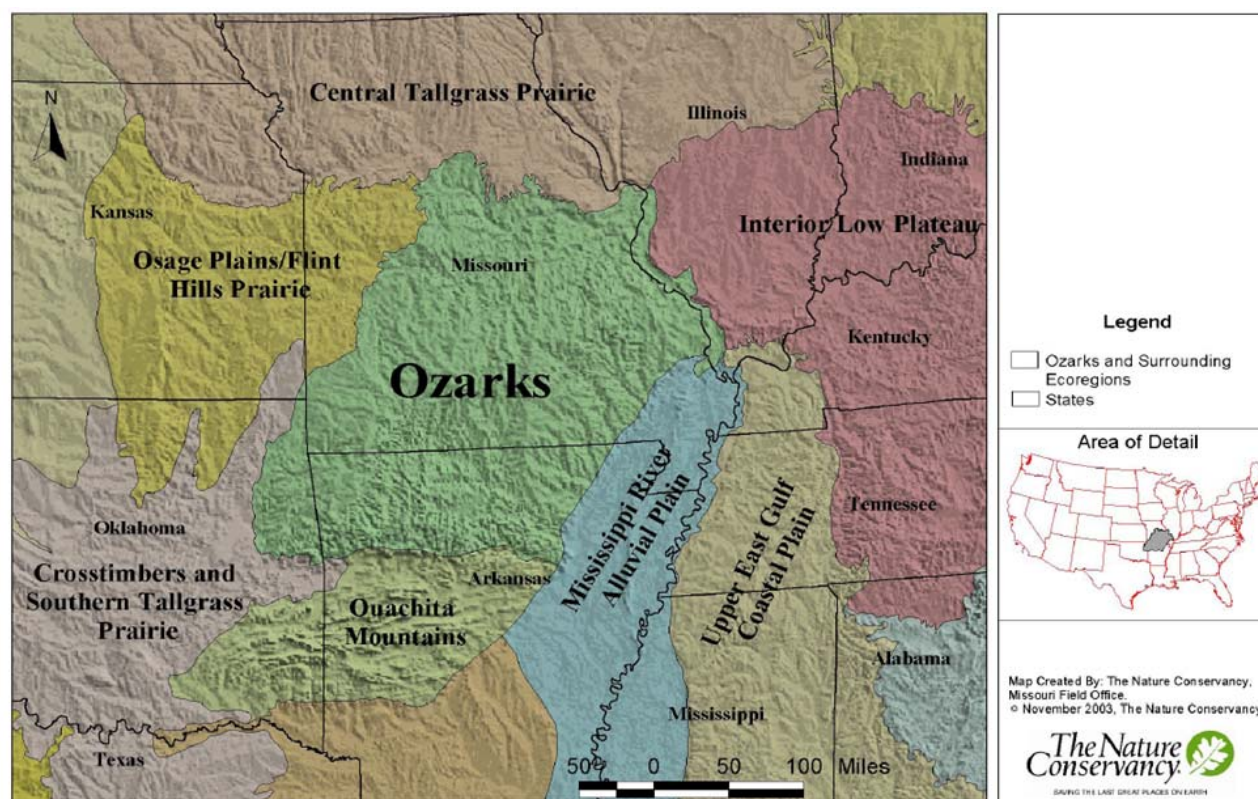
Ecoregions denote areas of general similarity in ecosystems and in type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance. These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, tribes, and nongovernment organizations that are responsible for different types of resources within the same geographical areas (EPA, 2010).

The Nature Conservancy's (TNC) ecoregion planning approach divides the nation into natural areas as the foundation for identifying and protecting unique natural areas and features. TNC ecoregions were based on original work by Robert Bailey which are similar to Omernik's ecoregions and were modified by TNC in cooperation with the network of Natural Heritage Programs (Omernik 1987; Bailey, 1989).

Ozark Plateau NWR is located within TNC's, Bailey's, and Omernik's "Ozarks ecoregion", an area encompassing nearly 34 million acres in parts of Missouri, Arkansas, Oklahoma, Illinois, and a small corner of Kansas (see Figure 3-2). Oklahoma's portion of the Ozarks ecoregion constitutes approximately 5.8 million acres, or roughly 17% of the total ecoregion acreage. Along with the Ouachita region to the south, the Ozarks form the only significant highland region in mid-continental North America. Parts of this region have been continually exposed for at least 225 million years. Because of high habitat diversity and antiquity of the landscape, Ozark biota is characterized by an unusually high level of species disjunctions and endemism, with more than 160 endemic species documented from the ecoregion. (TNC, 2003).

High levels of topographic, geologic, edaphic and hydrologic diversity exist throughout the Ozarks, resulting in a wide variety of habitat types. This is a region of rugged uplands with abundant exposed rocks and variable soil depths. The landscape in various terrestrial subsections of the Ozarks ranges from extensive areas of karst terrain on irregular plains, to highly dissected regions with steep hills and deeply entrenched valleys, as well as limited areas of ancient low mountains with elevations up to 3000 feet. There are also smaller, linear areas of alluvial terrain and major riparian features. (TNC, 2003).

Figure 3-2. Ozarks Ecoregion (The Nature Conservancy, 2003).



3.1.2.1 Terrestrial Description

The Ozark Plateaus support a mosaic of forest, prairies, glades, barrens, and savannas depending on such factors as topography, bedrock, soils, fire, and native herbivores. These plant communities vary widely in their composition and size, and they appear to have changed significantly since settlement by Europeans. Open, grassy communities, such as savannas, barrens, and glades, were more common in the northern and particularly the northwestern sections of the Ozark Plateau than in the southern Boston Mountains region, which was more densely forested (Heikens, 1999). Historically, most of this habitat occurred in a more open woodland condition. However, the combination of large-scale harvesting and decades of fire suppression have resulted in much of this habitat currently being densely stocked, relatively even-aged second-growth forest.

Presently mesic forests have a relatively high diversity of tree species and a diverse vegetative structure. In the Ozarks region, these forests are typically dominated by white oak (*Quercus alba*), northern red oak (*Quercus rubra*), mockernut hickory (*Carya tomentosa*), bitternut hickory (*Carya cordiformis*), sugar maple (*Acer saccharum*), and white ash (*Fraxinus americana*). The moist soil conditions often allow the development of abundant understory vegetation including dominant small trees such as flowering dogwood (*Cornus florida*), rusty blackhaw (*Viburnum rufidulum*), northern spicebush (*Lindera benzoin*), strawberry bush

(*Euonymus atropurpureus*) and pawpaw (*Asimina triloba*). Other common forest trees include shumard oak (*Quercus shumardi*), chinquapin oak (*Quercus muehlenbergii*) and American basswood (*Tilia americana*). This habitat type is found throughout the Region and in both the Boston Mountains and Springfield Plateau sections. Sugar maples are often associated with the most mesic sites and those that experience infrequent fire. The more mesic sites often have greater understory development/ structure. (ODWC, 2005).

3.1.2.2 Aquatic Description

The Ozark Plateau NWR is located atop the Ozark aquifer, which is part of a larger system called the Ozark Plateau aquifer system. This system includes the Springfield Plateau, Ozark, and the St. Francois aquifers. The age of rocks that comprise this system range from Cambrian to Mississippian. The rocks consist of dolomite, sandstone, shale, and chert which tend to dip southward. The aquifer system reaches into southern Missouri and small portions of southeastern Kansas and eastern Oklahoma. The Ozark aquifer is by far the thickest aquifer in the northern aquifer system. The Ozark aquifer is comprised of limestone and dolomite with some areas containing chert, shale, and sandstone. These rocks date back to Late Cambrian to Middle Devonian. Most of the water that comes from the Ozark is used for agricultural purposes, although some of the water is used for industrial and municipal reasons. The aquifer is more than 3,000 feet thick in most places, but in central Arkansas it extends to 5,000 feet (USGS 1992-95) (Renken, 1998).

There is a study unit that involves most of the aquifer which includes all four states. It has an area of 48,000 square miles. There are major water quality concerns in the study area that include elevated concentrations of nutrients, elevated concentrations of bacteria, trace elements, dissolved solids, and radionuclides in ground water. The area has a temperate climate with average annual precipitation around 38-48 inches per year. The study area has an average annual temperature of 56-60 degrees F, and evapotranspiration rates of 30-35 inches per year. The land surface area ranges from 200 feet to around 2,300 feet. There is mining in all four states and the greatest amount occurring in the northwestern portion. Lead-zinc mining has been economically important in the past and coal is still being mined. The

Figure 3-3. Ozark Aquifer (Credit: Unknown)



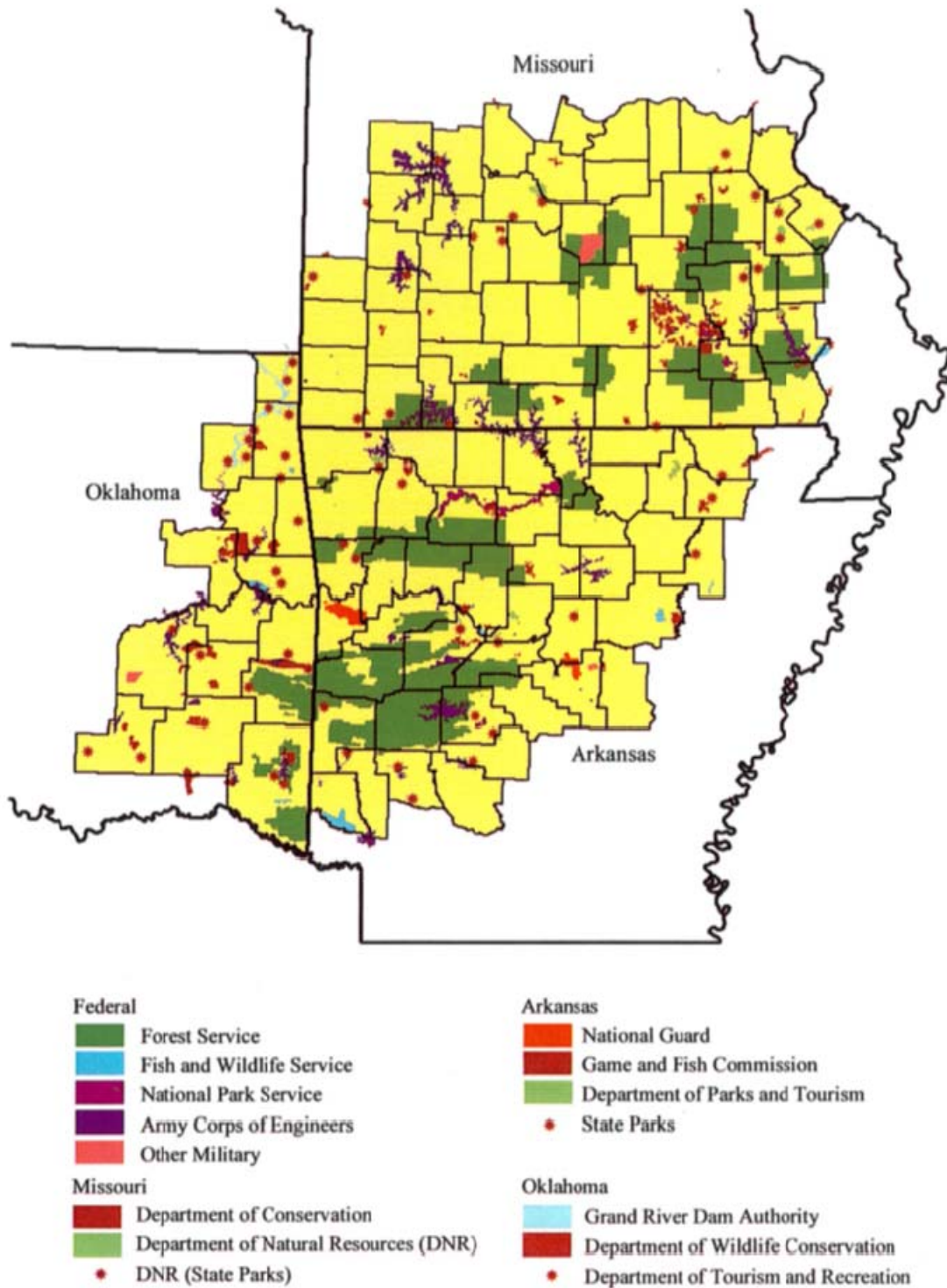
average annual runoff is about 14 to 20 inches per year in the Boston Mountains (Petersen et.al, 2005).

3.1.3 Protected Areas in the Ozarks Ecoregion

The International Union for Conservation of Nature (IUCN) defines a protected area as “a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (Dudley, 2008). Protected areas serve a variety of purposes for society. They are an expression of our community’s goals to maintain the value of biodiversity and to ensure these values are passed on to future generations. They represent the diversity of the earth’s history and the current natural processes, and provide many environmental services such as clean air, water, and nutrients. They are treasured landscapes reflecting the inherited cultures of many generations and they hold spiritual values for many societies (IUCN 2005).

Protected areas cover over 13% of the earth’s land surface (IUCN 2005). In the United States, over 10,480 protected areas, including state level protected areas, account for 27% of the land area (1,006,619 sq. mi) (UNEP 2008). Protected areas in the Ozarks total about 6.5 million acres and are shown in Figures 3-4 and 3-5.

Figure 3-4. Protected Areas in the Ozarks. (U.S. Forest Service, 1999).



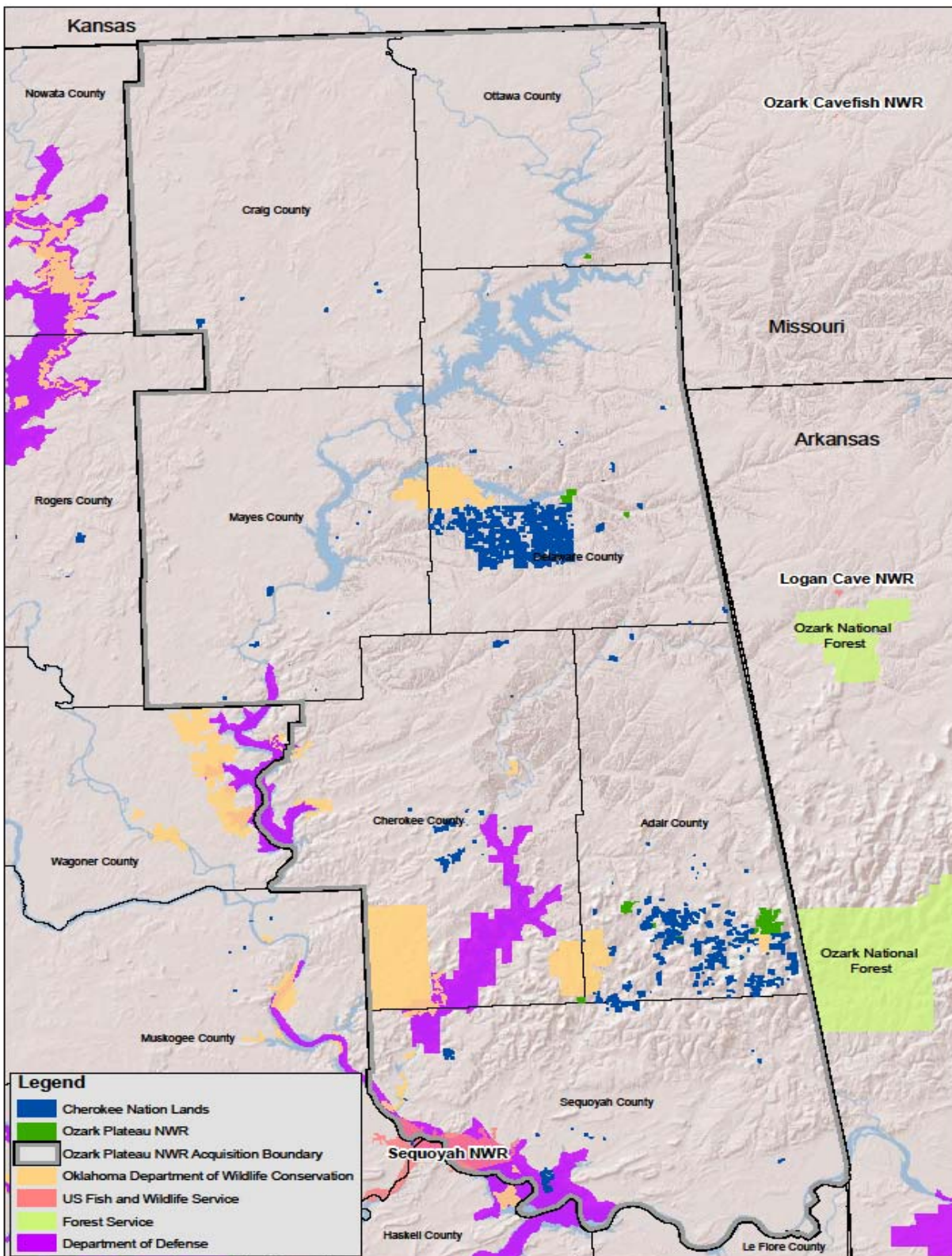


U.S. Fish & Wildlife Service

Ozark Plateau National Wildlife Refuge

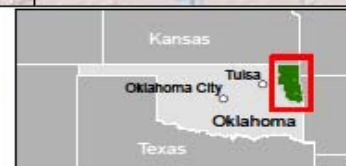
Ottawa, Delaware, Adair and Sequoyah Counties, Oklahoma

Acquisition Boundary Map



PRODUCED IN THE DIVISION OF REFUGE PLANNING
ALBUQUERQUE, NEW MEXICO
LAND STATUS CURRENT TO: 9/31/09
MAP DATE: December, 2010
BASEMAP: N/A
MERIDIAN: N/A
FILE: otc_acquisition_bound_12.6.10.sh

0 4 8 16 Miles
0 4 8 16 Kilometers



3.1.4 Migration Corridors

Conservation corridors are physical connections between disconnected fragments of plant and animal habitat. Without such connections some species would be unable to reach necessary resources like food, water, mates and shelter. Working with partners to identify key conservation corridors and crucial habitats is needed to conserve the habitat and wildlife species that depend on it.



Aerial of autumn foliage in the rolling hills of the Ozark Plateau. (Credit: Bruce Dale/National Geographic Stock)

Seasonal bat migration and the timing and corridors used are important factors taken into consideration in establishing and managing Ozark Plateau NWR. Gray bats are one of the few species of bats in North America that inhabit caves year-round, migrating each year between winter and summer caves. Gray bats have been documented to regularly migrate from 17 to 437 km between summer maternity caves and winter hibernacula (Tuttle 1976b; Hall and Wilson 1966). Gray bats exhibit strong philopatry to both summering and wintering sites (Tuttle, 1976a; Tuttle, 1979; Kennedy and Tuttle, 2005; Martin, 2007).

The most important migration corridors for the federally listed endangered and threatened Ozark cave species that Ozark Plateau NWR was established to protect and recover are those used by gray bats migrating between their summer maternity caves in eastern Oklahoma and where they hibernate during the winter in large caves in northern Arkansas and southern Missouri. These



Migrating gray bat. (Credit: Bat Conservation International)

migration corridors have not been specifically identified. However, with increasing threat of energy development projects, including wind power, and the extreme rate of development in the Ozarks of northwest Arkansas and southwest Missouri, it is important that these be identified and protected. Also, because Ozark Plateau NWR was established to provide habitat for interior nesting Neotropical migratory songbirds, cooperation and work with a number of partners within the Central Flyway, especially including the Central Hardwood Bird Conservation Region, is extremely important.

It is essential to protect large continuous stands of Ozark forest essential both for feeding areas, movement and migration corridors for bats and birds and nesting areas for migratory birds that need unbroken expanses of high quality oak-hickory and oak-hickory-pine Ozark forest. The expanses of unfragmented Ozark oak-hickory forests that are still present in much of the seven-

county acquisition area are recognized for their importance to the thousands of migratory birds that inhabit the forests for breeding, feeding and migration to and from breeding and wintering areas. Many of the cave sites are within or adjacent to these forested sites.

3.1.5 Refuge Location

The Ozark Plateau NWR consists of 4,093 acres in nine management units presently located in four counties (Adair, Cherokee, Delaware, and Ottawa) in Baily's Oak-Hickory Forest Ecoregion along the southwest edge of the Ozark Plateau and Boston Mountains in northeastern Oklahoma near the borders of Arkansas, Missouri, and Kansas and Fish and Wildlife Service Regions 2, 3, 4, and 6. It is approximately 90 miles east of Tulsa, Oklahoma, and 40 miles west of the Fayetteville, Arkansas metropolitan area. Ozark Plateau NWR has been authorized to expand up to 15,000 acres in a seven-county area in northeastern Oklahoma including the existing counties plus Craig, Mayes, and Sequoyah Counties. (See Chapter 1, Figure 1-1 for a map of current Refuge units and acquisition area).

3.1.6 Surrounding Land Uses

The conservation land status of Ozark Plateau NWR is just one of a variety of land uses found across the larger landscape. Urban, suburban, rural and industrial developments in northeast Oklahoma, northwest Arkansas, and southwest Missouri, as well as intensive agricultural and livestock land uses, present an array of threats to fish, wildlife, and their habitats, including invasive plants, feral animals, habitat fragmentation, pathogens, and pollutants. Tulsa County, Oklahoma, just 70 miles west of the Refuge area, has over 590,000 people and is the most densely populated county in the State of Oklahoma (Data Place, 2007). Northwest Arkansas and southwest Missouri together constitute one of the nation's fastest growing areas in population and commercial activity, due in part to the continued growth of Wal-Mart, Tyson Foods, and supporting industries (CensusScope, 1990-2000).

Ozark Plateau NWR is found within a matrix of surrounding land uses including rural residential and agricultural land uses; Cherokee Nation commercial and managed lands; the City of Tulsa; State Wildlife Management Areas; Oklahoma State Parks; National Forest; and U.S. Army Corps of Engineers-managed lands and waterways.

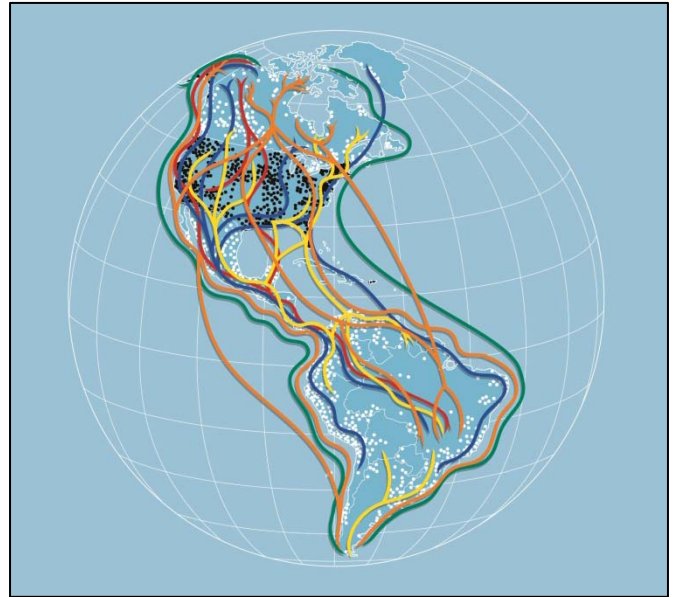
Rural land uses still predominate in the seven-county Ozark Plateau project area. Livestock grazing, growing sorghum, wheat, soybeans, and hay/alfalfa, and confined animal feeding operations for poultry and hogs, are typical agricultural activities throughout the area. Forest products from timber operations are a source of income for some landowners.

Tourism, including hunting and fishing, stimulate recreational developments including resorts, campgrounds, lake marinas, vacation homes, and associated support services. A newer trend in

the Ozarks is residential retirement development. Retirees are attracted by the relatively inexpensive land prices and the desirable aesthetics of the rural, rolling wooded hills, and small town atmospheres. The increasing population growth in the region is also stimulating changes in land use from agricultural to urban development uses, such as residential, commercial, and industrial development, primarily near the larger towns and cities.

3.1.7 Flyway

Because Ozark Plateau NWR was established to provide habitat for both federally listed threatened and endangered cave species and Neotropical migratory forest songbirds, it is important to protect large continuous stands of Ozark forest essential for feeding and nesting areas as well as movement and migration corridors in the Central Flyway. These migratory birds using the flyway need unbroken expanses of high quality oak/hickory and oak/hickory/pine Ozark forest. This requires cooperation among a number of partners throughout the Central Flyway.



Hemispheric flyways. (Credit: National Audubon Society)

3.2 Physical Environment

This section describes the physical environment in which the Ozark Plateau NWR is found. It includes a description of the climate, geology and soils, aquifers and groundwater, oil and gas occurrences and potential, environmental contaminants, and water and air quality found at the Refuge.

3.2.1 Climate

Adair, Delaware, Ottawa, Cherokee, Craig, Mayes, and Sequoyah Counties in northeastern Oklahoma lie in a belt of warm, humid, subtropical to continental-type climate. Mild weather prevails during the autumn and spring months. Clear skies and dry atmosphere prevail during the summer months with hot days and relatively cool nights. Winters are generally mild, with spells of cold alternating with periods of mild weather.

Mean annual temperature for the Stilwell, Oklahoma area is 60 degrees F. Monthly average temperatures range from 38 degrees F. in January to 82 degrees F. in July (see Figure 3-6). The first killing frost in the area occurs in late October, and the last killing frost in the spring can occur mid to late April. Relative humidity, on average, ranges from 42% to 95% during the day.

Major weather changes occur in the area when cool dry air from the Pacific Ocean or the Arctic meets warm, moisture-laden the Gulf of Mexico. Winters are short and mild. Average dates for the first frost in the fall are in October. Summers are long, hot, and humid. An average year has 180 clear days, 95 partly cloudy days and 140 cloudy days. Prevailing southeasterly winds average 10 miles per hour (National Weather Service, Stillwell, Oklahoma Station).

The area receives 35 to 55 inches of precipitation with an average rainfall is 43.68 inches (see Figure 3-7). Most of the rainfall occurs during the warmer months. May and June are the rainiest months, on average, whereas February is usually the driest month. Snow is usually light and remains on the ground for only a few days at a time. Nearly every winter has at least one inch of snow, with one year in two having ten or more inches.

Figure 3-6. Ozark Plateau NWR Average Monthly Temperatures (Fahrenheit)

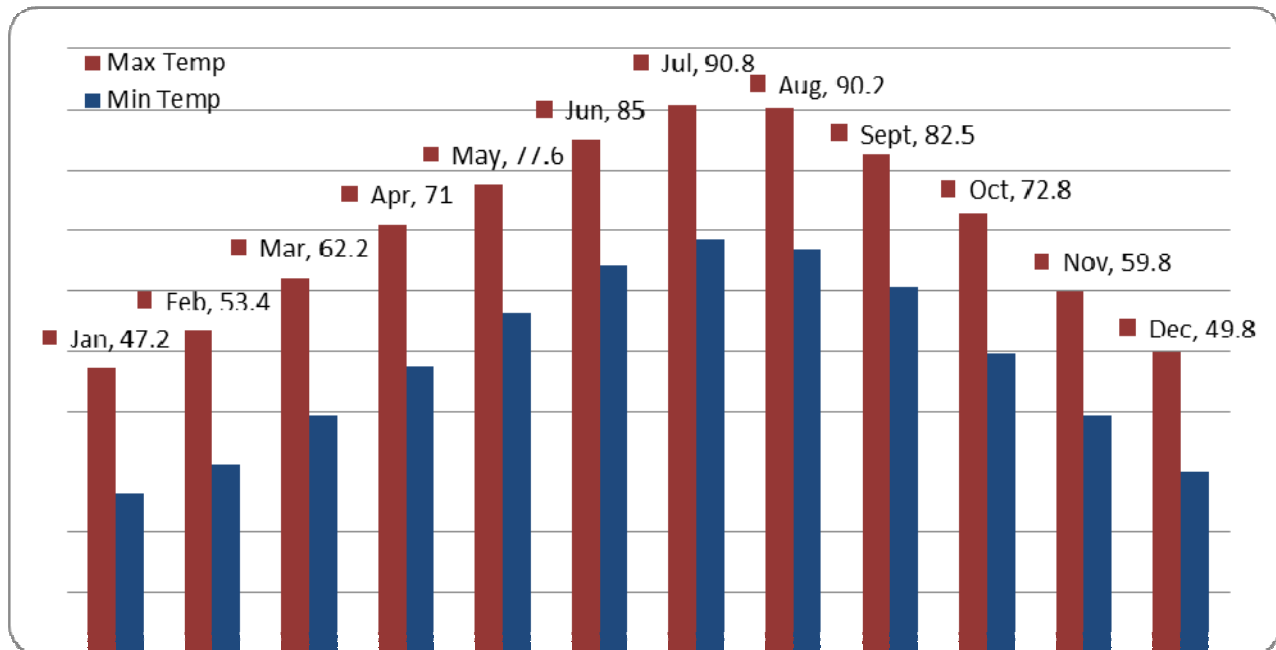
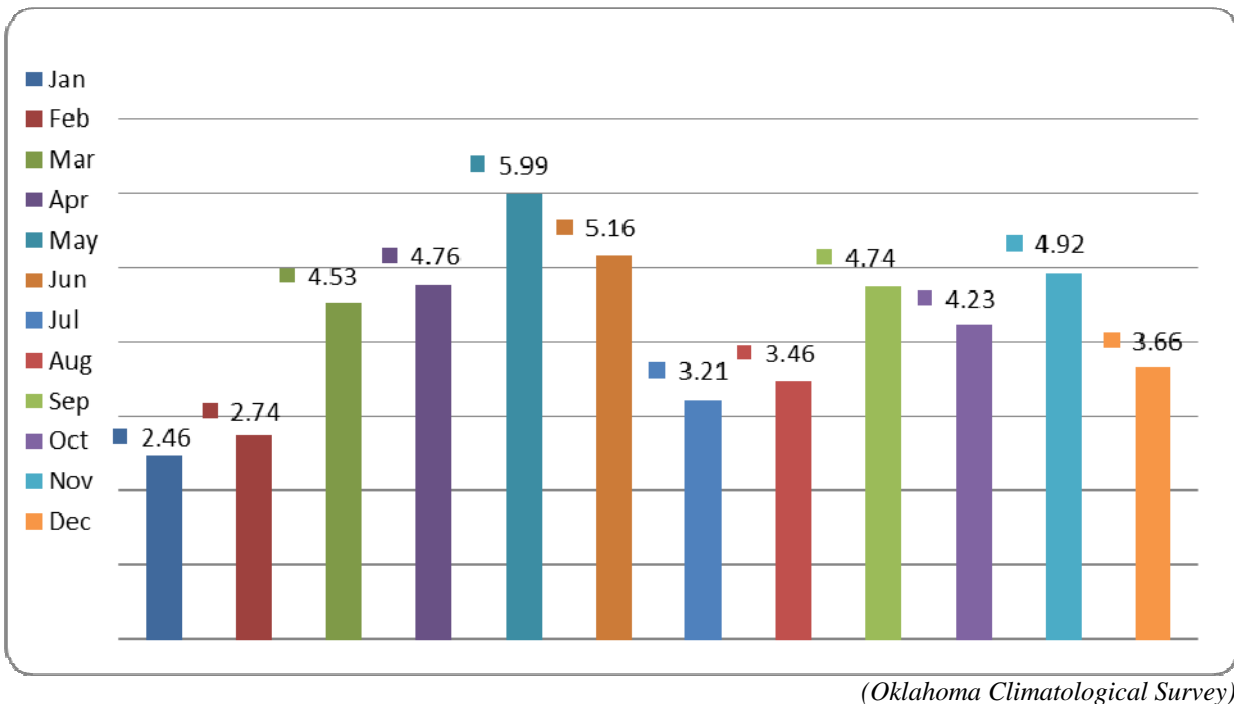


Figure 3-7. Ozark Plateau NWR 30-year Average Monthly Precipitation (inches)



3.2.2 Air Quality

Pursuant to the Clean Air Act, as amended in 1977, the Service has an affirmative responsibility to protect air quality related values on national wildlife refuges. Polluted air injures wildlife and vegetation, causes acidification of water, degrades habitats, accelerates weathering of buildings and other facilities, and impairs visibility.

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has established primary air quality standards to protect public health. The EPA has also set secondary standards to protect public welfare. Secondary standards relate to protecting ecosystems, including plants and animals, from harm, as well as protecting against decreased visibility and damage to crops, vegetation, and buildings.

The EPA has developed National Ambient Air Quality Standards (NAAQS) for six principal air pollutants (also called “criteria pollutants”). They are ground-level ozone (O₃), particulate matter (PM), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), and lead (Pb).

The Oklahoma Department of Environmental Quality maintains air quality monitors throughout the State. The nearest monitors to the Ozark Plateau NWR are in Pryor and Muskogee. All seven counties in the Ozark Plateau NWR acquisition area meet the NAAQS for the six principal air pollutants (www.deq.state.ok.us; www.epa.gov/, 2012). There may be scattered sites having

lesser quality air due to local industries and urban concentrations of vehicles, but to date there have been no violations of criteria pollutant standards.

3.2.3 Water Resources

Aquifers and Groundwater

The Ozarks are known for their clean springs, clear cold streams, deep reservoirs, and important underground aquifers. A major aquifer in the region is the Roubidoux, a deep aquifer located predominantly in Delaware and Ottawa Counties. One of Tulsa's principal water sources is an aquifer in Delaware County underlying some existing and proposed Refuge lands. Karst regions are particularly vulnerable to underground water contamination because karst formations can easily catch surface runoff, transfer it to underground water bodies, and transfer it back to other surface water bodies. Typical practices such as septic systems, confined animal feeding operations, and dumping trash and debris "out of sight" in sinkholes all jeopardize groundwater quality in the Ozarks.



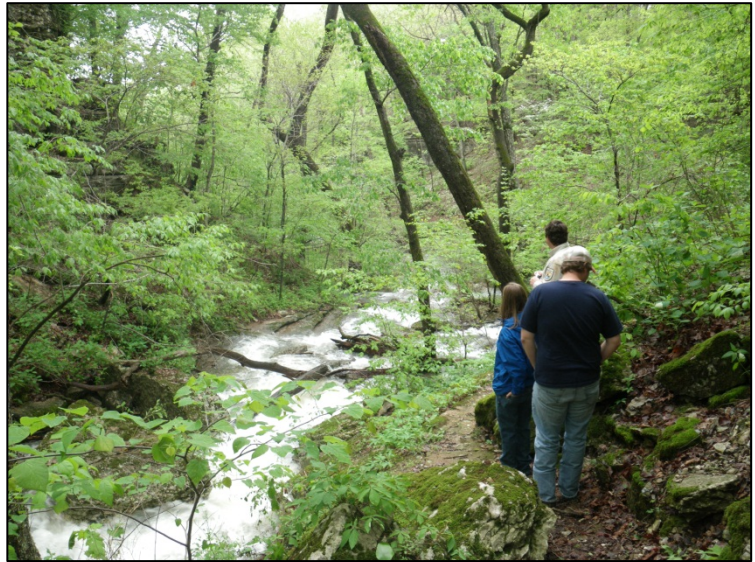
OT4 Cave Stream. (Credit: Steve Hensley)

Significant water courses in the approved land acquisition area are the Spring River, Neosho (Grand) River, Spavinaw Creek, and Sallisaw Creek, plus designated state scenic rivers

including the Illinois River, Barren Fork, Flint Creek, Lee Creek, and Little Lee Creek administered by the Oklahoma Scenic Rivers Commission. The Refuge protects portions of the Spavinaw Creek, Neosho River, Sallisaw Creek, Lee Creek, and Little Lee Creek watersheds. Grand Lake, Lake Hudson, Fort Gibson Lake, Tenkiller Lake, Robert Kerr Lake, Webber's Falls Lake, Lake Eucha, Spavinaw Lake, and Green Leaf Lake are known throughout the project area, for their aesthetic, recreational, and water supply qualities. Their existence drives much of the area's recreation-related development and economic sectors.

Water Rights

Currently, the Refuge does not own any water rights. In 1957, the Oklahoma Legislature created the Oklahoma Water Resources Board (OWRB) to manage the State's water resources (Focht, et. al., 2007). Stream water is considered to be water that is owned by the public and is subject to appropriation (i.e., a right to use water). If there is not enough water to satisfy all uses of a river, creek, lake or pond, the permit filing date determines who gets the water. "First in time, first in right." (Focht, et. al., 2007). The allocation system ties ownership of groundwater to surface land ownership



*High flow season (spring) on the Refuge.
(Credit: Steve Hensley, 2011)*

so that the amount of water allocated to each landowner is determined by the number of acres of land overlying the basin he or she owns. The OWRB regulates the use of groundwater, even though the groundwater is considered private property like oil, gas, coal and other minerals. A permit is required for non-domestic use of water, but even domestic users are prohibited from wasting groundwater pumped from a well (Focht, et. al., 2007). In eastern Oklahoma, there remains much controversy and issues regarding water rights, especially tribal water rights, such as in the cases of *Atlantic & P.R. Co. v. Mingus*, 165 U.S. 413 (1897), *U.S. v. GRDA*, 63 U.S. 229 (1960), *Choctaw v. U.S.*, 397 U.S. 620 (1970), *Oklahoma v. Tyson*, 258 F.R.D. 472 (N.D. Ok. 2009), and *Choctaw and Chickasaw Nations vs. Oklahoma City and the Oklahoma Water Resources Board*, CIV-11-927-C (2011) (Greetham; Ellis, 2011).

Water Quality

Water quality is a measure of the suitability of water for a particular use based on physical, chemical, and biological characteristics. Natural water quality varies from place to place, with the seasons, with climate, and with the types of soils and rocks through which water moves.

Water quality is also affected by human activities including, but not limited to, urban and industrial development, farming, mining, combustion of fossil fuels, and stream-channel alteration. (USGS, 2001).

The Clean Water Act of 1977 (CWA) requires states to identify and prioritize waters that do not currently support designated uses. Water bodies that do not meet one or more applicable water quality standards and those that are threatened for a designated use by one or more pollutants are listed on each state's 303(d) list. The 303(d) list includes waters impaired by both point and non-point source pollution. Point source pollution occurs when contaminants enter the water body from a distinct localized source, such as a chemical plant or equipment exhaust. Non-point source pollution occurs when contaminants enter the water body from indirect sources, such as residential development or agricultural practices.

Ozark Plateau NWR does not contain any impaired water bodies that are currently listed on the State of Oklahoma Department of Environmental Quality's 303(d) list (U.S. Geological Survey, 2001, and Oklahoma Department of Environmental Quality, 2010).

The Refuge and several partners conducted a water quality study in May and June of 2006 at four caves and one surface location to measure water quality and detect any groundwater contaminants. In karstic areas, surface contaminants may be transported to groundwater and ultimately cave ecosystems where they may impact resident biota. In the 2006 study, polar organic chemical integrative samplers (POCIS) and semi-permeable membrane devices (SPMD) were deployed to detect potential chemical contaminants in these systems. All caves sampled were known to contain populations of the federally listed threatened Ozark cavefish, *Amblyopsis rosae*. The surfacewater site was directly downstream from the outfall of a municipal wastewater treatment plant and a previous study indicated a hydrologic link between this stream and one of the caves. A total of 83 chemicals were detected in the POCIS and SPMD extracts from the surfacewater and cave sites. Of these, 55 chemicals were detected in the caves. The organic wastewater chemicals with the greatest mass measured in the sampler extracts included sterols, plasticizers, the herbicide bromacil, and the fragrance indole. Sampler extracts from most of the cave sites did not contain many wastewater contaminants, although extracts from samplers in the surfacewater site and the cave hydrologically-linked to it, had similar levels of diethylhexyphthalate and common detections of carbamazepine, sulfamethoxazole, benzophenone, N-diethyl-3-methylbenzamide (DEET), and octophenol monoethoxylate. Further evaluation of this system is warranted due to potential on-going transport of wastewater-associated chemicals into the cave. Halogenated organics found in caves and surface-water sites included brominated flame retardants, organochlorine pesticides and polychlorinated biphenyls. The placement of samplers in the caves (i.e., distance from cave mouth, etc.) may have influenced the number of halogenated organics detected due to possible aerial transport of residues. Guano from cave-dwelling bats also may have been a source of some of these

chlorinated organics. Seven-day survival and growth bioassays with fathead minnows (*Pimephales promelas*) exposed to samples of cave water indicated initial toxicity in water from two of the caves, but these effects were transient with no toxicity observed in follow-up tests (Bidwell, et. al., 2006).



Ridgewalking along unique geologic formations in the Ozark Plateau in search of caves. (Credit: Shea Hammond)

3.2.4 Geology and Soils

Geology

The Ozarks have been a continuous land mass since the end of the Paleozoic Era and are one of the oldest geological regions in North America (Heikens, 1999). They were uplifted at least twice; however, after the Cretaceous uplift, the region was eroded to a relatively flat plain, which existed until the second uplift in the late Tertiary (Heikens, 1999). The Ozarks are also known for their hilly topography, which resulted from uplifting during and since the Pennsylvanian Period (330-315 million years ago), all of which are unglaciated. Northwestern Arkansas and southwestern Missouri also share the Ozark Mountains' distinctive geology and topography.

The key geologic feature common throughout the Ozark Plateau is the presence of karst geological formations. Karst

formations are bedrock of limestone and chert that were deposited in the shallow inland seas during the Mississippian Period (365-330 million years ago). Since limestone can be dissolved by acidic runoff, underground caverns and streams, sinkholes, and other formations typical of karst areas have formed during the millions of years that have passed. Geologic formations of karst caves and sinkholes are found throughout the area and are the reason for the distinctive cave environments that support diverse and unique animal communities. In the northern portion of the area (Ottawa and Delaware Counties) cave forming formations are the St. Joe and Boone formations with some possibly found in the Cotter formation. Further south (in Adair County), caves are more likely to be found in the Pitkin limestone and Hale formation. Even further south (in southern Adair County and Sequoyah County), cave habitat can be found in large talus cracks in areas of Atoka sandstone. On the west side (Cherokee, Craig, and Mayes Counties), the St. Joe, Pitkin, and Hale formations are where caves are most likely to occur.

Economic mineral resources in the area include limestone, shale, cement, tripoli, sand and gravel. Oil and gas are also produced, but not in the major quantities as other parts of Oklahoma are known for. Mining is one of the lowest, or the lowest, industry in all seven counties, in terms of annual earnings (Government Information Sharing Project).

In Ottawa County the Tri-State lead and zinc mining area near Miami and Picher often produced the nation's records for zinc production between 1918 and 1945. No mining has occurred there since 1974, and now the tailing piles (mine waste) and groundwater contamination have led to the site's designation as an Environmental Protection Agency Superfund Site. It is one of the first and largest Superfund sites in the nation. (See also FWS Partial Restoration Plan and EA http://www.fws.gov/contaminants/restorationplans/tarcreek/rpTar_Creek_partial6_00_toc.cfm).

Soils

Soils in the Ozarks of Oklahoma have been influenced by the karst and sandstone geology and hilly topography, and range from sandy loams to heavy clays to rock outcrops, with various loams predominating. Loam is a soil textural class that is influenced to varying degrees by silt, sand, and clay. Loams are considered the best soil texture for agriculture. Soil associations that dominate the project area include the Enders-Conway-Hector and the Hector-Pottsville associations (Oklahoma Comprehensive Water Plan, 2012). For a detailed description of soil series, see the U.S. Department of Agriculture, Natural Resources Conservation Service's Soil Survey publication for the desired county.

Throughout the Ozark regions, erosion has resulted in thin, rocky soils. Soil depth ranges from areas of exposed bedrock and no soil, to areas with soil 10-40 cm deep, to pockets of relatively deep soil (>1 m). Most of the soils within the action area are Alfisols or Ultisols. They formed in material weathered from cherty limestone. Physical and chemical weathering has caused the cherty limestone to disintegrate into its least soluble components, which are chert and clay. The chert remains in the form of angular fragments or wavy horizon beds interstratified with layers of clay. Down slope movement by gravitational creep and overland water flow has altered the cherty material in the upper part of some soils. In general, the soils are shallow to very deep, moderately well-drained to excessively drained, and medium textured to fine textured. The soil temperature regime is mesic bordering on thermic, the soil moisture regime is udic, and mineralogy is mixed or siliceous.

Many of the soils on nearly level to moderately sloping upland divides are Fragiudults (Captina, and Tonti series). Many of the soils on moderately sloping to steep side slopes in the uplands are Paleudults (Clarksville series). Many of the soils on terraces and the adjacent flood plains are Hapludalfs (Razort and Waben series) and Paleudalfs (Britwater series) (USFWS et al. [BABO HFRP], 2010).

3.2.5 Oil and Gas Occurrences and Potential

Other than limestone, there is few known oil, gas, or mineral deposits in the area. Limestone and dolomite deposits and gravel do occur in Adair, Cherokee, Craig, Delaware, Mayes, southeast Ottawa, and extreme northern Sequoyah Counties. There has been some coal mining in western Craig, extreme western Mayes, and extreme southern Sequoyah Counties. Also, in the past lead and zinc has been mined in extreme northern Ottawa County. There are no oil or gas production sites or facilities on or near current Refuge property. However, if oil or gas is discovered near the Refuge in the future, development could contaminate groundwater aquifers, springs, and streams and, along with limestone quarries, directly destroy cave, aquifer, streams, and forest habitat.

The Refuge owns mineral rights on all Units. There are no mineral extraction operations on any Refuge lands.

3.3 Biological Environment

This section describes the biological environment in which the Ozark Plateau NWR is found. It includes a description of the present, historical, and potential future condition of terrestrial and aquatic habitat types found on and surrounding the Refuge, as well as the natural processes that influence them. It identifies priority wildlife species and representative species used for monitoring purposes, and includes a discussion of various wildlife types that benefit from the Refuge.

3.3.1 Habitat Types

The Ozark region encompasses all or portions of the Refuge's seven-county acquisition area of Adair, Cherokee, Craig, Delaware, Mayes, Ottawa, and Sequoyah counties. It is equivalent to the combination of the Ozark Highlands and the Boston Mountains in both Bailey's and Omernik's ecological classification systems. The Oklahoma Comprehensive Wildlife Conservation Strategy (Strategy) describes terrestrial habitats or "conservation landscapes" in the Ozark Region and prioritizes them as "very high, high, and/or moderate" in terms of conservation landscapes and issues (ODWC, 2005).

3.3.1.1 Terrestrial Classes

Northeastern Oklahoma is part of the Ozark Plateau geographic area containing hilly, deciduous forests in Bailey's Oak-Hickory Forest Ecoregion and supports an oak-dominated deciduous forest community. The principal oak species are blackjack, post oak, black oak, southern red oak, Shumard oak, pin oak, bur oak, and white oak. Hickory species include black hickory, shagbark hickory, and mockernut hickory. Typical understory vegetation includes flowering dogwood, eastern redbud, green brier, poison ivy, May apple, white sassafras, and coralberry.

Valleys in floodplains contain silver maple, river birch, American elm, eastern cottonwood, American sycamore, American linden, and various oaks. The Ozark chinquapin tree (*Castanea pumila* var. *ozarkensis*), a state species of concern, is scattered throughout the forested areas (ODWC, 2005).

Table 3-1. Terrestrial Conservation Landscapes on Ozark Plateau NWR Units (ODWC, 2005)

| Conservation Landscape | Ozark Plateau NWR Units |
|--|--|
| <i>Very High Priority Conservation Landscapes</i> | |
| Limestone caves | All Units |
| White Oak/Hickory Mesic Forest | Sally Bull Hollow, Liver, Gittin Down Mountain, Varmint |
| <i>High Priority Conservation Landscapes</i> | |
| Shortleaf Pine-Oak-Hickory Woodlands | Potter, Beck, Mary and Murray Looney, Eucha, Boy Scout |
| Herbaceous Wetlands | Mary and Murray Looney, Sally Bull Hollow, Varmint, Boy Scout, Eucha |
| Oak-Hickory Bottomland Hardwood Forest | Mary and Murray Looney, Eucha, Sally Bull Hollow, Varmint, Boy Scout |
| <i>Moderate Priority Conservation Landscapes</i> | |
| Post Oak/Blackjack Oak-Hickory Woodland and Forest | Sally Bull Hollow, Liver, Gittin Down Mountain, Varmint |
| Tallgrass Prairie | Beck, Mary and Murray Looney |

Limestone Cave

Much of the Ozark Plateau NWR is underlain by the Springfield Plateau, a formation of porous limestone with deep fissures that is often referred to as karst. Slightly acidic groundwater moves through the fissures and cracks in the limestone dissolving and/or eroding subterranean stream channels, and caves. Because of its geology, the Ozark Plateau contains many complex systems of interconnected aquifers, caves, sinkholes and springs, and these systems in turn support diverse subterranean communities of salamanders, bats, Ozark cavefish, cave crayfish and other cave and/or aquifer dwelling invertebrates. Caves are openings into the karst formation that connect the above ground community with the subterranean community. In contrast to the Springfield Plateau, the Boston Mountains section of the ODWC Ozark Region is a sandstone formation in which very few caves exist. Despite the widespread nature of the Springfield Plateau, cave systems are uncommon and locally-occurring. The distribution and biological composition of caves is poorly known and in need of further investigation (ODWC, 2005).

White Oak/Hickory Mesic Forest

The relative condition of White Oak/Hickory Mesic Forest habitat is currently poor with a declining trend. This forest type occurs as small patches of mesic forest in ravines and hollows within drier upland oak forest, or as long bands of habitat found on the lower slopes around small valleys, or the more protected northern and eastern slopes of hills and valleys. This habitat is found on the Refuge but restricted to certain physical features of the landscape and sites with favorable moisture and soil conditions. As a result this habitat type can only be managed or restored in specific areas and it rarely occurs as large contiguous landscapes (ODWC, 2005).



Autumn colors in the Ozark oak-hickory forest. (Credit: Shea Hammond)

Shortleaf Pine-Oak-Hickory Woodlands

Shortleaf Pine-Oak-Hickory Woodlands habitat occurs locally in portions of the Springfield Plateau in Cherokee and Delaware Counties. This habitat type is comprised of a mosaic of woodlands and forests dominated by Shortleaf Pine (*Pinus echinata*), and several species of oaks and hickories. These woodlands and forests are found on ridge tops, and on dry, rocky upper portions of east, south, and west-facing slopes. This habitat type is shaped by the combination of dry soils and periodic fire (ODWC, 2005).

Post Oak/Blackjack Oak-Hickory Woodlands and Forests

The relative condition of Post Oak/Blackjack Oak-Hickory Woodlands and Forests habitat is currently poor with a declining trend. Dry to mesic, oak-dominated woodlands, and forests are widespread on Refuge lands and typically occur on upper slopes, ridges, bluff escarpments, and slopes with a southern or western aspect. This plant community is structured by topographic position and naturally occurring fire and represents the majority of upland woodland and forest in the Ozark Region. This habitat type usually develops on sites with shallow or well-drained soils, and is dominated by only a few species of trees but is a structurally diverse mosaic of oak-hickory woodlands and oak-hickory forests that vary geographically depending upon soil conditions, aspect, and fire history (ODWC, 2005).

Herbaceous Wetlands

Herbaceous wetlands are small, uncommon and locally-occurring plant communities on the Refuge, usually found embedded within larger habitats or fire-maintained plant communities such as Tallgrass Prairies. The distribution, abundance and biological composition of herbaceous wetlands is poorly known in this Region and is in need of further study. Wetlands most frequently develop within or near the floodplains of streams and rivers. However in the Ozark Region, many floodplains are forested and are not conducive to the maintenance of herbaceous wetlands. Herbaceous wetlands are often seasonally flooded depressions within prairies and floodplains where periodic disturbances such as fire and flooding limit the encroachment of woody plant species. As a result of fire suppression and habitat loss, it is likely that much of the current herbaceous wetland habitat within the landscape exists in human-maintained areas such as pastures in both uplands and floodplains (ODWC, 2005).

Tallgrass Prairie

Tallgrass Prairie habitat remains where the shallow rocky soils are unsuitable for conversion to crop agriculture and ranching is the most common land use. Where prairie habitat remains, decades of continuous grazing, fire suppression and encroachment of native and non-native plants has resulted in changes in the plant community composition and structure. These changes include greater woody plant cover, increased proportions of exotic grasses and decreased abundance of native forbs. Tallgrass Prairies are herbaceous plant communities dominated by four common, tall grass species: big bluestem (*Andropogon gerardi*), Indian grass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*) and little bluestem (*Schizachyrium scoparium*). There are few sites currently on the Refuge of this habitat type. The structure of this habitat type is maintained by the occurrence of natural fires that limit the growth of woody plant species and favor grasses and some forbs. All four of the dominant grass species are present in most Tallgrass Prairie sites; however big bluestem and Indian grass tend to be most prevalent in mesic sites, while big bluestem and little bluestem are most common on drier sites. In mesic loamy soils such as those found in floodplains and bottomlands, switchgrass and big bluestem are often the dominant grasses (ODWC, 2005).

3.3.1.2 Aquatic Classes

The Ozark landscape is deeply dissected by clear-flowing, often spring-fed, moderate- to high-gradient streams.

Table 3-2. Aquatic Conservation Landscapes on Ozark Plateau NWR Units (ODWC, 2005)

| Conservation Landscape | Ozark Plateau NWR Units |
|--|---|
| <i>Very High Priority Conservation Landscapes</i> | |
| Springs | All Units |
| Gravel Bottom Streams | Sally Bull Hollow, Varmint, Mary and Murray Looney, Potter, Boy Scout |
| <i>Moderate Priority Conservation Landscapes</i> | |
| Large Rivers | Boy Scout |

Springs

The relative condition of Spring habitat is currently poor with a declining trend. Springs and seeps are widespread on Ozark Plateau NWR lands, but are extremely small habitats that are typically found in association with wetlands or the headwaters of streams. These springs are also associated with many caves. As a result of the limestone karst geology of the region, groundwater aquifers, subterranean streams, and springs are numerous in this area. The Springfield Plateau supports many species of conservation need that inhabit groundwater aquifers and these species may be encountered at springs or within caves (e.g., amphipods, isopods, and Grotto salamander). Despite the number of springs in the region, the distribution and biological composition of springs and seeps is poorly known in large part because these habitats are small and difficult to locate or access (ODWC, 2005).



*Fast-flowing stream on Ozark Plateau NWR.
(Credit: Shea Hammond)*

Gravel-bottom Streams and Associated Riparian Forests

The relative condition of Gravel-bottom Stream and Associated Riparian Forests habitat is currently poor with a declining trend, according to the Oklahoma Comprehensive Wildlife Conservation Strategy. All or nearly all of the streams on the Refuge have cobble or gravel substrates. Because of the karst geology of the Springfield Plateau, many surface streams have a strong groundwater connection. Most streams receive a substantial amount of their flow from springs and seeps. Many streams have sections in which the stream loses flow to or gains flow from shallow groundwater aquifers. Streams in areas of low elevation gradient have well developed series of pools and riffles. These streams are typically slightly too moderately entrenched, are much wider than they are deep, and have well-developed floodplains. Streams in areas with higher elevation gradients are typically wider than they are deep but are moderately entrenched, have few meanders, narrow floodplains, and are structured as a series of pools and steps (ODWC, 2005).

Small River

Small River habitat in the Ozark Region of Oklahoma is limited to the Spring and Illinois Rivers, each of which is a tributary of the Grand/Neosho River, which flow within the Refuge approved acquisition area. The lower portions of both rivers have been affected by impoundments that have reduced their effective lengths. The Spring River flows for approximately 15 miles in Oklahoma before reaching Grand Lake of the Cherokees. The lower part of the Illinois River has been impounded by the construction of Tenkiller Reservoir, which has reduced its length to approximately 40 miles of flowing water. Both the Spring River and the Illinois River are clear swiftly-flowing rivers with gravel to cobble substrates. Flow rates are typically greater during the winter and spring months and lower during the summer and fall. These small rivers contain gravel bars and sloughs but not the dynamic mosaic of sandbars, mudflats and sloughs that are found within the larger rivers. Sloughs along these rivers are typically rocky and surrounded by woody vegetation including river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), and red maple (*Acer rubra*) (ODWC, 2005).

Large River (Grand-Neosho River)

The relative condition of Large River habitat is currently poor with a declining trend. The only large river within the Ozark Region is the Grand-Neosho River that forms its western boundary. The Grand-Neosho River is dammed, forming Grand Lake, which has a cove that borders the Refuge's Boy Scout Unit. Historically, the Grand-Neosho was a deep, swift moving river but has been modified by the construction of three reservoirs that have inundated most of the river's length. The ODWC considers the large river habitat to be the three impoundments, the remaining river channel that connects these and the seasonally flooded areas along the river and reservoirs (ODWC, 2005).

3.3.1.3 Natural Disturbance Processes

The Refuge experiences frequent, small-scale wildfires that normally range from a few acres to approximately 1,000 acres. Because of the remote locations of most Refuge units, there is little or no damage to structures or other property from the wildfires. Wildfires on the Refuge tend to benefit native species and are therefore beneficial to the natural biodiversity of the habitats.

Tornadoes and ice storms occur infrequently on Refuge lands. They damage trees by breaking limbs and occasionally uproot trees, resulting in localized areas of dense, tangled ground debris and clutter.

Seasonal floods occur on the Refuge's gravel bottomed streams. The naturally occurring floods benefit the bottomland forests and riparian areas by replenishing nutrients and maintaining the native vegetation. These flood events do not cause damage to any structures or other Refuge resources. Most caves in the Ozarks are part of the groundwater aquifer and were formed by water flowing through them due to frequent flooding during rain events.

These caves provide substantial habitat for subterranean aquatic organisms adapted to these events. However, at times, flooding has caused problems for bats using caves that are inundated by water and also by repositioning sediments that either open or close cave passages.



*Ice storm in the Ozarks.
(Credit: Marvin Smith, Jan. 2009)*

The majority of earthquakes in eastern Oklahoma take place in both Oklahoma and Lincoln Counties, which are approximately 200 miles west of the Refuge (Oklahoma Geological Survey, 2010), however minor earthquakes, similar to the one occurring in Sally Bull Hollow during the summer of 2011, do infrequently occur in the seven-county acquisition area. These earthquakes may contribute to rocks falling within the caves.

3.3.1.4 Historical Habitat Description

The extent of pre-settlement savanna that occurred in the Ozark region is unknown. Some botanists have proposed that savanna was extensive in pre-settlement times, but others believe the area primarily was forest of varying tree densities. Most ecologists believe that before European settlement, the Ozark region consisted of plant communities with scattered, open-grown trees, primarily xeric oak (*Quercus*) species, intermixed with prairie. The Ozarks were described as beautifully picturesque; having an open grass area, with park-like groves, and where scattering oak trees interspersed did not inhibit the growth of grasses. In the late 1800's, tree

density had increased to an improved forest condition, as a result of the fence law enactment, which prevented livestock from grazing in woodlands. Despite the fact that the fence law was not enacted in portions of eastern Oklahoma until the mid-1900's, this increase in woody cover has been attributed to several factors, including soil erosion, prairie deterioration, gully formation and most commonly, fire suppression (Heikens, 1999).

Upland oak-hickory forests had a historic fire regime that played a significant role in their composition and structure (Lorimer, 2001; Abrams, 2005; Hutchinson et al., 2008). Most ecologists believe that, prior to European settlement, the Ozarks supported a lower-density forest, and that tree density generally has increased while the cover of herbaceous understory vegetation has been reduced due to fire suppression (Sauer, 1920; Howell and Kucera, 1956; Heikens, 1999).

3.3.1.5 Estimated Future Habitat Conditions due to Climate Change

Habitat within the Ozark ecoregion will respond to climate change in different ways and to varying extents, due in part to the heterogeneous impacts of climate change factors themselves and in part to other factors, such as the amount of stress an ecosystem may already be under and the adaptability of the species within it. The rate of potential adaptation may or may not be sufficient to keep pace with current and future rates of climate change (Bedoya et al., 2008).

According to TNC's climate wizard models, the northeastern Oklahoma region will have a 2-degree increase in annual temperatures and a 5% decrease in annual precipitation, (climatewizard.org, 2007). On the Refuge, changes in climate in and around caves may affect their habitat suitability for different bat species (Newson et al., 2009; page 109). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for bats (Newson et al., 2009, page 109). Warmer drier conditions may shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area. The Refuge would like to have more information on the effects of climate change on habitat and wildlife.

3.3.2 Wildlife and Plants

Wildlife

The area has a wildlife complement that represents Ozark oak-hickory and oak-hickory-pine forest, streams, springs, caves, aquifers, and other karst features on a landscape or ecoregion level. In addition to popular game and non-game species, it supports a diverse array of vertebrate and invertebrate species that not only are endemic to the Ozark Plateau, or Oklahoma, but are sometimes unique to each cave because of their isolation from one another. Because cave and aquifer ecosystem often develop their own endemic species complements, it is possible that numerous un-described and un-catalogued fauna may exist in the recently discovered, or yet

undiscovered, caves. Three new species of insects have been identified from one Refuge cave. The area encompasses the known distribution of the federally-listed endangered Ozark big-eared bat (*Corynorhinus townsendii ingens*), gray bat (*Myotis grisescens*), threatened Ozark cavefish (*Amblyopsis rosae*) and a portion of the endangered Indiana bat (*Myotis sodalis*) range in eastern Oklahoma and the Service's Southwest Region (Region 2). Also, two species of concern Oklahoma cave crayfish (*Cambarus tartarus*) and Delaware County cave crayfish (*Cambarus*



Ozark big-eared bats in AD125 Cave. (Credit: Steve Hensley)

subterraneus), use caves in the area. The forested areas surrounding the caves and overlying the aquifers not only protect groundwater quality in recharge areas but are also important for providing habitat for migratory bird and bat foraging, breeding, and nesting/roosting for wildlife species that need un-fragmented tracts of forest. Essential caves, movement corridors, and foraging habitat for the bats and ground water recharge areas supplying water to the aquifers used by the cavefish and cave crayfish may be found in the Refuge's seven-county approved acquisition area as well as across nearby state and Service Regional boundaries. This reflects in Ozark Plateau NWR's management goals of implementing a landscape approach for protection of habitats for a number of Service trust resources and the natural biological diversity in the Ozarks.



Bald eagle near Fort Gibson.
(Credit: Richard Stark, 2009)

Bald eagles (*Haliaeetus leucocephalus*) now have been delisted from federally endangered due to recovery and are found on the Refuge in northeastern Oklahoma because of the abundant rivers and reservoirs. The longnose darter (*Percina nasuta*), a federal species of concern, is found in one stream in the area (Lee Creek). Other federal species of concern found in the area include the eastern small-footed bat (*Myotis leibii*), the southeastern big-eared bat (*Corynorhinus rafinesquii*), the southeastern bat (*Myotis austroriparius*), the bat cave isopod (*Caecidotea macropoda*), the Bowman's cave amphipod (*Stygobromus bowmani*), the Ozark cave amphipod (*Stygobromus ozarkensis*), and Ozark chinquapin (*Castanea pumila* var. *ozarkensis*). In addition, the federally-listed endangered American burying beetle (*Nicrophorus americanus*) is also found within the acquisition area.

Plants

Prior to the 19th century, uplands were dominated by open stands of mature oak–hickory forest. Savannas consisting of scattered trees and tall grass prairies were also common throughout the project area. The open forest conditions and savannas were maintained by periodic wild fires that resulted naturally from lightning strikes or were intentionally set by indigenous native tribes as a land management tool. Through decades of fire suppression, the forest stands are now much denser with a closed canopy and a greatly reduced herbaceous understory. Areas once dominated by savannas have also evolved into dense stands of oak and hickory forest with shaded conditions that no longer support extensive areas of native grasses.



Spring leaves begin to green the Sally Bull Hollow Unit. (Credit: Steve Hensley)

Tree species found on upper drier ridges, include post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), and black hickory (*Carya texana*). Shallow eroded soils consist primarily of post oak and blackjack oak. In the more fertile valleys, burr oak (*Quercus macrocarpa*), white oak (*Quercus alba*), yellow oak (*Quercus muehlenbergii*), bitternut hickory (*Carya cordiformis*), and pecan (*Carya illinoensis*) are most common. Black oak (*Quercus velutina*) and mockernut hickory (*Carya tomentosa*) occur on moderately deep soils with intermediate moisture

conditions. Riparian zones, swales and wetlands support species such as water oak (*Quercus nigra*), sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus Americana*), red elm (*Ulmus rubra*), and green ash (*Fraxinus pennsylvanica*). Persimmon (*Diospyros virginiana*) and sassafras (*Sassafras albidum*) are found in the open areas where competition for sunlight and space is less intense. On steep north or northeast facing slopes, sugar maple (*Acer saccharum*), white oak (*Quercus alba*), and Shumard oak (*Quercus shumardii*) are common with a scattered occurrence of shagbark hickory (*Carya ovata*). Eastern redcedar (*Juniperus virginiana*), a highly invasive species is rapidly increasing over the entire project area as the result of continued fire suppression. Large areas of forestland throughout the project area have been cleared and planted with bermuda grass (*Cynodon dactylon*) and tall fescue (*Festuca arundinacea*) for pasture and hay production. A list of plants occurring on Ozark Plateau National Wildlife Refuge (surveyed by Dr. Ron Tyrl of OSU) is shown in Appendix D.

3.3.2.1 Priority Species

Priority species are identified based on federally listed threatened and endangered species, species of concern identified in the State's Oklahoma Comprehensive Wildlife Conservation Strategy, and representative species developed from the State Strategy and Refuge assessment.

*Threatened and Endangered Species***Ozark Big-Eared Bat**

The Ozark big-eared bat was federally listed as endangered on November 30, 1979 (44 FR 69208). Critical habitat has not been designated. The final recovery plan was signed on March 28, 1995 (USFWS, 1995). A five-year review on the current status of the Ozark big-eared bat was completed by the Service on May 22, 2008, wherein the Service determined that the existing listing classification of endangered remains valid (USFWS, 2008).



Ozark big-eared bat. (Credit: Merlin D. Tuttle of BCI)

The Ozark big-eared bat was federally-listed as endangered in 1979 due to its small population size, reduced and limited distribution, and vulnerability to human disturbance. Disturbance of hibernating bats causes the loss of critical fat stores and increases the probability of starvation during the winter, while disturbance at maternity roosts can result in loss of young. The bat also is listed as endangered by the States of Oklahoma, Arkansas, and Missouri (although the species is believed to have been extirpated from Missouri).

Refuge Units that occur in Adair and Cherokee Counties provide important cave and foraging habitat for this species. There are twelve known “essential caves”, defined as a cave used by a maternity colony or as a hibernaculum, in Oklahoma, six of which occur on the Ozark Plateau National NWR (USFWS et al. [BABO HFRP], 2010). Five of the six are used as maternity caves and three as hibernacula. Approximately one-third of the known Oklahoma maternity colonies roost in caves that occur on the Refuge, while over 50% of the entire known population of Ozark big-eared bats hibernate in caves that occur on the Refuge.

The Ozark big-eared bat is an insectivorous bat that specializes on moths and uses caves year-round. Colonies typically begin to form at hibernacula in October and November (Clark et al., 1996 and 2002). Both sexes hibernate together in clusters that typically range from two to 135 individuals (Clark et al., 1993, 1997 and 2002). The Ozark big-eared bat is known to exhibit winter activity (Kunz and Martin, 1982; Clark et al., 2002). Hibernating colonies gradually begin to break up in spring from April through May (Clark et al., 2002). Females also begin to congregate at warm maternity caves to give birth and rear their young over the summer (Clark et al., 1993, 1996, and 2002). Distances between hibernacula and summer caves are known to range from 6.5 to 65 km (4 to 40 miles). The exact timing of the formation of maternity colonies varies between years, but usually occurs between late April and early June (Clark et al., 2002; USFWS, 1995). Like other temperate bats, the species exhibits strong roost fidelity, returning to

the same maternity sites and hibernacula year after year (Kunz and Martin, 1982; Clark et al., 1996; Weyandt et al., 2005).



Lepidoptera moth. (Credit: Sean Mack)

Ozark big-eared bats typically emerge from their caves to forage shortly after sunset (Clark et al., 1993 and 2002). Forested habitats are an important source of food for the Ozark big-eared bat. A recent study on the diet of the Ozark big-eared bat and prey abundance in Arkansas found that the bats prey on a wide diversity of moth species, and that most of the species are dependent upon woody forest plants as a host (Dodd, 2006). The study also found a positive correlation between woody species richness and moth occurrence. Conservation of the Ozark big-eared bat, therefore, requires not only protection of important caves but also

forested habitat that supports abundant and diverse moth populations (Leslie and Clark, 2002; Dodd, 2006; Dodd and Lacki, 2007). Conservation practices that encourage a diversity of woody forest plant species (e.g., prescribed fire, selective thinning) to provide a rich prey base of moths benefit Ozark big-eared bat colonies. The Ozark big-eared bat has been shown to selectively forage in both edge and forested habitats and also to use habitats in proportion to prey availability.

A recent genetics study provides further insight into the need to protect each maternity colony. Weyandt et al. (2005) examined population genetic variability and found that maternally inherited markers differed among sites, indicating very strong site fidelity and limited dispersal by females and high natal philopatry.

Disease, including white-nose syndrome (*Geomyces destructans*) (WNS), which was not present at time of listing, and predation were not considered major factors for the endangered status of the Ozark big-eared bat. There was little information available on the disease, however this may affect their populations drastically in the future (see also Chapter 2: Sections 2.3.1. and 2.3.3 for more information on WNS).

The Service recently completed a 5-year review for the Ozark big-eared bat (USFWS, 2008). At the time of listing, the Ozark big-eared bat was known from only a few caves in northwestern Arkansas, southwestern Missouri, and northeastern Oklahoma. The entire population was estimated to consist of about 100-200 individuals. Since listing, additional caves used by

maternity colonies in the summer and as hibernacula have been discovered in Oklahoma and Arkansas. The population is estimated to currently consist of about 1,800 individual bats (Figure 3-8) with about 400 in Arkansas and 1,400 in Oklahoma.

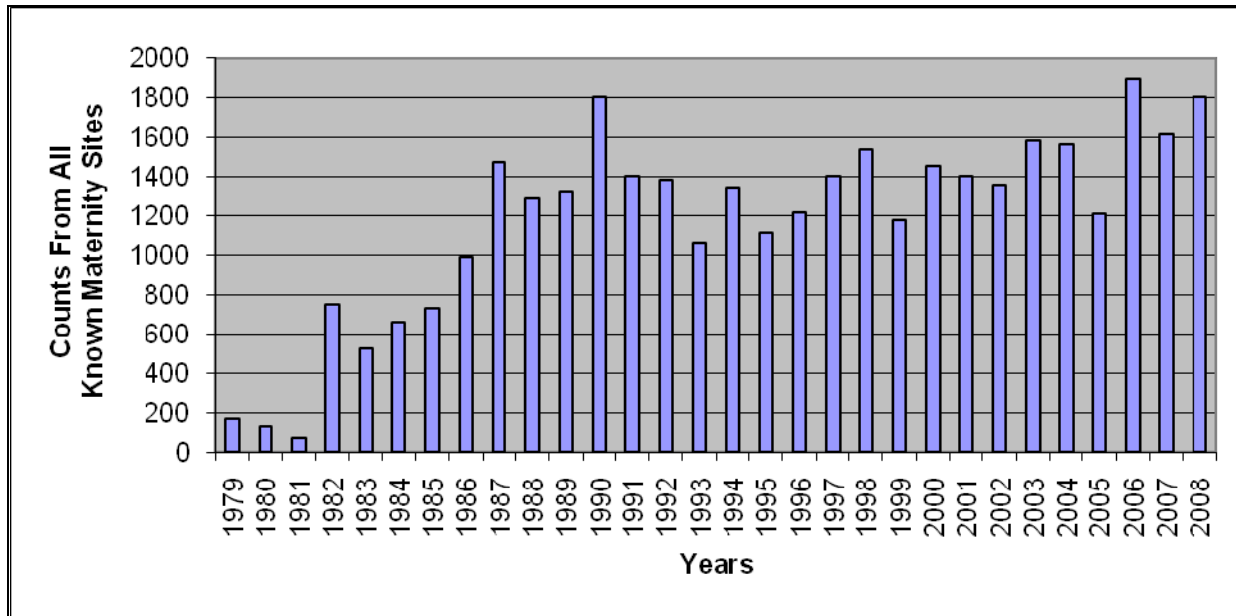


Figure 3-8. Population estimates of the Ozark big-eared bat by year since listing as endangered in 1979.

Census counts indicate that the overall population has experienced a slightly increasing trend since 1997 (Figure 3-9), when the last discovered essential maternity site from which we have several years of population data (a maternity cave in Arkansas) was added to the annual counts. The overall population estimate has averaged about 1,500 bats between 1997 and 2008. An increasing population trend is observed over this time period when the data from Arkansas is considered alone. In contrast, estimates from exit count data for Oklahoma indicate that the population size in Oklahoma has experienced an overall slightly declining trend since 1987, the first year in which annual monitoring efforts included all known essential maternity sites from the state. The apparent declining trend in Oklahoma may be attributable to movement among caves, including sites not known to us, and not an actual decrease in bat numbers, and due to the difficulty in monitoring bats at certain caves.

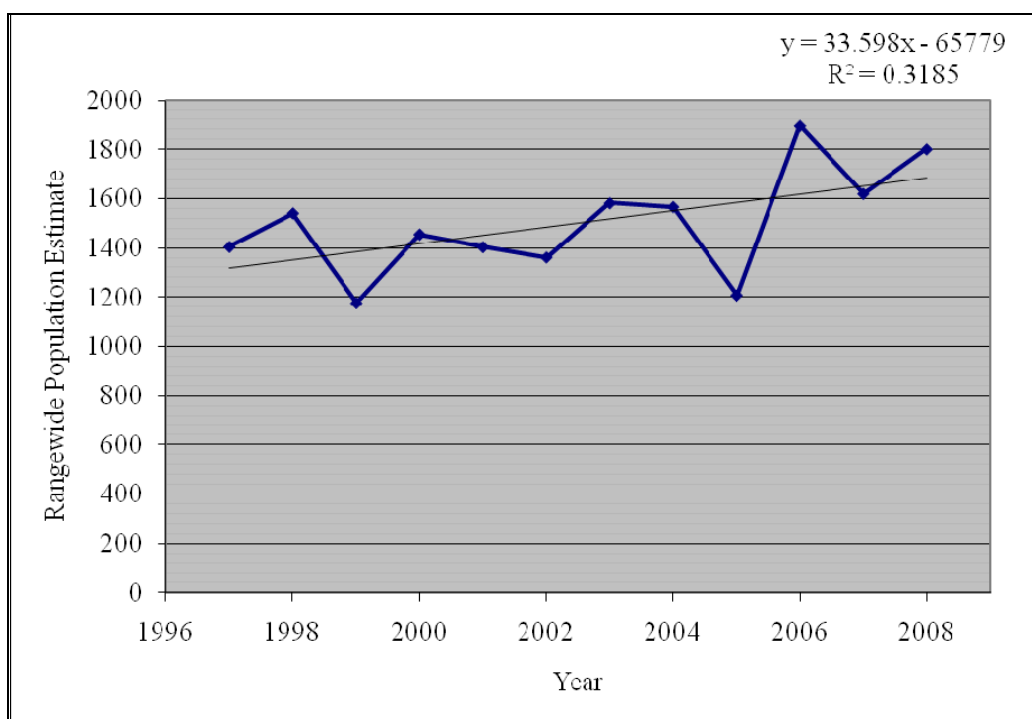


Figure 3-9. Overall Ozark big-eared bat population estimates based on summer counts from known maternity sites

Gray Bat

The gray bat was federally listed as endangered on April 28, 1976 (41 FR 17740). Critical habitat has not been designated. The final recovery plan was signed on July 8, 1982 (USFWS, 1982). The Service completed a five-review on the status of the gray bat on September 30, 2009 (USFWS, 2009). The Service determined that the existing listing classification of endangered remains valid primarily due to the potential threat of WNS.

The gray bat is a medium-sized bat with gray fur. The species belongs to the plain-nosed bat family, *Vespertilionidae*, and is one of the largest species within the genus *Myotis* in eastern North America (Decher and Choate, 1995).



Hibernating gray bat.
(Credit: Richard Stark)

The gray bat can be distinguished from other species in the genus *Myotis* by the uniform color of its dorsal fur in which hair shafts are gray from base to tip. The dorsal hairs of other bats within its range are bi- or tri-colored. Additionally, the wing membrane attaches at the ankle of the foot instead of at the base of the toes as in other members of the genus (Barbour and Davis, 1969; Harvey et al., 1981; Decher and Choate, 1995; Tuttle and Kennedy, 2005). The calcar on gray bats is not keeled and the skull has a distinct sagittal crest (Harvey et al., 1981; Mitchell, 1998).

Gray bats are one of the few species of bats in North America that inhabit caves year-round, migrating each year between winter and summer caves. Gray bats have been documented to regularly migrate from 17 to 437 km between summer maternity caves and winter hibernacula (Tuttle 1976b; Hall and Wilson 1966). Gray bats exhibit strong philopatry to both summering and wintering sites (Tuttle, 1976a; Tuttle, 1979; Kennedy and Tuttle, 2005; Martin, 2007).

Winter hibernation sites are typically deep vertical caves that trap large volumes of cold air (Tuttle, 1976a; Harvey et al., 1981; Harvey, 1994; Martin, 2007). Hibernation sites also often have multiple entrances where there is good air flow (Martin, 2007). During hibernation, the species typically forms large clusters with some aggregations numbering in the hundreds of thousands of individuals (Harvey, 1994; Tuttle and Kennedy, 2005). It is estimated that 95% of the species range-wide population hibernates in only nine caves (Tuttle, 1979).

Gray bats feed on flying insects over bodies of water including rivers, streams, lakes and reservoirs. Mayflies, caddisflies, and stoneflies make up the major part of their diet, but beetles



Stoneflies, a delicious food source for the gray bat.
(Credit: Gilbert Rowley; flytying123.com)

and moths also are consumed (Harvey, 1994; Tuttle and Kennedy, 2005). Gray bats are known to travel up to 35 kilometers from caves to prime feeding areas (La Val et al., 1977; Tuttle and Kennedy, 2005). However, most caves are within 1-4 km (0.6 – 2.5 miles) of foraging areas (Tuttle, 1976b).

Likely predators include wildlife known to prey on bat species such as snakes, owls, hawks, raccoons, bobcats, and feral house cats. Predation and WNS were not considered significant threats at the time of listing.

The fungus associated with WNS (*G. destructans*) was documented recently on gray bats in Missouri during the spring of 2010. Mortality events attributable to WNS have not occurred in any gray bat populations to date. Research is ongoing to determine whether all bats that come into contact with the fungus will develop WNS. However, the discovery of the fungus on gray bats is cause for concern. WNS appears to kill only hibernating bats. Conservation biologists, therefore, are concerned that gray bat populations may be impacted during future hibernation seasons. Because a large percentage of the gray bat population hibernates in a limited number of caves, disease transmission could occur rapidly and the resulting impacts could be severe.

In the 1982 approved Gray Bat Recovery Plan, populations at 13 sites (45%) have been stable or increasing (USFWS, 2009). Populations of many gray bat priority caves also have been

monitored, and roughly 33% of priority caves across the species' range have stable or increasing populations (USFWS, 2009).

Sasse et al. (2007) analyzed data from 48 gray bat maternity sites involving three subpopulations in the Ozark Highlands of Missouri, Arkansas, and Oklahoma between 1978 and 2002. The authors report that 79% of these colonies were stable or increasing. However, Elliott (2008) estimated that despite an overall increase in gray bat numbers in Missouri, the overall state population of this species was still only about 46% of what the maximum past population historically was.

Ozark Cavefish

The Ozark cavefish (*Amblyopsis rosae*) was listed as threatened on November 1, 1984 (49 FR 43965). Critical habitat has not been designated. The final recovery plan was signed on December 17, 1986 and revised in 1989 (USFWS, 1989). A five-year review of the listing status is currently being conducted by the Service.



Ozark Cavefish (Credit: Dante Fenolio)

Ozark cavefish are small fish reaching a maximum total length of about 5.0 cm (about two inches). The fish are true trogllobites (i.e., obligatory cave or aquifer inhabitants). They lack pigment, but appear pinkish-white because their translucent skin reveals blood and organs. The Ozark cavefish has only rudimentary eyes and no optic nerve since their lives are spent in the darkness of caves. The Ozark cavefish is difficult to distinguish from other cavefish species in the field. Differentiation is based on degrees of cave adaptation.

Knowledge of cavefish life history is limited. The species is believed to have low reproductive capacity and to be slow to reproductive maturity (Robinson and Buchanan, 1988). Infrequent reproduction may be an adaptation to a limited food supply.

The Ozark cavefish primarily feeds on small crustaceans such as copepods, isopods, and amphipods. Cavefish also prey upon small crayfish, small cavefish, oligochaetes (e.g., segmented worms), small salamanders and salamander larvae (Poulson, 1963).

The Ozark cavefish is considered the most adapted of all the cavefish for cave life due to well-developed sensory papillae. They tend to occur in caves with groundwater recharge (as opposed to caves that rely on surface water sources), and generally are acknowledged to be a groundwater obligate. Ozark cavefish occur in flowing cave streams with chert rubble substrate and pool areas. They also have been found in wells and sinkholes.

Ozark cavefish have no known documented predators. Predation likely occurs at times by species known to use caves such as raccoons and surface fish species that may enter caves. Similarly, disease currently is not considered to be a factor in population viability.

The Ozark cavefish has not been observed for over six years in 19 of the 35 sites that currently are considered occupied. Of the remaining 16 sites, the Service currently considers six populations to be in decline while 10 are considered stable (David Kampwerth, USWFS Recovery Lead, pers. comm.). However, Graening et al. (2009) recently conducted population trend analyses for seven currently occupied caves, and found two to have increasing population trends. Trends were not detected from the other five caves examined due to high variance and limited data. Cave Springs and Logan Caves represent approximately 80% of all countable Ozark cavefish. The other 12 occupied sites are represented by counts of 1-2 individuals typically, although higher counts have occurred.

A range wide estimate of countable cavefish using recent population monitoring numbers suggests about 220 individuals (Graening et al., 2009; David Kampwerth, USWFS Recovery Lead, pers. comm.). However, it must be noted that the population size of the Ozark cavefish is difficult to estimate. Biologists can only enter those "portals" (i.e., caves with streams, sink holes, wells) large enough to accommodate our size. Because we are unable to access groundwater conduits that the fish are distributed throughout, we can only count fish in accessible reaches of caves and wells.

Table 3-3. Oklahoma State Species of Concern occurring on the Refuge

| Common Name | Scientific Name | Global/State Conservation Status |
|----------------------------|---|---|
| Eastern small-footed bat | <i>Myotis leibii</i> | |
| Southeastern bat | <i>Myotis austroriparius</i> | |
| Rafinesque's big-eared bat | <i>Corynorhinus rafinesquii</i> | |
| Longnose darter | <i>Percina nasuta</i> | |
| Grotto Salamander | <i>Eurycea speleae</i> | G4 / S3 |
| Oklahoma cave crayfish | <i>Cambarus tartarus</i> | G1 / S1 |
| Bowman's cave amphipod | <i>Stygobromus bowmani</i> | |
| Ozark cave amphipod | <i>Stygobromus ozarkensis</i> | |
| Bat cave isopod | <i>Caecidotea macropoda</i> | |
| A cave amphipod | <i>Stygobromus alabamensis</i> | |
| Onondaga cave amphipod | <i>Stygobromus onondagaensis</i> | |
| A cave isopod | <i>Caecidotea ancyla</i> | |
| A cave springtail | <i>Pseudosinella</i> sp. nov. | N/A |
| Ozark chinquapin | <i>Castanea pumila</i> var. <i>ozarkensis</i> | |

Migratory Birds

The Refuge is located where the Central and Mississippi Flyways indiscernibly merge. This area also is located within the Central Hardwoods Bird Conservation Region (BCR), which is one of 67 BCRs identified by the four major bird initiatives operating under the auspices of the North American Bird Conservation Initiative (NABCI). BCRs are the regional ecological units through which the NABCI hopes to ensure the long-term health of North America's native bird populations.



Cerulean Warbler (Credit: Anonymous)

A wide variety of bird species occur in this area. One of the purposes of Ozark Plateau NWR's establishment is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that require nesting some distance from an edge (see Table 3-4). Because the Ozark Highlands contain some of the more extensive forests remaining in the central United States, the area likely serves as habitat for populations of interior forest bird species of conservation concern such as the Cerulean warbler (*cerulean Dendroica cerulean*) and worm-eating warbler (*Helmitheros vermivorus*). The habitats associated with the floodplains of the area's rivers and streams, such as wooded riparian zones, and emergent wetlands, and the reservoirs that occur within the Ozark Highlands provide habitat for numerous species of migratory waterfowl, water birds, and shorebirds. Waterfowl species common during spring and fall migrations include the mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), canvasback (*Aythya valisineria*), and lesser scaup (*A. affinis*), while wood ducks (*Aix sponsa*) are the primary breeding species of waterfowl in the area.

Table 3-4. Central Hardwoods Bird Conservation Region Priority Bird Species (2012)

| Forest-Woodland Priority Species | Continental Concern | Regional Concern |
|----------------------------------|---------------------|------------------|
| Red cockaded woodpecker | Y | Y |
| Brown-headed nuthatch | Y | Y |
| Cerulean warbler | Y | Y |
| Swainson's warbler | Y | Y |
| Bachman's sparrow | Y | Y |
| American woodcock | Y | Y |
| Wood thrush | Y | Y |
| Worm-eating warbler | Y | Y |
| Kentucky warbler | Y | Y |

| | | |
|-----------------------|--|---|
| Ruffed grouse | | Y |
| Yellow-billed cuckoo | | Y |
| Whip-poor-will | | Y |
| Northern flicker | | Y |
| Eastern wood-pewee | | Y |
| Blue-gray gnatcatcher | | Y |

3.3.2.2 Representative/Focal Species

Ozark Plateau NWR was established to prevent the extinction and help in recovery of federally listed threatened and endangered Ozark cave species, and prevent the need for listing additional species of concern. For that reason, the Refuge will focus monitoring those species as their “representative species”. “Representative species” are defined by the Service as species that represent larger guilds of species that use habitats similarly. Therefore, if the sustainability of a representative species is dwindling due to, for example, habitat fragmentation or poor habitat management, then it is assumed that many other wildlife species also interconnected within this habitat will be affected similarly. Monitoring both the habitat conditions concurrently with the health and population sustainability of the following threatened and endangered species and species of concern (see Table 3-5) will reflect the overall effectiveness of Refuge habitat management actions and guide future adaptive management strategies.

Table 3-5. Representative Species of Ozark Plateau NWR and respective federal and state status.

| | |
|--|--------------------|
| Ozark big-eared bat (<i>Corynorhinus townsendii ingens</i>) | Endangered |
| Gray bats (<i>Myotis grisescens</i>) | Endangered |
| Indiana bat (<i>Myotis sodalis</i>) | Endangered |
| Ozark crayfish (<i>Cambarus aculabrum</i>) | Endangered |
| Ozark cavefish (<i>Amblyopsis rosae</i>) | Threatened |
| Neosho madtom (<i>Noturus placidus</i>) | Threatened |
| Bald eagle (<i>Haliaeetus leucocephalus</i>) | Recovered |
| Eastern small-footed bat (<i>Myotis leibii</i>) | Species of Concern |
| Southeastern bat (<i>Myotis austroriparius</i>) | Species of Concern |
| Southeastern big-eared bat (<i>Plecotus rafinesquii</i>) | Species of Concern |
| Longnose darter (<i>Percina nasuta</i>) | Species of Concern |
| Ozark cave crayfish (<i>Cambarus tartarus</i>) | Species of Concern |
| Bowman’s cave amphipod (<i>Stygobromus bowmani</i>) | Species of Concern |
| Ozark cave amphipod (<i>Stygobromus ozarkensis</i>) | Species of Concern |
| Bat cave isopod (<i>Caecidotea macropoda</i>) | Species of Concern |
| Ozark chinquapin (<i>Castanea pumila</i> var. <i>ozarkensis</i>) | Species of Concern |

The area encompasses the existing known range of the federally endangered Ozark big-eared bat (*Corynorhinus townsendii ingens*) in Oklahoma. The Ozark big-eared bat is generally associated with caves, cliffs, and rock ledges in well drained, mature oak-hickory Ozark forests. Maternity caves and hibernacula occur in a number of different surroundings, from large continuous blocks of forest, to smaller forest tracts interspersed with open areas for agile maneuvering while foraging. All bat species on the Refuge play a major role in affecting both terrestrial species (controlling the local insect and pest populations) and subterranean species. Federally endangered gray bats (*Myotis grisescens*), federally endangered Indiana bats (*Myotis sodalis*), federally threatened Ozark cavefish (*Amblyopsis rosae*), and species of concern, cave crayfish (*Cambarus tartarus*) also use caves in the area, and frequently the same caves. Each of these species is directly or indirectly connected with one another in a complex cave food web. For instance, the bats feed on terrestrial insects (outside the cave) and deposit guano inside the cave. Guano is a highly nutritious protein-rich substance because bats don't completely digest their food (Bat Conservation International, 2005). Bat droppings in turn support an unusual and healthy subterranean ecosystem (Bat Conservation International, 2005). Within the caves, fungus and microscopic decomposers break down organic material such as guano, feeding a slew of other species including the Ozark cave amphipod and cave isopods. These creatures in turn feed the cave crayfish and Ozark cavefish. To conclude, bat guano supports a unique mycological community within Ozark caves (Graening, et al, 2011).

Other federal species of concern found in the area include the eastern small-footed bat (*Myotis leibii*), the southeastern big-eared bat (*Corynorhinus rafinesquii*), the southeastern bat (*Myotis austroriparius*), the bat cave isopod (*Caecidotea macropoda*), the Bowman's cave amphipod (*Stygobromus bowmani*), and the Ozark cave amphipod (*Stygobromus ozarkensis*). Isopods and amphipods, which feed on algae, diatoms, dead animals and/or plants, and bacteria, also play an important role in purifying cave or stream water.



Ozark cave amphipod (*Stygobromus ozarkensis*)
(Credit: Dante Fenolio, 2011)

Bald eagles (*Haliaeetus leucocephalus*) are no longer listed but are still protected and are found on the Refuge and in northeastern Oklahoma because of the abundant reservoirs and rivers. Bald eagles play an important role as a bird of prey controlling populations of small mammals and fish species occurring on and off the Refuge. The sustainability of bald eagles will indicate the quality and quantity of water resources on the landscape scale as well as reflect the abundance of prey. Lastly, the longnose darter (*Percina nasuta*), a federal species of concern, is found in one

stream in the area (Lee Creek) and feeds on small aquatic invertebrates. The fish will be another indicator of the health of the local aquatic resources that support many other fish and wildlife species.

3.4 Socioeconomic Environment

This section describes the socioeconomic environment of Ozark Plateau NWR. It includes a discussion of nearby human populations and economies; the archeological, cultural, and historical resources associated with the Refuge; public use opportunities and access; and public use and Service administrative facilities.

3.4.1 Population

The socioeconomic region contains Adair, Cherokee, Craig, Delaware, Mayes, Ottawa, and Sequoyah Counties- basically the northeast corner of Oklahoma. All the counties are not far east of Tulsa, Oklahoma, which has a population of approximately 916,000 (2008). However, the eastern counties adjacent to Arkansas also are not far west of Fayetteville and Fort Smith, Arkansas, with a 2008 population estimate of approximately 421,000. They are the largest and closest cities to provide certain services and amenities that are unattainable within the counties. Western Arkansas is one of the fastest growing areas in the nation and the related development is moving toward eastern Oklahoma. Such growth will probably result in substantial increases in Oklahoma land values in the future. The 2008 population estimate range for all seven Oklahoma counties in the project area was between 15,132 and 45,733, with all but 2 counties in the 30,000+ range. The region retains a rural flavor, even though some individual cities and towns are bustling with economic activity.



*Suburban sprawl in Bentonville, AR.
(Credit: treehugger.com, 2008).*

Population change can be an indicator of economic vitality, the types of economic sectors that are likely to be strong, probable development, disturbance impacts on wildlife habitat, and trends in real estate markets. The following table shows population changes in the seven counties between the 2000 census and 2008 population estimates.

Table 3-6. Ozark Plateau NWR Acquisition Area Population, 2000-2008. (Bureau of the Census)

| County | 2000 Census Population | 2008 Population Estimates | Number Increase, 2000-2008 | Percent Increase, 2000-2008 |
|-------------------|------------------------|---------------------------|----------------------------|-----------------------------|
| Adair | 21,038 | 21,811 | 773 | 3.7% |
| Cherokee | 42,521 | 45,733 | 3,212 | 7.6% |
| Craig | 14,950 | 15,132 | 182 | 1.3% |
| Delaware | 37,077 | 40,425 | 3,348 | 9.0% |
| Mayes | 38,369 | 39,912 | 1,543 | 4.0% |
| Ottawa | 33,194 | 31,849 | -1,345 | -4.0% |
| Sequoyah | 38,972 | 41,034 | 2,062 | 5.3% |
| Area Total | 226,121 | 235,896 | 9,775 | 4.3% |

3.4.2 Economy

3.4.2.1 Regional Economic Profile

The primary economic sectors (categories of economic activities) in the region include manufacturing, government, services, agriculture (including timber), and retail trade (Government Information Sharing Project). Although, not listed as a specific economic sector, tourism is an increasing contribution to local economies, especially through the sectors of services and retail trade. Other economic sectors in the project area include construction; finance, insurance, and real estate; transportation/utilities; wholesale trade; agricultural services; and a small amount of mining.

3.4.2.2 Economic Significance of the Refuge

Land acquired from willing sellers in fee by the Service is removed from the county tax rolls. However, to offset lost tax revenues, the county receives an annual payment in lieu of taxes, as provided by the Refuge Revenue Sharing Act of 1935 (16 U.S.C. 7145:49 Stat. 383, as amended). Funding is provided for these payments from net income from the sale of products or privileges on Service lands and appropriated funds from Congress. Some examples of receipts are oil and gas royalties, grazing fees, timber sales, etc. These funds are distributed based on one of the three following formulas that provide the highest return to the county:

- Seventy-five cents per acre,
- 25% of the net revenue received from the operation of the Refuge, or
- 3/4 of 1% of the appraised value of the property, which must be reappraised by the Service every five years (this formula is the most commonly applied).

If not enough revenues are available in the fund to make full payments, the Service distributes the funds proportionately nationwide. Congress is authorized to make up the difference. For Fiscal Year 2009, the Fish and Wildlife Service paid Adair County \$3,018, Delaware County \$1,059, and Ottawa County \$303.

Refuge Revenue Sharing payments usually exceed the property taxes paid by the previous private landowners in cases where agricultural exemptions exist. The payment figure varies due to local land price trends and at what level Congress appropriates additional funds to make up the shortfall. The Service is required to reappraise its refuge lands every 5 years to allow for adjustments in the payments to account for local land price trends. Private landowners continue to pay property taxes on lands on which the Service holds conservation easements.

3.5 Archeological, Paleontological, Cultural, and Historical Resources

3.5.1 Archeological and Paleontological Resources

The Refuge has partnered with the State Historic Preservation Office and the Sam Noble Museum of Natural History concerning archeological and paleontological sites for a number of years. Short-faced bear, tapir, peccary, and dire wolf remains have been discovered in caves on and near the Refuge. In addition, arrowheads, spear points, and grinding stones used by Native Americans during pre-settlement times, possibly by the Caddo and Osage Tribes, have been found on and near the Refuge. There is a possibility for unknown historical, archeological, and/or paleontological sites to be discovered in the future on or near the Refuge. With the help of the Refuge's partners, valuable information can be identified and preserved.

3.5.2 Cultural Resources

The Service, as are all other federal agencies, is required to protect cultural resources on all acquired lands under Section 106 of the National Historic Preservation Act of 1966, the Archeological Resources Protection Act of 1979 and the Antiquities Act of 1906 by consulting with the State Historic Preservation Officer or the Oklahoma Archeological Survey regarding the protection of any potential cultural resource sites on specific properties proposed for acquisition. If any archaeological or historical resources are acquired in the expanded area, Refuge management activities are supposed to protect or minimize impact on such resources. If cultural resources are found during construction of any Refuge facility, the Service is required to salvage or protect those resources. For those lands remaining in private ownership, it is a voluntary consideration by the private landowner to ensure protection of these resources.

The Ozarks are the home of a number of Native American Nations both here aboriginally and those forced to relocate here. Now these Nations have a significant influence on the past and present culture of the area and many of the people are of Native American ancestry. Native

American Nations in the seven-county area include the Cherokee, Creeks, Delaware, Eastern Shawnee, Miami, Modoc, Muskogee, Osage, Ottawa, Peoria, Quapaw, Seneca-Cayuga, and Wyandotte. Archeological sites may be extent throughout the region (<http://www.travelok.com/>).

3.5.3 Historical Resources

The Ozarks are significant for their history involving their use by early Native Americans as well as Native American tribes later forced to relocate from the east and west, and the westward expansion of European-American settlers and freed African-Americans after the Civil War. Numerous historic sites occur in the region such as homes, buildings, cemeteries, farmsteads, and settlements. Significant sites within the project area include original tribal government locations, Sequoyah's home, Tsa La Gi Cherokee Village, Fort Gibson Stockade, the Tri-State Mining area in Ottawa County, and a number of local museums associated with early settlement and timber industry. (Oklahoma Department of Tourism website, <http://www.travelok.com>).

There are several historical sites on Ozark Plateau NWR. For example, there are the remains of an old wagon trail that ran between Sallisaw and Tahlequah, Oklahoma on the Potter Unit, as



Historical cabin used by Oklahoma caving community for decades. Currently, the “Mary & Murray Looney Education & Research Center” (MMLERC) of Ozark Plateau NWR. (Credit: Steve Hensley)

evidenced by old bridge abutments. This trail was the main thoroughfare for local travelers, prior to the development of roads and highways. Crystal Cave on the Potter Unit was a commercial cave used for local dances in the 1920s and 30s. There is an old rock dam on the Potter Unit that was constructed to provide swimming opportunities dating back to pre-1916. Cabins and infrastructure on the Mary & Murray Looney

Unit have historical significance to the caving community in the Ozarks because they were used by many caving experts as a base station to explore caves in eastern Oklahoma and western

Arkansas, including January-Stansbury Cave, which was later donated by Mary and Murray Looney to the Refuge (Graening, 2011).

3.6 Current Management & Administration

This final section describes how the Refuge currently administers and manages its resources including: funding and staffing, facilities and infrastructure, landscape level resources/issues, Refuge habitats and wildlife, public uses, and cultural resources.

3.6.1 Administration

Currently, there are three full-time Refuge staff members, one Wounded Warrior, one Student Conservation Association (SCA) intern, and one part-time Student Career Experience Program (SCEP) student. Refuge Headquarters is currently located at the Mary & Murray Looney Education & Research Center (MMLERC), which provides only one office. Due to limitations on office space at these Headquarters, each of these staff members described above works out of either the Oklahoma Ecological Services (ES) Field Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR.



Refuge Manager, Wildlife Refuge Specialist, and Maintenance Worker. (Credit: Brian Fuller, 2010)

3.6.1.1 Funding & Staffing

The Refuge receives funding and staffing for operations, infrastructure and maintenance, through the Department of the Interior budget approved by Congress, and allocated to refuges by the U.S. Fish and Wildlife Service Southwest Regional Office. Refuge staff continues to seek additional funding elsewhere, such as applying for grants and working with NGOs, in order to implement all current management activities and educational programs.

As mentioned above, Refuge staff currently consists of three permanent full-time exempt (FTE) employees. These include:

- Refuge Manager/Wildlife Biologist (GS-12)
- Deputy Refuge Manager/Wildlife Refuge Specialist (GS-07/09)
- Maintenance Worker (WG-07/08)

Additional staff and work volunteers include:

- Wounded Warrior
- SCA intern
- SCEP student
- Youth Conservation Corps member (shared with Sequoyah NWR)
- Volunteers: 10 to 20 volunteers per year from the local chapter of the National Speleological Society (Tulsa Regional Oklahoma Grotto, Central Oklahoma Grotto, Arbuckle Mountain Grotto) and other organizations that provide 300 to 1,000 hours of volunteer labor per year
 - Volunteers help with a number of projects including cave mapping, cave gates construction/repair/maintenance, environmental education, invasive plant removal, trail maintenance, litter and trash cleanup, cabin renovation and maintenance, chimney repair, 2010 Ozark Summit administration and support, research and citizen science, and wildlife inventorying and monitoring
- At present there is no formal Friends Group
 - However, the Tulsa Regional Oklahoma Grotto (local chapter of the National Speleological Society) has served as an informal friends group for over 20 years. Being a 501(c) non-profit, they have assisted with numerous projects and have held donated land for the Refuge while going through the long realty process.

3.6.1.2 Administrative Facilities and Infrastructure

Mary & Murray Looney Education & Research Center (MMLERC)

The Refuge currently operates and maintains the Mary & Murray Looney Education & Research Center (MMLERC), a 1,200 square feet, semi-renovated cabin with one meeting room, one office, two bathrooms, one sleeping room, and a kitchen. The MMLERC is ADA-accessible from the parking lot into the cabin. Adjacent to the MMLERC, there is an un-renovated and unused outdoor pavilion consisting of 300 square feet enclosed studio space and a 200 square feet outdoor patio.

Refuge Headquarters Site

The Refuge operates Refuge Headquarters at the MMLERC cabin, which provides only one office and is primarily used for hosting environmental education (EE) and interpretation programs. Refuge staff currently works from various office locations (non-centralized) including the Oklahoma Ecological Services Field Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR.

Access Roads

The Refuge uses and maintains a 0.25-mile, unpaved and unimproved (dirt/rock) access road to the MMLERC, with a gate. There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles near the MMLERC. Excess parking is

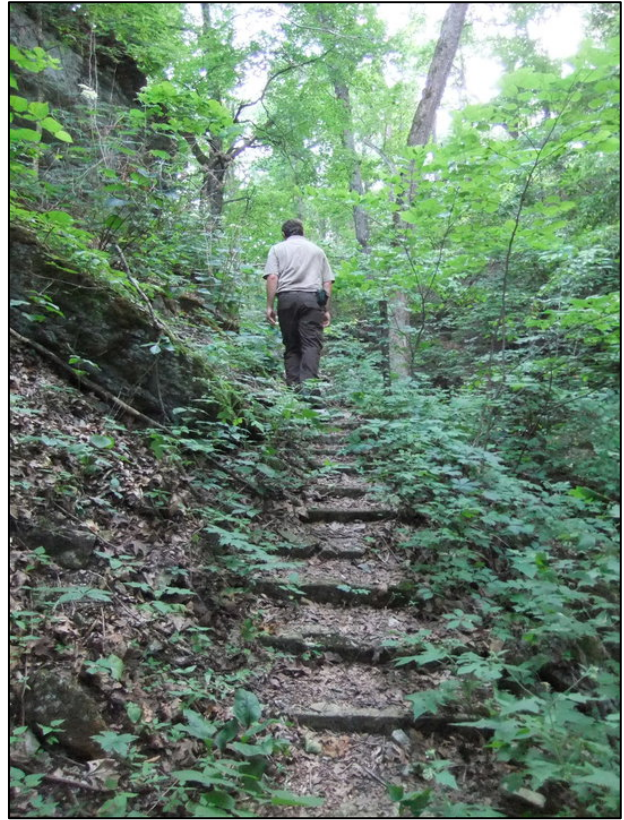
available near the maintenance shop, next to the Guess House (150 yards). Refuge staff utilizes a very narrow access road to the Beck Unit maintenance shop which currently does not have a turn-around area.

Nature Trails and Overlooks

Currently, the Refuge utilizes and maintains a few trails around the Refuge including a deteriorating path from the MMLERC to the pavilion, a small path from the parking area to the MMLERC, one 1/4-mile trail from MMLERC to Spavinaw Creek, 1/8-mile trail from MMLERC to the old garden area at top of hill, 150-yard trail from Guess House to the MMLERC, and 1/4-mile of trails near the Guess House on the Looney Unit. Currently, there are no established overlook areas.

Public Use Signs and Interpretive Displays

Currently, the Refuge neither posts public use signs for any Refuge units, except for at the entrance of caves stating that they are closed to the public, nor posts interpretive displays at the MMLERC or on the Looney Unit. The signs in the cave entrances are designed and placed so as not to draw attention to the cave.



*Walking the lush nature trails of the Looney Unit.
(Credit: Sarah Catchot)*

Boundaries

There are 60 miles of unit boundaries with a total of over 4 miles of fencing and 11 gates that are maintained and repaired by Refuge staff. Only two of the Refuge units have been completely surveyed and marked (see Chapter 2, Table 2-3).

Maintenance Shops and Service Buildings

The Refuge utilizes and maintains two maintenance shops and one storage building including: Beck Unit Shop: 50' x 30' metal building on concrete pad for cave gate construction and storage; Looney Unit Shop: 50 x 30 metal building on concrete pad for all other maintenance and contains a WNS decontamination site; and Guess House metal storage building: 30' x 20'.

Refuge Housing

Ozark Plateau NWR provides Refuge housing for Refuge staff at the Guess House, located on the Looney Unit and one bedroom at the MMLERC cabin for volunteers, researchers, interns,

educators, Refuge staff, and other guests. In addition, the Refuge would currently maintain a life use agreement with Leslie Krause, in which, after he resides and maintains Krause House on the Beck Unit, the house reverts to the Refuge (via donation) at termination of agreement.

Utilities/Right-of-ways

The only utility right-of-ways on the Refuge are two Public Service of Oklahoma electric utility and telephone right-of-ways on the Looney Unit and Beck Unit. On the Looney Unit, a 1,400 ft. right-of-way runs from the county road on the west side east to the MMLERC cabin and a 1,100 ft. right-of-way runs from the east side west to the Guess House. On the Beck Unit, a 200 ft. right-of-way runs from Highway 10/59 south to the Krause House.

3.6.1.3 Oil and Gas Operations/Management

The Refuge owns mineral rights on all units. Currently, there are no mineral extraction operations on any Refuge lands and none are anticipated in the future.

3.6.1.4 Partnerships

Since Ozark Plateau NWR (originally the Oklahoma Bat Caves National Wildlife Refuge) was established in 1985, the Service staff has continually kept local, municipal, county, state, tribal,



Caving partners and volunteers. (Credit: Steve Hensley)

and Congressional officials and agencies apprised of its activities.. Cooperative partnerships with landowners to protect and manage caves and surrounding habitat on private property have been successful. Numerous collaborative research, monitoring, protection, mapping, and management ventures have helped protect the Ozark big-eared bat, gray bat, and Ozark cavefish populations and helped prevent extinction of other federally listed species as well as reduce the need for future listing of species of concern.

In addition to acquiring fee title and conservation easements from willing sellers, the Service has also purchased management easements from TNC. It has also developed management agreements with the City of Tulsa and the Cherokee Nation for certain tracts of land and established an inter-agency agreement with the Ozark National Forest in Arkansas to coordinate cave and karst management. In addition, the Service worked with the Oklahoma Department of Wildlife Conservation (ODWC) to develop a project to protect caves and foraging habitat on private land that is funded through Section 6 of the Endangered Species Act. The Service's

Partners for Fish and Wildlife Program has also been used to assist private landowners in protecting caves and foraging habitat on their lands. In addition, the Service is helping to implement the Natural Resource Conservation Service's (NRCS) Healthy Forest Reserve Program to protect federally listed cave species in eastern Oklahoma on private land surrounding the Refuge.

Partnerships continue to be an important part of the Refuge's actions to acquire, manage, and conserve lands, inventory and monitor, conduct research, assist in protecting and restoring habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation. The Refuge continues to build and maintain relationships with landowners adjacent to and near the Refuge, private businesses, citizen science groups/projects, NGOs, local, state, tribal, and federal agencies (for a full list of partners, see Chapter 5, Table 5-1).

3.6.1.5 Memorandums of Understanding & Agreements

The Refuge maintains partnerships with private landowners, conservation organizations, state, tribal, and federal agencies through conservation agreements, memoranda of understanding (MOU), the Partners for Fish and Wildlife Program, Section 6 of the Endangered Species Act, and provides technical assistance. Currently, the Refuge has a conservation agreement (in need of updating) adjoining the Liver Unit in Adair County with the Cherokee Nation to protect and provide cave access across 120 acres. Also the 130 acre-Eucha Unit is managed through a conservation agreement with the City of Tulsa on Spavinaw Creek and adjoins the Beck Unit in Delaware County. It protects a historic federally listed endangered Ozark big-eared bat cave and groundwater recharge areas to an aquifer used by federally listed threatened Ozark cavefish. Also, the Refuge has entered into a memorandum of agreement (MOA) with Ozark National Forest just across the state line in Arkansas and Region 4 of the Fish and Wildlife Service to cooperate on cave management and cave species monitoring. In addition, the Refuge works with the National Speleological Society (NSS) through a national memorandum of understanding between the Service and NSS to assist with implementation of the Federal Cave Resource Protection Act to help with cave management, exploration, mapping, inventorying, resource monitoring, cave gate construction, clean up, and search for important undiscovered caves and other karst resources. The Refuge also works with Bat Conservation International (BCI) through a national memorandum of understanding between the Service and BCI to protect, study, and manage bats and their habitat.

3.6.1.6 Law Enforcement and Resource Protection

The Refuge currently shares a Law Enforcement (LE) Officer with Sequoyah NWR and works with the Service's Zone LE Officer from Salt Plains NWR and Division of Law Enforcement out of Edmond, OK. In addition, it relies on assistance from ODWC Game Wardens, County Sheriff

Deputies, Oklahoma Highway Patrol, and Cherokee Nation Marshals. The Refuge has also worked with other state, tribe, and/or federal LE agencies to ensure legal compliance, safety, and protection of Refuge resources.

3.6.1.7 Safety

The Refuge currently follows their (draft) Ozark Plateau NWR Station Safety Plan, Cave Safety Plan, and utilizes a cave-specific “job hazard analysis”, which identifies risks and recommended protective measures for caving activities.

3.6.2 Current Landscape-level Management

3.6.2.1 Ozark Habitat Loss & Fragmentation

Land and Conservation Easements Acquisition from Willing Sellers and Conservation Agreements

The Refuge addresses habitat loss and fragmentation by acquiring land and conservation easements from willing sellers (up to 15,000 acres) and entering into conservation agreements with private landowners, conservation organizations, state, Tribal Nations, and other federal agencies. The Refuge does not build or permit the construction of any new roads or infrastructure on Refuge lands except for Refuge operation purposes and would continue its practices of maintaining and restoring forested habitat as resources allow. Conservation Agreements with Cherokee Nation, City of Tulsa, and private landowners continue to preserve forested and/or cave habitats.

Restoration

The Refuge restores 70 acres of agricultural land to forested habitat at the Beck Unit. Additionally, the Refuge maintains approximately 4,000 existing acres as forested habitat.

3.6.2.2 Climate Change

Monitoring

The Refuge staff and university partners monitor baseline cave microclimates with temperature and humidity loggers, which record data every fifteen minutes or every hour everyday year-round. The loggers are located in one Refuge cave and one cave managed jointly with TNC.

Service staff and university partners monitor known maternity colonies and hibernacula annually. Two techniques are used to estimate colony size at these caves. 1) Conduct an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography. 2) For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. Acoustic monitoring is also used to gain insight on use of Refuge tracts and caves by bat species.

The technique used at the hibernacula consists of entering the cave and counting the bats. Monitoring bat population sizes on private, State, Tribal, and Refuge lands provides baseline information for understanding how climate change is affecting populations.

The Refuge conducts surveys by contracting with universities, nongovernmental organizations, and working with volunteers to monitor mammals, birds, herps, fish, cave invertebrates, terrestrial insects, and vegetation. Table 3-7 shows surveys that have been completed on the Refuge Units.



Using night vision optics to count bats emerging from summer maternity cave. (Credit: Sarah Catchot, 2010)

Table 3-7. Species Surveys Completed on Ozark Plateau NWR until 2012.

| <i>Species Survey</i> | <i>Management Unit Surveyed</i> |
|----------------------------|---|
| Mammals | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Birds | <ul style="list-style-type: none"> • Sally Bull Hollow • Mary & Murray Looney • Eucha • Beck • Potter |
| Herpetofauna | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Fish | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Cave invertebrates | <ul style="list-style-type: none"> • Sally Bull Hollow • Eucha • Beck • Gittin Down Mountain • Liver • Varmint • Mary & Murray Looney • Potter • Boy Scout |
| Terrestrial insects | <ul style="list-style-type: none"> • Sally Bull Hollow • Mary & Murray Looney |
| Vegetation | <ul style="list-style-type: none"> • Sally Bull Hollow • Gittin Down Mountain • Liver • Mary & Murray Looney |

Green Infrastructure

The Refuge installs and maintains energy-efficient appliances and a heating and cooling system (stove, refrigerator, dishwasher, hot water heater, washer and dryer) at the MMLERC. Water filtration systems are also maintained at the MMLERC and Guess House, thereby reducing the need to bring bottled water onto the Refuge.

Carbon Sequestration

There is no current monitoring of this.

3.6.2.3 Surface and Ground Water Quality & Quantity

Land and Conservation Easements Acquisition from Willing Sellers

The Refuge acquires land and conservation easements from willing sellers to protect the land from development. In the past 25 years, the Refuge has purchased 3,572.35 acres in fee, 162 acres of conservation easements, manages 359 acre of conservation agreements, anticipates purchasing about 400 acres in the next few years, and is approved to acquire up to 15,000 acres from willing sellers in the future. Once acquired, the Refuge implements appropriate forest management practices to control water run-off such as burning to control fuel loads and invasive species, planting native species, thinning, controlling unauthorized grazing, and monitoring the health of the forest and effects of management practices. The Refuge uses adaptive forest management practices on its existing 4,093.35 acres of oak-hickory forest, grasslands, and riparian areas within recharge areas.

Groundwater Mapping

The Service works with private landowners, NGOs, universities, Tribal Nations, USGS, and Regional Service Hydrologist, I&M, and Contaminants personnel to map groundwater recharge areas within the acquisition area, in and around all Refuge units, including private lands, specifically used for locations where Ozark cavefish, cave crayfish, and other important aquatic cave organisms are present. The Refuge identifies all landowners in determined and potential recharge zones and seeks permission to perform delineation process, which consists of using fluorescent-dye tracing to determine recharge areas, general directions of groundwater flow, and minimum and maximum groundwater travel times in days and miles from losing streams as a result of dye tracing.



*Steve Hensley gets wet as he emerges from cave.
(Credit: Shea Hammond)*

Monitoring

The Refuge partners with universities, USGS, EPA, Oklahoma Department of Environmental Quality, and OWRB to monitor surface and groundwater quality (amount of pesticides, nitrates, phosphates, pharmaceuticals, and heavy metals) on and around all units on the Refuge. Water sampling has taken place on the Mary & Murray Looney Unit and other Refuge units.

The Refuge also partners with local municipalities and water authorities to share information about water levels affecting the Refuge. The Refuge coordinates surface water quality monitoring in Spavinaw Creek with the City of Tulsa and the State of Oklahoma. Spavinaw Creek is a water supply source for the City of Tulsa. The Refuge and the City share this monitoring data.

Partnerships

The Refuge works with adjacent and nearby landowners (private, NGOs, state, Tribal Nations and federal agencies) to implement conservation agreements, assist with wildlife management through the Partners for Fish and Wildlife program and Section 6 of the Endangered Species Act, and provide technical assistance.

3.6.2.4 White-nose Syndrome (WNS)

WNS National Plan

The Refuge would implement the actions and standards in the current White-nose Syndrome National Plan (<http://www.fws.gov/whitenosesyndrome/pdf/WNSnationalplanMay2011.pdf>), as it is updated. At this time, the actions include controlling access to caves for only WNS research and monitoring needs, decontaminating cave gear, and monitoring T&E and non-T&E bats to establish baseline data on Refuge and neighboring private-land caves.

Monitoring

The Refuge partners with universities, caving organizations and other NGOs, state, Tribal Nations, USGS, and other federal agencies to monitor for WNS on- and off- the Refuge.

Public Outreach

The Refuge performs public outreach regarding WNS by visiting schools and leading educational or interpretive discussions about the issue, discussing it with local landowners and organizations, and producing exhibits/booths on the topic.

Cave Access Control

The Refuge posts signs prohibiting public entry in all Refuge caves, constructs and maintains cave gates to control access to caves, and receives on-call LE support from Sequoyah NWR.

3.6.2.5 Migration Corridors

The Refuge monitors baseline bird and bat populations in caves and on bat routes using mobile acoustic monitoring to identify high risk areas and locate areas that would minimize impacts of wind energy farms and other development projects.

3.6.3 Current Habitat Management

3.6.3.1 Degradation of Cave, Stream, and Forest Habitat

Cave Protection

The Refuge continues its current activities with caving organizations and other volunteers to build, maintain, and repair approximately 50 cave gates on- and off-Refuge. The Refuge posts signs prohibiting entry at cave locations, continues a policy of maintaining confidentiality of cave locations, and implements the Federal Cave Resource Protection Act. LE officers stationed at Sequoyah



Protective grill over Ozark big-eared bat cave on Liver Unit. (Credit: Steve Hensley)

NWR and a Zone Officer at Washita NWR provide “on-call” response to investigate cave gate vandalism and consult on effective monitoring actions. The Refuge partners with local residents, TNC, Grand River Dam, and State/Tribal Game Wardens to monitor for unauthorized entry to caves and report any sightings or violations to the Refuge Staff. The Refuge staff also removes trash and some graffiti from caves, when necessary.

Fire Management

See Fire Management category below.

Boundaries

The Refuge surveys and marks Refuge boundaries, as funding becomes available.

Partnerships

The Refuge consults with adjacent landowners about any illegal grazing issues and removes any illegal dump materials.

3.6.3.2 Lack of Detailed, Scientific Cave Habitat Data

Research and Monitoring

The Refuge contributes research efforts on the Ozark Subterranean Biodiversity Project, similar projects, and other cave fauna bio-inventories in collaboration with the USFS, NPS, Tribal Nations, state agencies, universities, TNC and other NGOs, on all Refuge units and surrounding private lands. Additionally, the Refuge conducts annual monitoring surveys of bat hibernacula and maternity sites, as well as cavefish and cave crayfish surveys. The technique used at the maternity sites consists of conducting an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography. For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. Acoustic monitoring is used to gain insight on use of Refuge tracts and caves by bat species. The technique used at the hibernacula consists of entering the cave and counting the bats. The Refuge also searches for additional cave locations and cave mapping efforts on known caves with Refuge staff, cavers, NSS and other partners. Cave mapping informs the Refuge staff of overlying landowners and help to identify outreach efforts.



*Refuge Manager and Biologist return to the “light of the sun” after a hard day’s work monitoring in the caves.
(Credit: Shannon Wallace)*

3.6.3.3 Invasive Flora

Fire Management

See 3.6.3.4 Fire Management category below.

Herbicide Treatment

The Refuge does not currently use chemical treatments for invasive flora.

Mechanical Treatment

The Refuge removes invasive plants with hand tools, chainsaws, and uses a tractor to mow approximately 10 acres total one time per year on the Krause, Looney, Sally Bull Hollow, and Eucha Units.

Partnerships

The Refuge continues to work in partnership with the City of Tulsa and Land Legacy for challenge cost-share for invasive plant control using hand tools or mechanical treatment, plantings, and prescribed burning (see 3.6.3.4 Fire Management below). The Refuge also continues partnerships through agreements with private landowners for prescribed burns by Service personnel on approximately 400 acres every 3-5 years. The Refuge also inventories vegetation in partnership with Oklahoma State University to monitor native and invasive plants.



Prescribed burn on the Looney Unit. (Credit: Shea Hammond)

3.6.3.4 Fire Management

Ozark Plateau NWR enhances its Fire Management Program through assistance provided by Service personnel of the Oklahoma/North-Texas Fire Management District (remotely located at Wichita Mountains Wildlife Refuge).

Wildfire Management

The Refuge typically experiences frequent, small-scale wildfires that normally range from a few acres to approximately 500 acres per year.

Management responds to a wildland fire on Refuge lands based on objectives established in the applicable Habitat Management Plan (HMP) and Fire Management Plans (FMP). A wildfire may be concurrently managed for more than one objective. Response to wildland fire is based on ecological, social, and legal consequences of the fire. Responses to wildland fire are coordinated with all affected agencies/tribes/cooperators regardless of the jurisdiction at the ignition point. The appropriate response to wildland fire is dictated by:

- the circumstances under which a fire occurs;
- the likely consequences to firefighter/public safety and welfare; and
- the natural/cultural resource values to be protected

Initial response is the immediate decisions and actions taken to react to an ignition. These decisions and actions may include a management or initial decision to postpone taking action on the ground based on conditions, safety, and/or competing priorities. Initial response to human-caused wildfires will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Unplanned natural ignitions may be managed to achieve HMP and FMP objectives when risk is within acceptable limits. Wildland Fire Decision Support System has tools available to assist in these decision processes, 1)

organizational needs assessment, 2) complexity analysis. Objectives established in applicable HMP and FMPs direct strategy/tactics selected in response to wildland fires on federal land.

The Refuge receives wildfire suppression assistance from local fire departments, the Oklahoma Department of Agriculture, Food and Forestry – Oklahoma Forestry Services, Tribal Nations, and Service personnel and other federal agency personnel. The Refuge pursues funding to implement 1) FireWise activities 2) coordination/training with adjacent volunteer fire departments and 3) community wildfire protection plan (CWPP-e) actions and fuel treatments.

Prescribed Fire Management

The Refuge implements their FMPs on the Looney and Sally Bull Hollow Units. Treatment goals for forest management are to maintain open understory, reduce fuel loads, and foster mature oak-hickory or oak-hickory-pine overstory, while increasing understory diversity through prescribed fire. Prescribed fire is planned on a 3 to 5 year rotation. Although actual acres treated per year vary due to units selected for treatment and treatment boundaries, an annual average of approximately 400 acres per year is treated during the rotation cycle. Currently, the Refuge does not have a FMP to perform prescribed fire management on other Refuge units.

Monitoring

All projects are monitored to determine if treatment objectives were met and to document weather, fire behavior, fuels information, and smoke dispersion. Evaluation reports are to be completed and maintained in the project file and accomplishment reports (namely, FMIS and NFPORS), as per agency requirements.

3.6.4 Current Wildlife Management

3.6.4.1 Threatened and Endangered (T&E) Species and Species of Concern

Monitoring and Research

The Refuge contributes scientific research efforts on the Ozark Subterranean Biodiversity Project, similar projects, and other cave fauna bio-inventories in collaboration with the USFS, NPS, Tribal Nations, state agencies, universities, TNC and other NGOs, on all Refuge units and some surrounding private lands.



FWS biologist handling an Ozark big-eared bat. (Credit: Shea Hammond, 2011)

Additionally, the Refuge conducts annual monitoring surveys of bat hibernacula and maternity sites, as well as cavefish and cave crayfish surveys. The technique used at the maternity sites

consists of conducting an exit count as the bats emerge from the cave at night using night vision optics, thermal videography, and infrared videography. For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. The technique used at the hibernacula consists of entering the cave and counting the bats. Radio telemetry and acoustic monitoring surveys are done to gain insight on migration and movement corridors bat species utilize.

Partnerships

The Refuge partners with private landowners, the NSS, TNC, the City of Tulsa, universities, the Grand River Dam Authority, ODWC, Tribal Nations, and USGS to conduct monitoring and surveys of T&E species on- and off- Refuge. The Refuge also partners with Oklahoma State University and University of Central Oklahoma to perform genetic research on bat species to identify genetic diversity and gather information related to WNS.



Surveying cave crayfish. (Credit: S. Hensley)

Fire Management

See 3.6.3.4 Fire Management above.

3.6.4.2 Migratory and Resident Bird Species

The Refuge conducts bird point counts during the spring and other migration seasons to monitor bird populations and establish data trends over time. The Refuge uses prescribed fire to promote ideal nesting/foraging habitat in Ozark forests for bird species (see 3.6.3.4 Fire Management). The Refuge enforces the policies of limited public use activities and maintains continuous forest habitats to favor interior forest bird species.



“Yellow-throated warbler feeds its fledgling”. (Credit: Phil W./“it’slaterthanyouthink” of flickr.com, 2004)

3.6.4.3 Resident Non-T&E Species

Monitoring

The Refuge conducts mobile acoustic monitoring once or twice a month from the spring through fall from roadways and videography of cave entrances during the spring and summer to determine non-T&E bat population counts and habitat preferences. Collecting this information allows the Refuge to continue assessing population declines due to WNS and habitat loss, focus

conservation efforts on specific habitat types, and fulfill the Refuge's mission of preventing the listing of species.

Bioinventories

The Refuge performs approximately one bio-inventory in 2 or 3 caves every 5 years by volunteers and other partners to monitor other cave species.

3.6.4.4 Invasive Fauna Species and Pest Management

The Refuge does not currently manage for invasive fauna species or pests.

3.6.5 Current Public Use Opportunities

3.6.5.1 Hunting

The Refuge does not currently allow hunting.

3.6.5.2 Environmental Education

The Refuge manages high-quality, environmental education (EE) programs on the Looney Unit and at the Mary & Murray Looney Education & Research Center (MMLERC), by permit only. These programs are limited to 10-20 people, 2 or 3 times per week in the spring and fall, 1 or 2 times per week in the summer, and approximately once per month in the winter. These EE programs are primarily “place-based” on Refuge resources- including on-site, field-based classes and experiential education in Ozark forests, streams, riparian areas, and karst environments on the Looney Unit and/or on nearby private lands in cooperation with local residents.

EE programs are hosted, sponsored, and lead in cooperation with multiple partners. The Refuge works with Ozark Tracker Society to provide place-based EE programs to teach tracking, survival, bird language, and mentoring skills as well as fostering opportunities for people to develop a meaningful relationship with nature. Ozark Plateau NWR also coordinates Refuge-based collegiate-level classes and field trips, with the following universities: Oklahoma State University (OSU), University of Oklahoma (OU), Rogers State University (RSU), Northeastern State University (NSU), University of Arkansas (UA), University of Southern Mississippi, University of Missouri, Missouri State University, and John Brown University. As part of overnight EE programs, NGOs and university groups (of approximately 30 people maximum) camp “primitively” overnight in the designated area, by permit only, approximately 12 weekends per year. Local K-12 school classes conduct site visits to the Looney Unit and MMLERC for resource education programs. The Refuge coordinates with tribal entities to provide tribal-hosted EE programs from a Native American cultural perspective in their Native language and English to share information regarding cultural and natural resources, local ethno-botanical knowledge, and healthy living and cooking using native/natural edible plants. The Refuge works



Coyote mentoring program at the MMLERC. (Credit: Shea Hammond, 2010)

with many other partners including: BCI, Blue Thumb, Boy Scouts of America, Campfire USA, Land Legacy, NSS, Tulsa Audubon Society, TNC, and approximately 1,000 hours from dedicated volunteers.

3.6.5.3 Interpretation

The Refuge manages interpretive programs regarding cave and karst resources for approximately 25 people per month on-site at the Looney Unit and MMLERC, and five to several hundred people per month off-site at schools and events. On-site interpretation programs are conducted in coordination with local residents, BCI, Blue Thumb, Boy Scouts of America, Campfire USA, Land Legacy, NSS, Ozark Tracker Society, Tulsa Audubon Society, TNC, universities including OSU, OU, RSU, NSU, UA, and John Brown University. On-site programs (aside from introductory interpretive discussions for most EE groups that visit the Refuge) are primarily for school and youth groups, civic organizations, naturalists/scientists, university faculty and students, Tribal groups, Service staff, and other agency staff. Interpretation may include short interpretive hikes on primitive trails and discussions that interpret natural and cultural information regarding the Ozark ecoregion, karst ecosystem, geology, water resources, Native American cultural resources and paleo resources, federally listed T&E species, especially about bats and other cave species, species of concern, game and nongame species, migratory birds, and cave technology



Hidden shelter. (Credit: Shea Hammond)

demonstrations (anabat acoustic detectors, real-time infrared and thermal videography, night vision, etc). Refuge staff conducts visits to local K-12 schools, especially in October to make interpretive presentations on bats, usually during the Halloween season.

3.6.5.4 Wildlife Observation & Photography

The Refuge provides wildlife observation and photography opportunities by permit only on the Looney Unit, in conjunction with interpretive and/or EE programs, to view and/or photograph Ozark Plateau NWR's diverse habitats including Refuge forests, streams, and cave exteriors as well as wildlife including resident and migrating birds, mammals, fish, insects and butterflies, etc. There are currently no opportunities for unescorted, unpermitted wildlife observation and photography.

3.6.5.5 Wood Harvesting

The Refuge does not currently permit wood harvesting by the public.

3.6.5.6 Public Outreach

Refuge staff performs public outreach by hosting information booths and making presentations at public shows, such as the Illinois River Festival and the Wildlife Expo in central Oklahoma. The Refuge maintains a Fish and Wildlife Service website with limited information. Confidentiality is maintained to protect sensitive cave and karst resources. As is currently, no pamphlets or fliers about the Refuge are available.

3.6.6 Current Cultural Resource Management

3.6.6.1 Historical Sites

The Refuge protects historical sites by keeping those areas confidential and limiting public access. The Refuge partners with SHPO and Tribal Nations to preserve these sites.

3.6.6.2 Archeological and Paleontological Sites

There are currently four known archeological sites on Sally Bull Hollow, Potter, and Looney Units and short-faced bear and tapir remains on one Refuge Unit. All these sites are kept confidential with limited public access. The Refuge partners with Sam Noble Museum archeologists and paleontologists (from University of Oklahoma), SHPO, and Tribal Nations to preserve all archeological and paleontological sites.

Chapter 4: Management Direction



*Stepping into the future (Looney Unit of Ozark Plateau NWR).
(Credit: Shea Hammond)*

Goals, Objectives, and Strategies Overview

Chapter 4 will guide Refuge conservation management for at least the next 15 years. The goals, objectives, and strategies within this chapter were developed as a result of a long process of defining and understanding Refuge issues and determining sustainable solutions that address the various needs and values of the environment and the community through multiple meetings, conferences, and other methods of communication with the public and various partners and agencies within the Ozark Plateau.

In this chapter, the Refuge outlines its priorities by defining long-term goals that align with Ozark Plateau National Wildlife Refuge's purposes. In order to achieve these goals, it defines measurable and attainable objectives to be accomplished within

the lifetime of this Plan, as long as staffing and funding are available. Following each objective, a rationale is articulated stating why this objective is necessary, and specific strategies are outlined to provide specific examples, ideas, and/or actions in order to meet the objective.

Ozark Plateau NWR organized its management into four broad goal categories including the landscape-level context, wildlife habitat & population management, visitor services, and infrastructure & administration. Throughout the chapter, the Refuge highlights the necessity of working with multiple partners across the landscape in order to achieve its goals. In addition to articulating the future management direction in each objective and subsequent strategy, the core planning team also found it important and useful to identify and include which potential partners the Refuge could work with to realistically accomplish them. For a full list of Ozark Plateau NWR's current and potential partners, see Chapter 5, Table 5-1.

Adaptive Management

Even though the objectives and strategies in this chapter are specifically articulated to guide future management, the Refuge acknowledges that the future remains uncertain. Understanding ecological interactions on the Refuge, anticipating effects of a changing climate, knowing how to prevent and respond to the threat of white-nose syndrome, recognizing that there are gaps in available data, and anticipating changes in funding make future management planning quite difficult and complex. For this reason, the Refuge will use this chapter merely as a guide to stay on track with its overall goals and with intent to achieve current objectives, however, the most effective approach to resource management over the long-term is an adaptive one. Adaptive management is a management style in which the effectiveness of management actions is frequently monitored and evaluated, and future management is modified as needed based on the results of this evaluation or other relevant information as it becomes available. Ozark Plateau NWR will use adaptive management and implement Strategic Habitat Conservation (SHC) on a landscape-level throughout the lifetime of this CCP in order to most effectively prevent extinction and ensure continuing existence of federally listed threatened and endangered (T&E) Ozark cave species, and prevent the need for future listing of species of concern in the Ozarks.

Refer to the table of contents for a brief overview of the four long-term goals and subsequent short-term (15-year span) objectives that provide the context for the future management direction of Ozark Plateau NWR.



Bloodroot; also known as “GiGa UNa(s)TeTlv” in Cherokee.

(Credit: Shea Hammond)

4.1 Goal 1: Landscape-level Context

Collaborate with multiple partners to implement Strategic Habitat Conservation on a landscape-level in order to prevent extinction and recover federally listed threatened and endangered Ozark cave species as well as prevent the need for listing other Ozark species of concern.



Dedicated partners. (Credit: Steve Hensley)

4.1.1 Objective 1: Continue Building Landscape-Level Partnerships.

Throughout the lifetime of this CCP, continue building and strengthening partnerships at a landscape-level on public and private lands, crossing state and regional boundaries, with private landowners, conservation organizations, universities, state agencies, Tribal Nations, Landscape Conservation Cooperatives (LCCs), and other federal agencies to collaborate on addressing conservation issues and solutions, conducting research, sharing technical expertise, educating the public, assisting in land conservation management activities, and leading conservation-related conferences, with the primary objective of preventing the extinction of and recovering federally-listed cave species and preventing the need for listing other species of concern.

Rationale: Although acquiring additional lands and conservation easements from willing sellers for the Refuge itself is the most secure means for protecting habitat for federally-listed cave species and other species of concern, purchase of all areas necessary for the

recovery of these species is not feasible due to the amount of area they would require. For example, Ozark big-eared bats are known to forage within up to a 5-mile radius (Clark et al., 1993) and gray bats forage within a 20-mile radius of caves (LaVal et al., 1977). Furthermore, maternity colonies, hibernacula, and foraging habitat occur in multiple states and Service regions. For example, Sally Bull Hollow Unit lies within one mile of the Arkansas Stateline and Service Region 4 (Southeast). Gray bats migrate between Oklahoma maternity sites and hibernacula in northern Arkansas (Region 4) and southern Missouri (Region 3) (see also Goal 1, Objective 2). Additionally, more than 97% of all lands in Oklahoma are privately-owned (ODWC, 2005). On a landscape level, landowners are essential in maintaining or restoring habitat conditions and protecting cave sites to assist with the overall prevention from extinction and recovery of federally listed threatened and endangered Ozark cave species as well as the need for listing other species of concern.

Maintaining current partnerships, always seeking opportunities for new partners, and continuously building relationships with a variety of landscape-level stakeholders remains to be essential in order for the Refuge to acquire and conserve its lands and enter into conservation easements or agreements from willing sellers, monitor and research, protect and restore habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation.



*A summit brings together landscape-level partners for sustainable management of Ozark ecosystems.
(Credit: Shea Hammond)*

Strategies:

- Work beyond the Refuge boundaries with multiple stakeholders throughout the ecological landscape (private landowners, private conservation organizations, state agencies, Tribal Nations, LCCs, and other federal agencies)
- Contact partners on an ongoing basis to gather and share information and/or ideas in meetings, conferences, webinars, luncheons, etc.
- Lead and/or participate in conservation research and/or education projects that involve multiple partners across boundaries on the landscape-level
- Continue to be involved in the Ozark Summit and other large meetings/conferences with multiple collaborators
- Continue to take a leadership role in the Greenway of the Cherokee Ozarks

- Take a leadership role, present data, and share concerns, questions, and successes in other important landscape-level conservation-related conferences
- Coordinate with partners for conservation easements and conservation agreements
- Educate landowners about incentives such as the Service's Partners for Fish & Wildlife Program, Section 6 of Endangered Species Act, NRCS Healthy Forest Reserves Program, and others and assist with implementation to help private landowners implement natural resource management actions that are complementary with goals of the Refuge
- Provide opportunities for citizen science groups/projects to engage in refuge or off-refuge conservation efforts
- Partner and collaborate with nongovernmental organizations (NGOs) to assist with EE/interpretation programs, coordinating/leading large conservation-related conferences, habitat management, land acquisition, conduct research, monitor, and to share knowledge
- Work closely with private businesses to encourage environmentally-sound business practices
- Collaborate and contract with universities to work together on various research and monitoring projects, assist in coordinating/leading large conservation-related conferences, provide educational opportunities, and to share knowledge
- Coordinate conservation goals/projects with city, county, state, tribal and other federal representatives
- Continually show appreciation, respect, and gratitude to all staff, partners, Friends, and volunteers for their time, energy, and contributions to conservation (verbally, in letters or awards, and by hosting banquets, potlucks, retreats, etc.)

4.1.2 Objective 2: Coordinate Across Service Regions to Better Manage Federally Listed Ozark Cave Species on a Landscape-Level.

Within the lifetime of this CCP, Ozark Plateau NWR will continue Service-wide coordination across state lines and Service regional boundaries to implement Strategic Habitat Conservation on a landscape-level through adaptive management. The purpose is to prevent extinction and help recover all federally listed threatened and endangered Ozark cave species and prevent the need for listing others by protecting and managing important surface and subterranean aquatic and terrestrial habitat as prescribed in the species' recovery plans.

Rationale: The distribution of the federally listed threatened and endangered Ozark cave species (Ozark big-eared bat, gray bat, Indiana bat, and Ozark cavefish) that Ozark Plateau NWR was established to protect and recover, cross several state and Service Regional boundaries. Therefore, in order for the Refuge to achieve its purpose of assuring the continuing existence and aiding in the recovery of federally-listed



Cave management collaboration. (Credit: Steve Hensley)

endangered and threatened Ozark cave species, it is necessary to implement landscape-level SHC by working across state, federal, and tribal borders with in Oklahoma, Missouri, Arkansas, and Kansas and Service Regions 2, 3, 4, and 6.

Ozark Plateau NWR has taken steps within its own Region (2) to implement SHC. Aside from building and maintaining strong partnerships across the landscape-level with various landowners, conservation organizations, cities,

universities, state, tribal and other federal agencies, in 2005, Ozark Plateau NWR was authorized to expand its acquisition area from about 3,000 acres up to 15,000 acres in seven counties in northeast Oklahoma. These partnerships and acquisition of land and conservation easements from willing sellers has lead the Refuge further in accomplishing conservation objectives. However, to fully implement the recovery tasks of protecting essential habitat as identified in the recovery plans for the Ozark big-eared bat (1995), gray bat (1982), Indiana bat (1983; draft 2007), Ozark cavefish (1989), and Ozark cave crayfish (1996), it will be necessary to acquire land and/or conservation easements from willing sellers across state and FWS Regional boundaries into Arkansas, Missouri, and Kansas. This is specifically addressed in Recovery Task 1.4 of the Ozark Big-Eared Revised Recovery Plan. This task can be accomplished by expanding Ozark Plateau NWR's authority to acquire and manage land across these boundaries or by establishing similar new refuges in these various states and Service regions dedicated to protect and manage federally listed cave and karst species.

Ozark Plateau NWR has a unique conservation location because the Refuge lies in northeast Oklahoma near state borders of Missouri, Arkansas, and Kansas, which correspond to the Service Regions 2, 3, 4, and 6 (see Chapter 2, Figure 2-2). Currently, Logan Cave NWR in northwest Arkansas protects an important federally listed gray bat, Ozark cavefish, and Ozark cave crayfish cave and is managed as a satellite of Holla Bend NWR, in Region 4 of the Service. Similarly, Cavefish NWR in southwest Missouri was established to protect the federally listed Ozark cavefish and Pilot Knob NWR in south central Missouri was established to protect an important federally listed Indiana bat hibernaculum; both are managed as satellites of Mingo NWR in Region 3 of the Service.

Management of these satellite cave refuges is challenging due to a lack of dedicated staff and funding as well as unique wildlife and habitat needs. Consequently, over a number of years there has been a cooperative effort among Holla Bend NWR, Mingo NWR, and Ozark Plateau NWR to work together to plan and implement SHC cave and karst management practices on a landscape level on and surrounding these refuges. This cooperation has been beneficial for accomplishing some recovery tasks for Ozark federally listed cave species through adaptive management; however, no formal management agreement is currently in place to ensure that it continues. In addition, Ozark Plateau NWR, Logan Cave NWR, Cavefish NWR, and Pilot Knob NWR are very close to southeast Kansas. There is a small portion of the Ozarks in southeast Kansas where a maternity colony of federally listed endangered gray bats have been documented near Pittsburg, Kansas (Hays and Bingman, 1964). To assure that all federally listed Ozark cave resources are addressed, coordination should be maintained with the state of Kansas and the Service's Region 6 as well.

There are significant Service trust resources throughout the Ozarks in these states that would benefit from expansion of the National Wildlife Refuge System in order to facilitate successful SHC on such a landscape-level. Because Ozark Plateau NWR's authorized purpose is to prevent extinction of federally listed Ozark cave species, help assure their recovery, prevent the need for listing additional species, and because the Refuge has dedicated funds and staff with experience in cave and karst management, Ozark Plateau NWR could manage Logan Cave, Cavefish, and Pilot Knob NWRs as additional management units across these state and regional boundaries. Logan Cave would be most practical because of its proximity to existing units of Ozark Plateau NWR. However, because of the expertise in cave resource management by a number of partners in Missouri and Arkansas, SHC could also be accomplished across state and regional borders by establishing new refuges similar to Ozark Plateau NWR in Regions 3 and 4. In addition, this would foster local, state, and regional support. These two potential new refuges and Ozark Plateau NWR would work closely together across political boundaries to protect and manage a number of Service cave and karst trust resources on a true landscape level in the Ozarks. Details on management logistics on such a large landscape scale regarding staffing and funding would need to be coordinated among Service Regions 2, 3, 4, and 6.

Strategies:

- Coordinate with the state of Arkansas and FWS Region 4 to manage Logan Cave NWR as a unit of Ozark Plateau NWR or in cooperation with Ozark Plateau NWR
- Coordinate with the state of Missouri and FWS Region 3 to manage Cavefish NWR and Pilot Knob NWR as units of Ozark Plateau NWR or in cooperation with Ozark Plateau NWR

- Coordinate with the state of Kansas and FWS Region 6 for Ozark Plateau NWR to cooperatively manage federally listed Ozark cave species
- Establish new acquisition areas within the landscape-level of Arkansas, Missouri, and Kansas and Service Regions, 3, 4, and 6 to include a larger range of all federally listed Ozark cave species (such as the Ozark big-eared bat, etc.) as addressed by the recovery tasks presented in their recovery plans

4.1.3 Objective 3: Acquire Lands within Approved Acquisition Area.

Within the length of this CCP, take a Strategic Habitat Conservation approach to prioritize land acquisition within the approved acquisition boundary of up to a total of 15,000 acres of Refuge land utilizing fee title acquisition, conservation easements and/or agreements from willing sellers with private landowners, conservation organizations, state agencies, Tribal Nations, and other federal agencies to address Ozark habitat loss, fragmentation and to accomplish the Refuge goals at a landscape-level.

Rationale: Some timber harvesting in the region involves the clearing of forested areas and converts them to cattle and other agricultural uses, resulting in the loss of mature tree forests, increasing understory growth, increasing water runoff, and decreasing groundwater recharge. Mining operations near the Refuge remove trees and reduce habitat for bat foraging and other species. Current and projected agricultural uses on the landscape result in a patchwork mosaic of open rangelands, further fragmenting the Ozark forests. The region is also experiencing increasing road and right-of-way construction and other infrastructure development.



Ozarks landscape – Adair County. (Credit: Steve Hensley)

Increased urban and agricultural development and commercial uses of water decreases both surface and groundwater quality and quantity. In a northeastern Oklahoma study, Bidwell et al. (2010) showed that caves and species within the caves were exposed to contaminants including pesticides, antibiotics and other pharmaceuticals, fragrances, and other plasticizers. Potential sources of water contaminants include sewage lagoons, municipal and industrial wastewater treatment outflows, septic systems, mining operations, runoff from landfills, confined animal feeding operations, roads, and agriculture (Aley, 1990; 1999).

The construction of reservoirs over the years has resulted in the loss of some Ozark caves and riparian forests in the ecoregion. Some caves near the reservoirs are flooded periodically, depending on rainfall and lake levels because of hydropower generation and flood control operations, making them inaccessible and uninhabitable by bats. Land acquisition could prevent similar negative effects from occurring in the future.

Strategies:

- Build trust and long-term relationships and enter into conservation easements and agreements with willing landowners
- Collaborate with energy companies, local universities, Oklahoma Department of Wildlife Conservation (ODWC), Tribal Nations, United States Geological Survey (USGS), Service Ecological Services (ES), and other partners to identify and delineate important migration routes to determine important migration and wildlife corridors utilized by resident and migratory bats, birds, and other species as an SHC approach to prioritize potential land acquisition sites (see Goal 1, Objective 7)
- Work with partners to develop a habitat suitability index model to determine optimum forest and cave habitat requirements for Ozark big-eared bats, gray bats, cavefish, and cave crayfish. Use as an SHC approach to prioritize potential land acquisition sites, according to findings from this model.
- Use geological records and work with knowledgeable individuals and organizations such as local chapters of the National Speleological Society (NSS) to search for and assess new important caves within the Ecoregion, used by federally listed cave species and species of concern (see Goal 2, Objective 4)
- Delineate recharge area of cavefish and crayfish caves and use as a SHC approach to prioritize potential land acquisition sites (see Goal 2, Objective 5)
- Once 15,000-acre limit has been acquired within the approved acquisition area, explore the feasibility and need to expand into other areas and/or to acquire additional acreage (a Land Protection Plan would need to be developed)

4.1.4 Objective 4: Implement Climate Change Monitoring & Mitigation Program.

Collaborate with interdisciplinary partners within the first 5 years of the CCP to conduct research and monitoring of climate changes and effects of climate changes on the habitat and wildlife representative of the Ozark Highlands Ecoregion, as well as actively lead efforts in climate change mitigation through use and education of energy-efficient management operations and sustainable infrastructure to last throughout the length of the CCP and to be continued as long as climate change poses a threat to federally listed T&E and native species.



Service staff measuring a guano pile.
(Credit: Steve Hensley)

Rationale: Secretarial Order 3289 establishes a Department of the Interior-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on Tribal Nations, the land, water, ocean, fish and wildlife, and cultural heritage resources that it manages. It also promotes climate change mitigation through the use of renewable energy and reduction of the carbon footprint in management operations. The Service has also recognized the challenge of how to protect its wildlife and habitats in a changing climate (see 2010

Climate Change Strategic Plan and the 2011 *Conserving the Future* vision document of the Refuge System for more information).

The Refuge would like to know more about how climate change is currently affecting and will affect its habitats and species. Data provided by Climate Wizard (www.climatewizard.org, accessed June 2010) indicates that within the area of the Refuge the temperature is expected to warm by about 5 degrees F, while moisture is anticipated to decrease between now and 2050. Changes in climate in and around caves may affect their suitability for different bat species (Newson et al., 2009). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for bats (Newson et al., 2009). It has also been observed on the Refuge that there are temporal variations on migration and birthing of Ozark big-eared bats and gray bats, however, more literature is needed to document this. Warmer and drier conditions may affect surface and groundwater availability, fire regimes, and shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area. Because of the unprecedented scope of affected landscapes, the Service must work together with other federal, state, tribal and local governments, LCCs and private landowner partners, to develop landscape-level strategies for understanding and responding to climate change impacts.

In addition, considering sustainability on all Refuge management levels (habitat and wildlife, infrastructure, administration) such as using renewable energy sources, energy-efficient appliances, and water conservation systems will not only reduce or offset carbon emissions, but will also reduce cost to the Refuge in the long-run. It could also be a great opportunity to be a sustainable living model for visitors and partners.

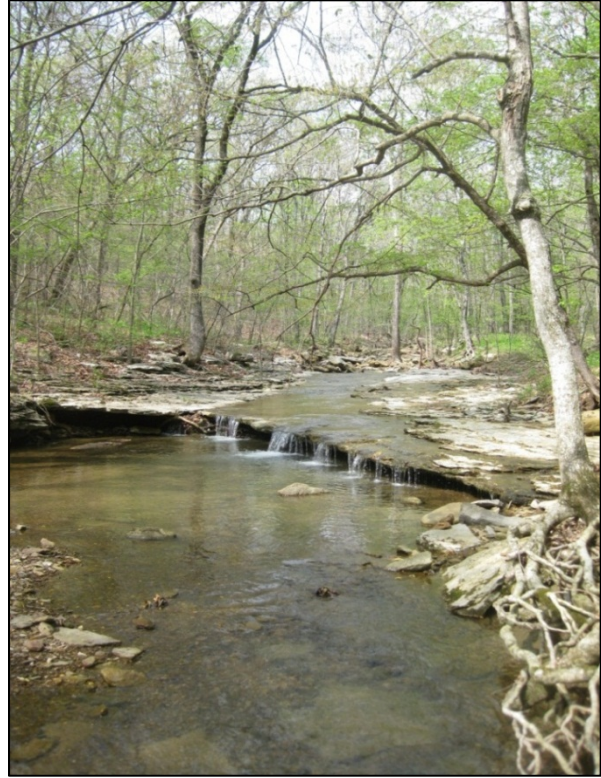
Strategies:

- Sequester carbon by acquiring up to 15,000 acres of land that already have large, continuous stands of native oak-hickory forests and preserving them (see Goal 1, Objective 3)
- Partner with universities to determine the best locations to implement a long-term data logger program to collect air temperature, humidity, light, cave rock temperature, groundwater elevation, and cave stream temperature data at cave, surface and groundwater locations on and surrounding each unit every fifteen minutes or every hour everyday year-round
- Install permanent weather stations at the Looney, Boy Scout, and Sally Bull Hollow Units, and any appropriate new areas acquired to establish baseline climate information and measure trends over time
- Work with university partners to monitor the known maternity colonies and hibernacula annually as a tool for measuring changes of duration and seasonal occurrence to identify potential effects of climate change (conduct an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography; take guano pile measurements in the fall or winter to estimate colony size; perform acoustic monitoring to gain insight on use of Refuge tracts and caves by bat species)
- Work with cooperative landowners, NGOs, universities, state agencies, Tribal Nations, USGS, Service Inventorying & Monitoring (I&M) and other federal agencies to develop a monitoring program and conduct surveys of invertebrates, herpetofauna, fish, birds, and mammals in the Ozark forest, cave, and aquatic habitats as a tool to identify effects of climate change on Refuge wildlife species
- Identify and delineate migration corridors of bat, bird or other wildlife species (see Goal 1, Objective 7)
- Share and present data, surveys, and research with landscape-level conservation partners, organizations, states, Tribal Nations, and federal agencies, as appropriate for climate change findings and mitigation
- Assist in organizing, leading, or presenting information at landscape-level climate change-related conferences
- Install solar panels on the Looney Unit and potentially on any newly acquired or developed buildings, if amount of sun is appropriate, to offset carbon and rely mostly on alternative energy sources
- Use energy-efficient heating and cooling system and appliances (geothermal heating and cooling system, insulation, stove, refrigerator, dishwasher, on-demand hot water, washer and dryer) on all Refuge buildings
- Install a rainwater collection system at the Looney Unit and the Guess House for irrigation purposes

- Use a water filtration system at the Mary & Murray Looney Education & Research Center (MMLERC) and all Refuge buildings to reduce energy and waste associated with bottled water

4.1.5 Objective 5: Implement Water Quantity & Quality Monitoring & Management Program.

Within five years of this CCP, and in collaboration with municipalities, local universities, Service Environmental Contaminants branch of ES Oklahoma Field Office, USGS and other partners, monitor both surface and groundwater quality results at least every 5 years on- or off- Refuge streams and caves and any new caves acquired, measuring contaminant levels and determine how they affect federally listed cavefish and other cave species. Implement a water quantity monitoring program to establish baseline data on trends in water levels by recording water flows at least every two years in Refuge hydrologically-connected caves and streams and those associated with any new areas acquired. Based on monitoring results, subsequently take appropriate management actions, working alongside landscape-level partners, to remediate water issues.



In the Ozarks, water is an extremely valuable resource for both terrestrial and subterranean wildlife.

(Credit: Shea Hammond)

Rationale: In the northern part of the Refuge acquisition area, abandoned lead and zinc mines (Tri-State Superfund Site [the former Tar Creek Superfund Site]) have contaminated surface and groundwater resources. Increasing deforestation and conversion to urban and agricultural land uses in the region is also increasing the volume of water run-off and decreasing the capability of the watershed to filter this run-off. Unfiltered water contains a higher volume of both contaminants and nutrients, such as nitrogen, phosphorus, metals, pesticides, pharmaceuticals, and plasticizers.

Habitat degradation and pollution due to these agricultural activities and development pose serious risks not only to the groundwater quality but are primary threats to aquatic cave fauna such as the threatened Ozark cavefish (Crunkilton, 1984; Culver et al, 2000; Graening and Brown, 2003; USFWS, 2010). The karst environments (i.e. a landscape that is underlain by limestone and caves, sinkholes, springs, and other features and that

has special drainage characteristics due to the greater solubility of limestone) in which the cavefish occur, are highly vulnerable to groundwater pollution. Contaminated surface water can enter the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (i.e. a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. These karst features provide for only minimal natural filtration processes. Once underground, the subterranean network of caves and conduits also allow for additional rapid water movement. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances (Green et al. 2006).

In addition, the quantity of surface and groundwater of the aquifer surrounding the Refuge is being affected by agriculture and increasing urbanization. Impervious surfaces and man-made drainage systems are preventing surface water to seep through the ground and recharge the aquifer in the natural manner that it used to. There has also been an increase in water consumption due to an increasing population in growing urban areas nearby. These contributing factors are lowering surface and groundwater levels, which consequently affect subterranean and aquatic habitats and their respective species on the Refuge and surrounding areas.

Strategies:

- Acquire lands with caves and/or recharge areas or enter into agreements with willing sellers for conservation easements (up to 15,000 acres) to protect groundwater recharge areas for caves, riparian zones for surface streams and springs, and other areas and implement appropriate watershed management (see Goal 1, Objective 3)
- Work with USGS to install small water quality measurement devices (semi-permeable membrane), submerge them in cave water, springs, or other groundwater sources, and streams; leave them for one month, send results to a laboratory for analysis, monitor, and schedule this procedure to re-occur every 5 years in Refuge and hydrologically-connected streams (such as Spavinaw Creek), and caves, (including January-Stansberry, Duncan Field, Crystal caves), as well as off-Refuge (Twin, McGee, Long's, Jailhouse caves) and other acquired or appropriate cave discoveries to measure contaminant levels and determine how they affect cavefish
- Install water quantity devices permanently, to record data constantly, reviewing results every two years to establish baseline data on water levels and identify trends in water levels in January-Stansberry, Duncan Field, Crystal, Twin, other new caves acquired, and any other important caves within the landscape-level

- Work with and educate landowners in implementing private land incentive programs such as the Service's Partners for Fish & Wildlife Program, Section 6 of Endangered Species Act, NRCS Healthy Forest Reserves Program, and others. Assist with implementation to help private landowners implement water resource management such as sustainable forest management practices to enhance natural water filtration in surrounding caves and aquifers, construction of fencing along streams and riparian areas to control access by cattle, restoration of riparian vegetation, and to educate them on their influence on groundwater quality.
- Contract with private companies, universities, and the USGS to map groundwater recharge areas within the acquisition area, in and around all Refuge units, including private lands, specifically where cavefish are present (see Goal 2, Objective 5)
- Consult with adjacent landowners about any illegal grazing issues and remove any illegal dump materials
- Periodically sample prey insects in foraging areas, guano in summer caves, and surrogate bat species to monitor pesticide amounts that may be affecting T&E species and identify source of any pesticides
- Work with landowners, city, county, state, Tribal Nations and other governmental agencies to implement appropriate road construction and maintenance that reduces amount of sedimentation
- Partner with local municipalities and water authorities to share information about water levels and water quality affecting the Refuge, including federally listed species and species of concern
- Coordinate and share surface water quality monitoring information of Spavinaw Creek with the City of Tulsa and the State of Oklahoma environmental and water resource agencies
- Work closely with private businesses to promote sound environmental management practices that affect groundwater and surfacewater levels and quality
- Promote development of local watershed councils, stream teams, and citizen science groups to address local concerns through collaboration and education
- Explore the feasibility of acquiring water rights

4.1.6 Objective 6: Assist with White-nose Syndrome Research, Monitoring, Prevention, and Recovery.

Throughout the duration of this CCP, implement the most current actions recommended by leading researchers, scientific organizations, and agencies in order to monitor and prevent the spread of white-nose syndrome (WNS) on all bat species on- and off- Refuge, as well as implement actions to facilitate the recovery of impacted species. In addition, throughout the lifetime of this CCP, educate and inform the public about what WNS is, how it is affecting bats, and how people can help prevent it from spreading to the Refuge and other caves.

Rationale: WNS is a disease, caused by the fungus *Geomyces destructans*, responsible for unprecedented mortality in cave-hibernating bats in the northeastern and central U.S and eastern Canada (Lorch et al, 2011). This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to cave-hibernating bats throughout North America. More than 5 million hibernating bats have died since 2007 (Froschauer, 2012). Biologists



WNS-affected bat, New York.
(Credit: Ryan von Linden)

with state and federal agencies and organizations across the country are still trying to figure out how to minimize the spread and impacts of the disease and recover impacted populations. To date, seven bat species are known to be affected by the disease: gray bat *Myotis grisecens*, the little brown bat *M. lucifugus*, eastern small-footed bat *M. leibii*, Indiana bat *M. sodalis*, northern long-eared bat *M. septentrionalis*, big brown bat *Eptesicus fuscus*, and the tri-colored bat *Perimyotis subflavus*. Four of these species, (gray, the northern long-eared, big brown, and tri-colored bats) occur on areas managed by the Refuge. Although the fungus *Geomyces destructans* was found on a cave myotis in northwestern Oklahoma in 2010, the disease WNS has not yet been documented on the Refuge. However, scientists predict that WNS will continue to spread, making it even more critical to address the issue in a future management direction.

Strategies:

- Acquire lands with caves and/or recharge areas or enter into agreements with willing sellers for conservation easements (up to 15,000 acres) to increase protection of cave resources and monitor caves of WNS (see Goal 1, Objective 3)
- Coordinate and partner with caving organizations, NGOs, universities, state agencies, Tribal Nations, USGS, and other federal agencies to implement a permanent monitoring program in forests and caves on- and off-Refuge to monitor for WNS and determine which bat species are being affected by it
- Partner with caving organizations, laboratories, state and tribal agencies in Oklahoma, Missouri, and Arkansas, USGS, and ES to track movement and occurrence data of WNS for each bat species, search for bat mortality in caves, collect data on soil and cave substrate samples, and search for physical signs of WNS-affected bats
- Coordinate with wildlife health organizations, zoos, universities, state, Tribal Nations, ES and other agencies to assist in the recovery of impacted species and

implement effective mitigation strategies, (i.e., environmental manipulations, vaccines, captive management program, etc.) to reduce or eliminate *G. destructans* from affected bats or sites, as they are identified

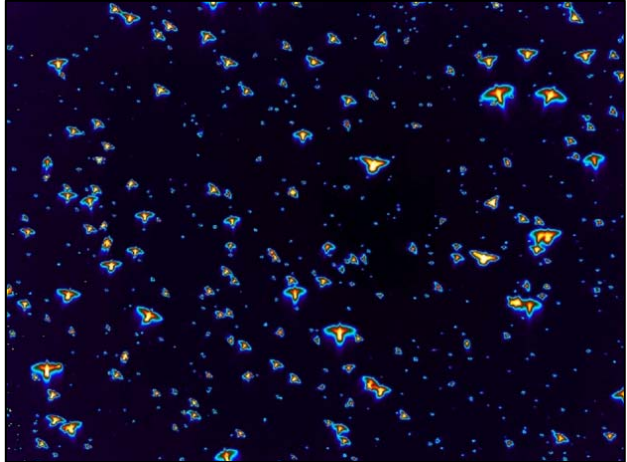
- Collaborate with academic, scientific, and wildlife conservation partners to take an active role in participating in various WNS research projects using Refuge resources
- Share, report, and compare findings with NGOs, researchers, universities, state, tribal, and federal partners including national participating diagnostic laboratories for WNS
- Conduct genetic sampling to identify which populations are genetically isolated, by comparing nuclear and mitochondrial DNA among bats from essential maternity caves to assist in WNS research (Weyandt et. al., 2005)
- Identify and monitor important roost trees, caves, and foraging habitats of bat species that have been known to be affected by WNS (i.e. northern long-eared, big brown, and tri-colored bats, etc.)
- Coordinate and partner with caving organizations, other NGOs, public, private, and home schools, universities, Tribal Nations, states, and other agencies to conduct public outreach regarding WNS by visiting schools, discussing the issue with local landowners, producing exhibits at the MMLERC and at festivals, conferences, and schools, and include information on WNS in environmental education and interpretation programs
- Increase cave monitoring, especially as more lands are acquired (up to 15,000 acres), and utilize law enforcement (LE) support to assist when needed, to prevent the potential spread of the fungus by unauthorized entry
- Maintain and continue construction of cave gates to control access to caves and prevent the potential spread of the fungus by unauthorized entry
- Investigate the feasibility and necessity of installing motion- and light-activated alarms inside all essential maternity and hibernacula caves, and do so when and where deemed feasible. The alarms would notify Refuge staff and LE of any intruders and would record occurrences.
- Identify and delineate migration corridors of bat, bird or other wildlife species (see Goal 1, Objective 7)
- Share and present data, surveys, and research with landscape-level conservation partners, NGOs, states, Tribal Nations, and federal agencies, as appropriate for the prevention of and recovery from WNS of all bat species
- Implement all other actions under the most current WNS National Plan (Plan is available online at <http://www.fws.gov/whitenosesyndrome/pdf/WNSnationalplanMay2011.pdf>), as it is updated, and WNS Response Plan for the State of Oklahoma (http://www.wildlifedepartment.com/wildlifemgmt/Oklahoma_Response_Plan_WNS.pdf)

4.1.7 Objective 7: Identify Migration Routes/Habitat Corridors.

Implement monitoring and research projects in collaboration with energy companies, local universities, ODWC, Tribal Nations, USGS, Service ES, and other landscape level partners to identify important migration routes and habitat corridors utilized by resident and migratory bats, birds, and other species within 5 years of the CCP's approval.

Rationale: These research projects are necessary to acquire more information on migration routes, which could be beneficial for future conservation planning efforts. Identified migration routes could inform SHC planning of land acquisition. In order to understand how climate change affects migratory routes utilized by various species, the routes must first be identified and delineated. Knowledge of migratory routes would also be beneficial during early planning stages

of development projects in order to minimize the impacts to migratory species. Wind energy farms on migration routes, for example, cause mortality in migratory bird and bat species due to direct strikes and barotrauma from turbine blades (Johnson et al, 2002). Additionally, due to the spread of and devastating effects caused by WNS, identifying migration routes will be critical to cave ecosystem conservation efforts at the landscape-level.



Thermal image of purple martins. (Credit: University of Oklahoma Animal Migration Research Group)

Strategies:

- Collaborate with multiple landscape-level partners and take an active role in participating in various wildlife migration corridor identification research projects on- and off- Refuge
- Utilize various methods (i.e., conduct acoustic route monitoring, banding, tagging, and using radio transmitters, radar technology, and other technology) to identify migration corridors of bat, bird or other wildlife species
- Use GIS to delineate high risk areas based on identification of migration corridors
- Conduct genetic sampling to identify which populations are breeding, by comparing nuclear and mitochondrial DNA among bats from essential maternity caves (Weyandt et. al., 2005)
- Participate in ES project reviews, when necessary, of any proposed wind farms or other development projects in the ecoregion

- Share and present data, surveys, and research with landscape-level conservation partners, organizations, states, Tribal Nations, and federal agencies, as appropriate

4.2 Goal 2: Wildlife Habitat & Population Management

Protect, enhance, conserve and restore Ozark natural caves, springs, streams, aquifers, wetlands, watersheds, forests, and groundwater recharge areas to prevent extinction and recover federally listed cave species as well as prevent the need for listing other native species including migratory birds and other species of concern in the Ozarks to promote natural species diversity on a landscape-level.

4.2.1 Objective 1: Protect, Enhance, and/or Restore Forested Habitat.

Over the lifetime of this CCP, protect, enhance, and/or restore approximately 4,038 acres (and up to 15,000 acres of approved acquired land) of upland and riparian forested habitat to conditions believed to exist prior to European settlement on- and off- Refuge in order to improve the overall health of the forest ecosystem, enhance opportunities for foraging, provide movement corridors, and offer watershed protection for the benefit of migratory birds, bats, and other cave species. Desired forest conditions include a moderately-stocked, healthy forest that is able to naturally regenerate, with a well-developed understory dominated by native grasses and forbs, with a small shrub and woody component.



Prescribed fire on the Looney Unit to restore forest to its natural conditions. (Credit: Shea Hammond)

Rationale: Early descriptions of the Ozark region of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). However, since European settlement, suppression of the natural fire regime has led to overcrowded forest

conditions. In addition, many fragments of forest were cut for commercial logging. As a result, today's remaining forest areas mostly consist of exceedingly high densities of even-aged stands with an excessive fuel load and a lack of well-developed understory. Current conditions not only lead to unnatural and uncontrollable wildfires, but they are also not ideal for native vegetation and wildlife to thrive as they once had. Forest habitat restoration measures (such as prescribed fire, thinning, native planting, etc.) that mimic the historic fire regime and maintain a natural mosaic of plant communities representative of the ecosystem will reduce the risk of unplanned, high-intensity wildfires while also supporting a greater diversity of native flora and fauna. In addition, continuing to implement natural disturbances will help to increase ecosystem resiliency to climate change (Tartowski, et. al., 1997).

The authorized purpose of Ozark Plateau NWR is to prevent extinction of federally listed endangered and threatened Ozark cave species, help in their recovery, and reduce the need for future listing of species of concern in the Ozarks. Restoring habitat on and surrounding the Refuge to conditions that promote a more open, and regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) is anticipated to provide an enhanced foraging environment and abundant food source for the Ozark big-eared bat, and protect important flight corridors for gray bats. Another purpose of Ozark Plateau NWR is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that must nest some distance from an edge. The forest also plays an important role in preventing degradation of water quality in caves used by the Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish. Because surface water enters groundwater systems rapidly in karst areas, degradation of sensitive underground habitats used by the cavefish can occur rapidly. Large stands of healthy forest provide natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter water bodies from surface run-off. In order to implement SHC to sufficiently increase habitat diversity on a landscape-level to prevent extinction of these listed cave species, it is important that mature Ozark forest is restored and maintained, and that management practices adapt to the species' habitat requirements, as they are identified. (USFWS [BABO HFRP], 2010).

Strategies:

- Use SHC planning to establish wildlife corridors to connect tracts of Ozark hardwood forest or to connect Ozark forest with other habitat types such as riparian forest, other large tracts of continuous stands of Ozark forest, and other protected lands (e.g., National Forest, State wildlife management areas, tribal lands, etc.) through land acquisition and entering into conservation easements and/or agreements

- Acquire lands or enter into agreements with willing sellers for conservation easements (up to 15,000 acres) to manage and/or restore acquired lands to appropriate habitat (i.e. mature oak-hickory forest habitat) (see Goal 1, Objective 3)
- Verify the accuracy of existing data regarding forested habitats (including flora surveys) and trends in populations of species affected by this habitat (i.e., Ozark big-eared bat, Gray bat, Ozark cavefish, Ozark cave crayfish, migratory songbirds, woodland moths, Ozark chinquapin, etc.). Maintain and update databases, standardize data collection methods, and perform data collection in consistent intervals to ensure proper health and management of forest ecosystem.
- Utilize information, as peer-review literature becomes available, to guide adaptive management strategies toward most appropriate forest conditions and high quality habitat possible for the benefit of federally listed cave species and migratory birds
- Work with Service I&M on GIS projects to identify and map the distribution and the condition of forest, woodland, and savannah habitats on- and off- Refuge to establish baseline conditions on a landscape-level
- Work with partners to evaluate the effectiveness of various forest management strategies (e.g., prescribed fire, midstory thinning as a tool to diversify forest structure to increase understory vegetation) and use adaptive management accordingly
- Work with and educate landowners in implementing programs such as the Service's Partners for Fish & Wildlife Program (see <http://www.fws.gov/partners/>) and the NRCS Healthy Forests Reserve Program to help private landowners enhance habitat surrounding caves by teaching them how to implement adaptive sustainable forest management practices (i.e. maintain their land in oak-hickory forest, encourage groups of landowners to work together to manage habitat for hunting leases or hardwood timber production, restore Ozark oak-hickory forest on non-utilized pastures or crop fields, and provide cost-share funding to install fences to control cattle grazing within this habitat type, provide cost-share for educational programming of habitat conservation and management for the public and private landowners, etc.)
- Preserve, maintain, and/or restore forested and/or cave habitats as per formal and informal agreements with private landowners, The Nature Conservancy (TNC), Land Legacy, NSS, the City of Tulsa, Oklahoma Scenic Rivers Commission, ODWC, Tribal Nations, Natural Resource Conservation Service (NRCS), Grand River Dam Authority (GRDA), Army Corps of Engineers, Ozark National Forest, and other organizations or agencies
- Update outdated agreements and develop additional formal conservation agreements where possible to ensure the preservation, maintenance and/or restoration of forested and/or cave habitats
- Support cooperative efforts between utility companies, cities, counties, research institutions, Tribal Nations, and other government agencies to develop best

management practices and management recommendations to minimize the impact of road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices

- Distribute informational materials with guidance on adaptive sustainable forest management practices and recommendations to landowners, utility companies, Tribal Nations, and other governmental agencies (reassess/update and redistribute when possible)
- Develop and/or distribute educational materials for schools and landowners that highlight the value (i.e., ecological and economic) of the ecology of hardwood trees and Ozark forests
- Respond to wildland fire based on objectives within Habitat Management Plan (HMP) and Fire Management Plan (FMP) while considering ecological, social, and legal consequences of the fire. Coordinate response to wildland fire with all affected agencies/tribes/cooperators regardless of the jurisdiction at the ignition point. Initial response to human-caused wildfires will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Unplanned natural ignitions may be managed to achieve HMP and FMP objectives when risk is within acceptable limits.
- Continue to implement FMPs for Looney Unit and Sally Bull Hollow Unit for forest restoration to maintain open understory, reduce fuel loads, foster mature oak-hickory or oak-hickory-pine overstory, and increase understory diversity through prescribed fire burns on approximately 400 acres per year in 3 to 5 year rotations
- Develop a FMP for all Refuge Units, including burn plans and a training program for Refuge staff, to increase the use of prescribed fire to one-third of the Refuge's total acreage per year including future acquired lands (approximately 1,300 acres in 2012), in 3 to 5 year rotations.
- Partner with private contractors, local fire departments, Oklahoma State University, the Oklahoma Department of Agriculture, Food and Forestry – Oklahoma Forestry Services, Tribal Nations, National Park Service, the Forest Service, and Service personnel from Wichita Mountains NWR in order to receive firefighting support with prescribed burns on and adjacent to Refuge lands
- Seek and utilize forest management assistance programs to expand partnerships and funding opportunities for management on and adjacent to Refuge lands (e.g., Wildland-Urban Interface Program, which provides financial aid to local fire departments in order to receive firefighting support for prescribed burns)
- Increase the number of agreements with surrounding private landowners for prescribed fire to burn up to 1/3 of the total Refuge adjoining lands on a 3 to 5 year rotation by working with partners (i.e. local fire departments, Oklahoma State University, the Oklahoma State Forestry Division, tribal entities, NRCS, National Park Service, the Forest Service, etc.) to perform outreach and increase communication

- Keep construction to a minimum of any new roads or infrastructure on all Refuge Units, unless necessary (for example, for new Headquarters site or as access roads on newly acquired lands are needed)
- Define Refuge boundaries for public awareness and to increase LE capabilities by contracting surveyors to survey and mark all unsurveyed and unmarked boundaries on the Refuge, using permanent metal boundary markers, and maintaining/repairing existing boundary gates and markers
- Reintroduce blight-resistant Chinquapin (*Castanea ozarkensis*) (<http://www.ozarkchinquapin.com/>)
- Work with partners to develop a habitat suitability index model to determine optimum forest and cave habitat requirements for Ozark big-eared bats, gray bats, cavefish, cave crayfish, and other representative species and employ the best adaptive management practices to meet these requirements

4.2.2 Objective 2: Protect, Enhance, and/or Restore Aquatic Habitat.

Over the lifetime of this CCP, through outreach efforts, stronger partnerships and implementation of watershed and groundwater recharge area management practices, protect, enhance, and/or restore surface and subterranean aquatic habitats, on- and off-Refuge, used by federally listed cavefish, and species of concern cave crayfish, and other aquatic species in order to achieve sustainable population trends of these species.



Cave crayfish residing in Twin Cave.
(Credit: Steve Hensley)

Rationale: Conventional agriculture run-off and increasing urban development result in contaminated surface water, which freely enters groundwater with limited natural filtration in areas of karst topography such as in the Ozarks, adversely affecting cavefish, cave crayfish, and other species. In addition, abandoned lead and zinc mines of the Tri-State Superfund Site in the northern part of the Refuge acquisition area have contaminated surface and groundwater resources. Increasing deforestation and conversion to urban and agricultural land uses in the region increases the volume of water run-off and decreases the capability of the watershed to filter this run-off. Unfiltered water contains a

higher volume of both contaminants and nutrients, such as nitrogen, phosphorus, metals, pesticides, pharmaceuticals, and plasticizers. Degradation of habitat and water quality has been identified as a major threat to aquatic cave species (USFWS Cavefish 5-year Review, 2010).

Agriculture and increasing urbanization also affects the quantity of surface and groundwater of the aquifer surrounding the Refuge. Impervious surfaces and man-made drainage systems are preventing surface water to seep through the ground and recharge the aquifer in the natural manner that it used to. This is lowering groundwater levels, which affect subterranean and aquatic habitats on the Refuge and surrounding areas. An increase in water consumption due to an increasing population in nearby urban areas is also contributing to lower surface and groundwater levels.

Strategies:

- Use SHC planning to establish wildlife corridors to connect tracts of springs, gravel bottom streams, riparian forests, rivers, wetlands, etc. with other habitat types such as wet caves or other protected lands (National forests, State wildlife management areas, tribal lands, etc.) through land acquisition and entering into conservation easements and/or agreements
- Acquire lands or enter into agreements with willing sellers for conservation easements (up to 15,000 acres) to implement appropriate watershed management to protect groundwater recharge areas for caves, riparian zones for surface streams and springs, and other areas
- Work with and educate landowners in implementing programs such as the Service's Partners for Fish & Wildlife Program (see <http://www.fws.gov/partners/>) and the NRCS Healthy Forests Reserve Program to help private landowners enhance aquatic habitats by teaching them how to implement adaptive sustainable land and water management practices (i.e. maintain or restore natural riparian or forest habitats along streams or within recharge areas, promote importance of native flora species and removal of non-native/invasive species, implement appropriate forest management practices to control water run-off such as burning, provide cost-share funding to construct fencing along streams and riparian areas to control access by cattle, provide cost-share for educational programming of habitat conservation and management for the public and private landowners, etc.)
- Preserve, maintain, and/or restore aquatic and/or cave habitats as per formal and informal agreements with private landowners, TNC, Land Legacy, NSS, the City of Tulsa, Oklahoma Scenic Rivers Commission, ODWC, Tribal Nations, NRCS, GRDA, Army Corps of Engineers, Ozark National Forest, and other organizations or agencies
- Develop additional formal conservation agreements where possible to ensure the preservation, maintenance and/or restoration of aquatic and/or cave habitats
- Support cooperative efforts between utility companies, cities, counties, research institutions, Tribal Nations, and other government agencies to develop best management practices and management recommendations to minimize the impact of road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices on surface and subterranean aquatic habitat

- Develop and distribute informational materials with guidance on adaptive sustainable land and water management practices and recommendations to landowners, utility companies, Tribal Nations, and other governmental agencies (reassess/update and redistribute when possible)
- Develop educational materials and programs for schools and landowners that highlight the value (i.e., ecological and economic) of the ecology of aquatic habitats (rivers, wetlands, streams, springs, wet caves, etc.) of the Ozarks
- Keep construction to a minimum of any new roads or infrastructure on all Refuge Units, unless necessary (for example, for new Headquarters site or as access roads on newly acquired lands are needed)
- Remove and rehabilitate or replace culverts and road crossings with new structures that do not create barriers to fish
- Work with local universities, USGS, Service Contaminants, Water Resources, and other Service personnel to implement a permanent water quality and quantity monitoring program (see Goal 1, Objective 5)
- Partner with local municipalities and water authorities to share information about water levels and water quality affecting the Refuge, including federally listed species and species of concern
- Contract with private companies, NGOs, the USGS, and Service personnel to map groundwater recharge areas within the acquisition area, in and around all Refuge Units, including private lands (see Goal 2, Objective 5)
- Define Refuge boundaries for public awareness and to increase LE capabilities by contracting surveyors to survey and mark all unsurveyed and unmarked boundaries on the Refuge, using permanent metal boundary markers, and maintaining/repairing existing boundary gates and markers
- Reduce Refuge use of herbicides and other pesticides in floodplains, riparian areas and cave recharge areas
- Work with landowners, city, county, state, Tribal Nations and other governmental agencies to implement appropriate road construction and maintenance that reduces amount of sedimentation
- Protect wetlands and/or floodplains as they are acquired within the acquisition boundary
- Work with Service I&M and other partners such as NSS to develop inventorying & monitoring programs to evaluate overall health of aquatic habitats and resources in order to evaluate and guide Refuge adaptive management actions
- Use historic literature and field studies to determine probable historic distribution and aquatic conditions, in conjunction with a landscape-level evaluation of location and distribution of surface and subterranean aquatic habitat types
- Work with Service I&M and other partners such as NSS to verify the accuracy of existing data regarding aquatic habitats (including flora surveys) and trends in

populations of representative species, maintain and update databases, standardize data collection methods, and perform data collection in consistent intervals to ensure proper health and management of aquatic ecosystems

- Work with Service I&M and other partners such as NSS on GIS projects to identify and map the distribution and the condition of aquatic habitat on the Refuge to establish baseline conditions
- Work with partners to develop a habitat suitability index model to determine optimum aquatic habitat requirements for Ozark cavefish, Oklahoma cave crayfish, Delaware County cave crayfish and other species as needed, and employ the best adaptive management practices to meet these requirements
- Share results of ecological monitoring and studies to land and water use planners, and conservation and scientific agencies
- Explore the feasibility of acquiring water rights

4.2.3 Objective 3: Provide Undisturbed, Safe, and Protected Cave Habitat.

Provide undisturbed, safe, and protected cave habitat by eliminating cave vandalism incidents throughout the length of this CCP for the benefit of natural resources, bat species, and other cave species on-Refuge and off-Refuge. This will be accomplished by implementing the Federal Cave Resources Protection Act and working with landowners, conservation organizations, state agencies, Tribal Nations, and other federal agencies.

Rationale: Human disturbance and vandalism are the leading factors in the degradation of cave habitats and decline in bat populations. In recent years, people have vandalized cave gates, destroyed and removed cave formations, modified passageways, littered, graffitied, and damaged the caves with smoke from fires.

The Refuge routinely repairs cave gates about three or four times per year due to vandalism and unauthorized entry. Disturbance of hibernating bats causes the loss of critical fat stores and increases the probability of starvation during winter, while disturbance at maternity roosts can result in a loss of young (Tuttle, 1979). Protection of caves from human disturbance and destruction are identified as the most important recovery need of the three federally listed



Belles Bluff cave gate. (Credit: Steve Hensley)

cave species known to occur on the Refuge (USFWS Ozark big-eared Bat Recovery Plan, 1995; USFWS Gray Bat Recovery Plan, 1982 ; USFWS Ozark Cavefish Recovery Plan, 1989).

Strategies:

- Acquire lands or enter into agreements with willing sellers for conservation easements (up to 15,000 acres) to protect and/or restore cave habitat and habitat surrounding caves (i.e., riparian recharge areas, oak-hickory forest, grasslands, etc.) (see Goal 1, Objective 3)
- Work with and educate landowners in implementing programs such as the Service's Partners for Fish & Wildlife Program (see <http://www.fws.gov/partners/>), NRCS Healthy Forest Reserves Program and NSS cave management projects to encourage a controlled entry policy to avoid disturbance to cave habitat and its respective species
- Protect and/or restore cave habitats as per formal and informal agreements with private landowners, TNS, Land Legacy, NSS, the City of Tulsa, Oklahoma Scenic Rivers Commission, ODWC, Tribal Nations, NRCS, GRDA, Army Corps of Engineers, Ozark National Forest, and other organizations or agencies
- Develop additional formal conservation agreements where possible to ensure the protection of cave habitats
- Support cooperative efforts between utility companies, cities, counties, research institutions, Tribal Nations, and other government agencies to develop best management practices and management recommendations to minimize impacts to cave habitat and cave species of road, pipeline, and utility line construction, and the impacts of right-of-way maintenance practices
- Develop and distribute informational materials to landowners, utility companies, Tribal Nations, and other governmental agencies with guidance on how to protect cave and karst resources (reassess/update and redistribute when possible)
- Develop educational materials and programs for schools and landowners that highlight the value (i.e., ecological and economic) of the ecology of cave and karst habitats, the need to protect these environments, and highlight protection methods
- Work with the NSS and their local chapters (grottos) and other partners to identify unknown caves (see Goal 2, Objective 4)
- Work with local cavers, NSS, universities, and other partners to map known caves on- and off-Refuge in order to inform the Refuge staff of overlying landowners and to help identify outreach efforts
- Maintain confidential information regarding cave locations on-Refuge and off-Refuge to protect cave fauna, as required by the Federal Cave Resources Protection Act

- Work with Service I&M and other partners on performing biological inventory within caves and tracking data of location and biological composition of known caves
- Work with the NSS and their local chapters (grottos) and other partners to eliminate injuries, illnesses and fatalities in caving and at the same time effectively protect all life that visits or resides within cave environments
- Control access to Refuge caves susceptible to disturbance by constructing appropriately designed gates that allow bat passage (especially for those that host or that have the potential to be occupied by federally listed threatened and endangered species such as Ozark big-eared bat, gray bat, and Ozark cavefish)
- Work with GRDA, TNC, ODWC and ES to increase Section 6 of Endangered Species Act funding and other types of funding for cave gating projects and land acquisition
- Work with landowners, volunteers, caving organizations and other NGOs, the State, Tribal Nations, and other federal agency staff to build, maintain, and repair approximately 50 cave gates on- and off-Refuge, and others as they are needed
- Monitor all cave gates to determine their effectiveness regarding adequate bat use and assess maintenance needs (deterioration due to humid cave environments, vandalism, illegal entry, etc.)
- Delineate all cave recharge areas that have not yet been delineated to identify and/or protect from sources of contamination (e.g., human disturbance, pollution, CAFO, illegal grazing issues, illegal dump materials, etc.). This will guide Refuge prioritization of conservation efforts (e.g., identify stakeholders that the Refuge needs to communicate with and establish a partnership and/or an agreement to mitigate recharge area disturbance) (see Goal 2, Objective 5).
- Post signs prohibiting entry at cave locations and continue the policy of maintaining confidentiality of cave locations
- Increase LE presence and monitoring of caves by Refuge staff and a LE officer based at Sequoyah NWR who would dedicate part of his or her time to working for Ozark Plateau NWR, to include routine visits once every three months or variable by season based on bats' use of the cave
- Define Refuge boundaries for public awareness and to increase LE capabilities by contracting surveyors to survey and mark all unsurveyed and unmarked boundaries on the Refuge, using permanent metal boundary markers, and maintaining/repairing existing boundary gates and markers
- Keep construction to a minimum of any new roads or infrastructure on all Refuge units, unless necessary (for example, for new Headquarters site or as access roads on newly acquired lands are needed)
- Limit the use of adding new man-made fire breaks in order to prevent creation of additional trails and/or off-road vehicle access that may provide access to or near caves

- Install and develop alarm systems and/or infrared video cameras at essential maternity and hibernacula caves on- and off-Refuge to deter and detect cave vandalism
- Also, see strategies in Goal 1, Objective 6 regarding WNS

4.2.4 Objective 4: Locate Additional Caves.

Throughout the life of this CCP, locate additional important caves, defined as “a naturally occurring void, cavity or recess that occurs beneath the earth’s surface or within a cliff or ledge, and includes limestone and sandstone talus caves”, utilized by federally listed cave species (i.e. Ozark big-eared bat, gray bat, Ozark cavefish, etc.) and other cave species of concern within the Ozark Highlands of Arkansas, Oklahoma, and Missouri (Ozark Big-Eared Bat 5-year Review, 2008.).



*Entrance to January-Stansberry Cave on the Looney Unit.
(Credit: Richard Stark)*

Rationale: The measures most important to conserve listed cave species include obtaining and utilizing knowledge of the cave locations used by the species in order to limit human disturbance to occupied caves and protect known caves and surrounding foraging areas from habitat degradation and loss. Essential information, such as the location of caves used by listed species, is often incomplete. For example, numbers of Ozark big-

eared bats estimated from summer maternity counts are larger than those found in winter hibernacula counts. This indicates there are likely major hibernacula being used by this species but that have not yet been located. Locating additional caves and other karst features could help the Refuge take a SHC approach to identify target areas for future acquisition.

Strategies:

- Partner with local cavers, NSS, universities, Tribal Nations, USGS, Service I&M, and others to map full subterranean extent of known caves to identify all surface cave entrances (which may lead to other unidentified caves)
- Map searched and unsearched geological areas that are conducive to cave formation on- and off-Refuge in order to inform Refuge staff of overlying land use and prioritize areas to be searched in the future

- Coordinate with local landowners and perform public outreach to identify unknown cave sites on private lands
- Coordinate with volunteers, cave and geological experts, NSS, universities, Tribal Nations, and other willing partners to locate additional caves within the Ecoregion by “ridge walking”, which includes walking along faults, contacts, depressions, springs, sinking streams and/or other appropriate geological areas which may lead to potential cave locations (Ashbrook, 1996)
- Investigate the use of technology such as satellite and aerial imagery (to look for features indicative of having a cave opening), thermal imagery (to locate potential hot or cold zones), radio telemetry (track bats to unknown roost sites), and others
- Increase partnerships with TNC, Land Legacy, Bat Conservation International (BCI), NSS, other organizations, and Tribal Nations by going to meetings, working on joint cave mapping and identifying projects, and contracting through cost-share or joint funding to assist them with their projects

4.2.5 Objective 5: Delineate Recharge Area of Cavefish and Crayfish Caves.

Within the lifetime of this CCP, work with private landowners, environmental consultants, NGOs, universities, Tribal Nations, state and other federal agencies to delineate the groundwater recharge area of all known cavefish and crayfish caves that have not yet been delineated on or around the Refuge.

Rationale: The recharge area of caves (i.e., the area that contributes water to a cave) used by the Ozark cavefish can be extensive (e.g., 20 square miles) (USFWS [BABO HFRP], 2010). The Ozark cavefish is considered the most adapted of all the cavefish for cave life due to well-developed sensory papillae. They tend to occur in caves with groundwater recharge (as opposed to caves that rely on surface water sources), and generally are acknowledged to be a groundwater obligate. Therefore, knowledge of a cave’s recharge area will help the Refuge identify potential hazards and sources causing ecosystem health issues (i.e., human disturbance, pollution, petroleum production, confined animal-feeding operations (CAFO), grazing issues, illegal dump materials, etc.) and subsequently, will inform which surface areas the Refuge needs to focus its restoration and conservation efforts. In addition, this would help the Refuge to reprioritize which stakeholders they need to establish new partnerships and/or agreements with.



Cavefish. (Credit: Dr. Art Brown)

Strategies:

- Work with private landowners, NGOs, universities, Tribal Nations, USGS, Service Regional Hydrologist, I&M, & Contaminants personnel and other partners to assist in delineation process (outlined in strategies below)
- Identify all landowners in determined and potential recharge zones and seek permission to perform delineation process
- Use fluorescent-dye tracing to determine recharge areas, general directions of groundwater flow, minimum and maximum groundwater travel times in days and miles from losing streams as a result of dye tracing
- Determine relationship between surfacewater drainage basins and groundwater basins
- Produce map of watershed area based on results of the dye tracing (<http://www.nh.nrcs.usda.gov/technical/Publications/Topowatershed.pdf>)
- Acquire lands, conservation easements, and/or enter into agreements with willing landowners (up to 15,000 acres) in determined and/or potential recharge zones (see Goal 1, Objective 3)



*Cluster of Ozark big-eared bats. Hurricane Creek, July 2008.
(Credit: Richard Stark)*

conduct scientific research in order to advance and share information and knowledge regarding the ecology of federally listed cave species and cave species of concern that occur on and off the Refuge.

Rationale: The Refuge was established to prevent extinction of and recover federally-listed Ozark cave species, which include the Ozark big-eared bat, gray bat, Indiana bat, and Ozark cavefish. The Refuge also currently protects nine species of concern to

4.2.6 Objective 6: Inventory & Monitor to Advance Scientific Knowledge Regarding Federally Listed Cave Species and Species of Concern.

Throughout the lifetime of this CCP, work with interdisciplinary partners including private landowners, conservation agencies, universities, Tribal Nations, state and federal agencies to establish an inventory & monitoring program to

prevent the need for future listing. The nine species of concern on the Refuge include the Oklahoma cave crayfish and Delaware County cave crayfish. Currently, there is little known about these Ozark cave species; their habitat requirements, genetics, effects of climate change, and how WNS will affect cave ecosystems. The Refuge would like to address scientific knowledge gaps regarding forest, surface, and cave habitat requirements and breeding ecology of cave species occurring on the landscape-level to better assess and manage for their needs. In addition, there is also a need to contribute to current scientific research regarding identification of genetic diversity and population dynamics of Ozark cave species. This genetic research would help conservation partners understand how climate change and WNS impact different cave species, as well as help to identify undetermined cave species. Increasing scientific data by monitoring, researching, and sharing information at the landscape-level is essential in order for the Refuge to be able to implement the best management practices to meet the needs of federally listed cave species and ensure their continuing existence.

Strategies:

- Coordinate with partners such as TNC, Land Legacy, BCI, NSS, universities, Tribal Nations, NRCS, USGS, and other organizations through challenge cost-share funding for joint projects, ESA Section 6 funding, tribal and state wildlife grants, and other funding where available, to address research needs
- Survey existing literature, reports, and museum records for historic distributions, abundances and habitat affinities of T&E and/or species of concern to assess baseline conditions for future monitoring and examine potential causes of population declines
- Work with local universities, USGS, Service Contaminants, Water Resources, and other Service personnel to implement a permanent water quality and quantity monitoring program (see Goal 1, Objective 5)
- Contract with private companies, NGOs, the USGS, and Service personnel to map groundwater recharge areas in and around all Refuge Units, including private lands, within the acquisition area (see Goal 2, Objective 5)
- Partner with local municipalities and water authorities to share information about water levels and water quality affecting the Refuge, including federally listed species and species of concern
- Continue to participate on cave fauna bio-inventory projects on Refuge units and private lands, such as the Ozark Subterranean Biodiversity Project, with volunteers, TNC and other NGOs, universities, state agencies, Tribal Nations, USFS, NPS, and other agencies, maintaining a scheduled monitoring program in which specific caves (approximately 5 per year) are inventoried on a five-year rotation with species identified by the Refuge to monitor cave resources
- Continue to partner with the private landowners, NSS, TNC, GRDA, the City of Tulsa, universities, the ODWC, Tribal Nations, and federal agencies to monitor

bat activity and population trends annually by using exit surveys, thermal and infrared videography of bat emergence, acoustic monitoring, radio telemetry monitoring of foraging, migration and other movements, guano measurements within maternity and other caves, and hibernacula counts

- Establish permanent, stationary acoustic monitors, both inside and outside of caves, on all Units determined necessary to record bat calls and identify which bat species use which caves and at what time(s) of the year
- Install permanent cameras in the January-Stansberry Cave and/or other appropriate caves to monitor bat activity to provide additional scientific information (i.e., seasonal use of the caves by the bats, observe bat behavior, etc.) and monitor human disturbance. In addition, these cameras could provide online web-streaming during the maternity season for interpretation purposes twenty-four hours per day.
- Identify and monitor important roost trees, caves, and foraging habitats of bat species that have been known to be affected by WNS (i.e. northern long-eared, big brown, and tri-colored bats)
- Implement climate data loggers program (see Goal 1, Objective 4) and develop an I&M program to monitor existing cave habitat conditions trends and determine bat cave habitat preferences
- Utilize radio tracking, a permanent mobile and stationary acoustic survey program, transects, insect surveys, guano dissection, vegetation surveys, and other methods on and around the Refuge to determine listed and non-listed foraging bat species presence and distribution, roost trees, foraging habitat preferences, habitat conditions that affect foraging ecology, and monitor trends overtime. Work with Service I&M to create a database documenting these results and use data to guide adaptive management to maintain and/or restore forest habitat and other bat foraging habitats.
- Assess the effects of forest and cave management practices (i.e. prescribed fire/thinning, etc.) on species' habitat selection, foraging, movement, breeding behavior and population trends
- Work with partners to develop a habitat suitability index model to determine optimum forest and cave habitat requirements for Ozark big-eared bats, gray bats, Ozark cavefish, Oklahoma cave crayfish, Delaware County cave crayfish and other federally listed species and species of concern as needed, and employ the best adaptive management practices to meet these requirements
- Partner with universities, state agencies, Tribal Nations, federal agencies and others to initiate research projects to identify bat migration periods and location of corridors
- Partner with universities, state agencies, Tribal Nations, federal agencies and others on a landscape-level to perform a population viability analysis in order to determine self-sustaining population targets for Ozark big-eared bats, gray bats and Ozark cavefish

- Continue partnering with Oklahoma State University and other scientific organizations to perform genetic research on- and off- Refuge of bat, crayfish, cavefish, and other cave species to identify undetermined cave species, determine population dynamics, identify genetic diversity, etc. by comparing nuclear and mitochondrial DNA samples
- Perform annual monitoring count surveys of cavefish and cave crayfish to understand population trends
- Work with landowners, conservation agencies, universities, Tribal Nations, and scientific agency partners to develop research projects to record and monitor the distribution, abundance, habitat preference, and breeding ecology of Ozark cavefish
- Share and present data, surveys, and research with landscape-level conservation partners, organizations, states, Tribal Nations, and federal agencies, as appropriate for the recovery of federally listed cave species

4.2.7 Objective 7: Inventory & Monitor to Advance Scientific Knowledge Regarding Migratory and Resident Non-T&E Species.

During the 15-year life of this CCP, work with partners to conduct surveys of all wildlife species that occur on the Refuge and within potential acquisition areas and establish an inventorying & monitoring program to advance and share scientific knowledge by researching non-T&E species' population trends, density, distribution, and habitat preferences.



Rationale: Non-T&E bat

Swabbing tri-colored bats for WNS. (Credit: S. Catchot)

species and many other non-T&E native species occur frequently on the Refuge; however, the Refuge is just beginning to collect information on these species. Most likely, there are at least fourteen non-T&E cave-dwelling species at Ozark Plateau NWR (USFS: Ozark-Ouachita Highlands Assessment, 1999). In order for the Refuge to adapt management strategies to meet the needs of its native species, it must first assess population trends, density, distribution, habitat conditions, and examine the relationships between this data in order to understand what habitat conditions most resident native species prefer. Monitoring these non-T&E species over time will help guide conservation efforts on specific habitat types and fulfill the Refuge's mission of preventing the future listing of any species. In addition, WNS remains a threat to T&E

species, species of concern, as well as non-T&E species. More baseline information regarding all species affected by or that affect bat populations could be valuable to assist in efforts to address WNS.

Strategies:

- Coordinate with partners such as BCI, Land Legacy, TNC, NSS, universities, Tribal Nations, NRCS, USGS, and other organizations through more challenge cost-share funding for joint projects, ESA Section 6 funding, tribal and state wildlife grants, and other funding, where available
- Work with local universities, USGS, Service Contaminants, Water Resources, and other Service personnel to implement a permanent water quality and quantity monitoring program (see Goal 1, Objective 5)
- Contract with private companies, NGOs, USGS, and Service personnel to map groundwater recharge areas within the acquisition area, in and around all Refuge Units, including private lands (see Goal 2, Objective 5)
- Continue to participate on cave fauna bio-inventory projects on Refuge units and private lands, such as the Ozark Subterranean Biodiversity Project, with volunteers, TNC and other NGOs, universities, state agencies, Tribal Nations, the USFS, NPS, and other agencies, maintaining a scheduled monitoring program in which specific caves (approximately 5 per year) are inventoried on a five-year rotation with species identified by the Refuge to monitor cave resources
- Survey existing literature, reports, and museum records for historic distributions, abundances and habitat affinities of non-T&E species to assess baseline conditions for future monitoring and examine potential causes of population declines
- Work with cooperative landowners, NGOs, universities, state agencies, Tribal Nations, USGS, Service I&M and other federal agencies to develop a monitoring program and conduct surveys of invertebrates, herpetofauna, fish, birds, and mammals to identify and document all wildlife species occurring on all units of the Refuge, potential acquisition areas, and with cooperating adjacent landowners (compile a species list)
- Perform annual monitoring count surveys of all non-T&E cavefish and mark recapture of cave crayfish to understand population trends
- Continue to partner with the private landowners, NSS, TNC, the GRDA, the City of Tulsa, universities, ODWC, tribal governments, and federal agencies to monitor bat activity, habitat preference, and population trends annually of non-T&E species (tri-colored bats, Northern long-eared bats, big brown bats, etc.) by using methods such as exit surveys, thermal and infrared videography of bat emergence, acoustic monitoring (see strategies below for more specifics), radio telemetry monitoring of foraging, migration and other movements, guano measurements within maternity and other caves, and hibernacula counts

- Establish permanent, stationary acoustic monitors, both inside and outside of caves, on all units determined necessary to record bat calls and identify which bat species use which caves and at what time(s) of the year
- Utilize radio tracking, a permanent mobile and stationary acoustic survey program, transects, insect surveys, guano dissection, vegetation surveys, and other methods on and around the Refuge to determine listed and non-listed foraging bat species presence and distribution, foraging habitat preferences, habitat conditions that affect foraging ecology, and monitor trends overtime. Work with I&M to create a database documenting these results and use data to guide adaptive management to maintain and/or restore forest habitat and other bat foraging habitats.
- Continue partnering with Oklahoma State University, other universities, and other scientific organizations to perform genetic research on- and off- Refuge of bat, crayfish, cavefish, and other cave species to identify undetermined cave species, determine population dynamics, identify genetic diversity, etc. Conduct genetic sampling to identify which populations are genetically isolated, by comparing nuclear and mitochondrial DNA samples.
- Work with landowners, scientific organizations, universities, state agencies, Tribal Nations, and federal agencies to identify timing and location of migration routes and corridors of non-T&E species (i.e. bear, butterflies, Neotropical birds, bats, fish, grotto salamanders, etc.)
- Identify and monitor important roost trees, caves, and foraging habitats of bat species that have been known to be affected by WNS (i.e. northern long-eared, big brown, and tri-colored bats)
- Assess the effects of forest and cave management practices (i.e. prescribed fire/thinning, etc.) on non-T&E species' habitat selection, foraging, movement, and breeding behavior and population trends
- Share and present data, surveys, and research with landscape-level conservation partners, organizations, states, Tribal Nations, and federal agencies, as appropriate for the conservation of natural ecosystems within the Ozarks

4.2.8 Objective 8: Inventory & Monitor Migratory and Resident Bird Species Utilizing the Refuge and Surrounding Landscape.

Throughout the lifetime of this CCP, work with partners such as bird conservation organizations, universities, state, tribal, and federal agencies to survey all bird species using the Refuge and surrounding



*Indigo bunting in the night on Ozark Plateau NWR.
(Credit: Shea Hammond)*

landscape. Develop an inventorying & monitoring program to better understand habitat requirements of these migratory and resident bird species, and finally adapt Refuge management accordingly, based on their conservation needs.

Rationale: The Refuge is located on the western edge of the Ozarks ecoregion and near the eastern edge of the Tallgrass Prairie Ecoregion, resulting in a “crossover” of eastern and western bird species found on the Refuge. Therefore, conservation of these migratory bird habitats is extremely critical, especially in the wake of increasing habitat degradation and fragmentation due to residential, commercial, and industrial development. In addition, one of the purposes of Ozark Plateau NWR’s establishment is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that require nesting some distance from an edge. The Refuge has developed strategies in accordance with protection and management recommendations of the Central Hardwood Bird Conservation Region (Partners in Flight).

Strategies:

- Implement recommendations from the Partners in Flight Plan (such as retain large mature tracts of forest, maintain/promote growth of native grasses and understory vegetation, restore the role of fire, maintain water quantity, quality and vegetation along streams and riparian areas, protect high quality riparian habitat, manage and restore degraded stretches, restore natural flows and flooding regimes, etc.) (see http://www.partnersinflight.org/cont_plan/default.htm)
- Maintain continuous stands of mature oak-hickory for interior forest Neotropical nesting birds (see Goal 2, Objective 1)
- Use prescribed fire to promote ideal nesting/foraging habitat in Ozark forests for bird species (see Goal 2, Objective 1)
- Continue the policies of limited public use activities to minimize disturbance on Refuge lands for the benefit and wellbeing of resident and migratory birds
- Survey existing literature, reports, and museum records for historic distributions, abundances and habitat affinities of migratory and resident bird species to assess baseline conditions for future monitoring and examine potential causes of population declines
- Work with landowners, bird conservation organizations, state agencies, tribal nations, and federal agencies to identify migratory bird species occurring near or on the Refuge during the spring and fall (compile a species list)
- Work with landowners, bird conservation organizations such as the National Audubon Society, universities, state agencies, Tribal Nations, and federal agencies to conduct seasonal nesting studies as well as MAPS banding of birds once a month for six months each year on the Refuge to gather additional data on

migration corridors, paths, origins and destinations, as well as population data trends

- Coordinate with Partners in Flight National Audubon Society, other bird organizations, universities, and other partners on migratory bird conservation management including research such as identify the quantity, quality and spatial configuration of available habitat, link habitat condition and population response, and anticipate future habitat conditions, in order to identify habitat requirements and set and achieve population objectives for priority landbirds of the Central Hardwood Bird Conservation Region
- Share and present data, surveys, and research with landscape-level bird conservation partners, organizations, states, Tribal Nations, and federal agencies, as appropriate

4.2.9 Objective 9: Map, Monitor, Research, and Implement Adaptive Management to Assess and Control Invasive Non-native Flora.

Throughout the lifetime of this CCP, determine the extent of non-native invasive flora on and surrounding the Refuge by mapping, monitoring, and conducting research to better understand



Invasive, Sericea lespedeza.

(Credit: Chris Evans of River to River CWMA)

the scale of the problem and address the issue through adaptive management solutions.

Rationale: Non-native invasive plants alter natural habitat conditions, which consequently affect native wildlife species. Evaluation of invasive and exotic plants that are detrimental to native flora and fauna species and maintenance of natural biodiversity is very important to the Refuge for the overall health and function of natural ecosystems within the Ozarks. The Refuge

must continue working with its partners to assess the extent and threat of non-native invasive flora on and around the Refuge, as well as adapt management actions, if necessary, to control and maintain them. Some non-native invasive species which may outcompete and displace native plants within hardwood forests and/or riparian areas of the Refuge include: *Sericea lespedeza*, tall fescue, Chinese privet, Japanese honeysuckle, Johnson grass, kudzu, beefsteak plant, Nepalese browntop, mimosa trees, and others. A vegetation survey from 2003 found that 8.7% of all plant species occurring on the Sally Bull Hollow Unit of the Refuge were non-native flora (Hayes). A survey is needed to assess and map the distribution of non-native species on all units of the Refuge in order to effectively inventory and monitor as well as manage them. These invasive plant species

may have some effect on bat's prey, including moths and other insects; however, no research has been done on this. Songbirds and migratory birds depend on native plants, shrubs, and trees for nesting, perching, and hosting a multitude of insects for prey. Consequently, non-native invasive flora also affects bird niches. In addition, exotic tree pathogens are affecting native chestnuts and flowering dogwood, which may also be altering forest structure and diversity.

Strategies:

- Coordinate with partners such as the City of Tulsa and Land Legacy for funding for non-native/invasive plant management (i.e., invasive plant removal, plantings, prescribed burning, limited herbicides application, etc.)
- Promote cost-share or incentives programs for private landowners and Tribal Nations to encourage them to control invasive and exotic species on adjacent lands
- Work with partners such as landowners, NGOs, universities, state agencies, Tribal Nations, and federal agencies to identify, document, and monitor all plant species (native and non-native) and map distribution of these species occurring on the all units of the Refuge
- Identify which non-native flora species are causing the greatest (negative) impact to T&E species, species of concern, and/or representative species
- Develop and implement management strategies (in an Integrated Pest Management Plan) to control non-native species causing greatest impacts to ecosystem in order to meet Refuge objectives (such as the use of prescribed burns, the application of minimal herbicide spot treatments, and removal of invasive plants with mechanical treatments including hand tools, chainsaws, and mowing with a tractor) (See also Goal 2, Objective 1)
- Reintroduce chestnut blight-resistant chinquapin (*Castanea ozarkensis*) (<http://www.ozarkchinquapin.com/>)
- Work with Service I&M to develop a monitoring program to evaluate the effectiveness of these control measures and to assess the ecological impacts caused by the use of chemical herbicides and prescribed burns
- Develop educational programs and materials about the ecological damage caused by invasive and exotic vegetation and introduced plant diseases and give practical examples of prevention of spreading and eradication methods

4.2.10 Objective 10: Map, Monitor, Research, and Implement Adaptive Management to Assess and Control Invasive Non-native Fauna.

Determine the extent of non-native invasive fauna on the Refuge to better understand the scale of the problem and address the issue through adaptive management solutions. The Refuge would evaluate the ecological damage done by exotic fauna species, identify the exotic species causing the greatest impact to important native flora and fauna species, develop control or management plans (e.g., trapping, hunting, etc.), monitor the effectiveness of these control measures, and coordinate with and educate private landowners, state agencies, Tribal Nations, and federal agencies to encourage them to control invasive and exotic species.

Rationale: The Refuge is concerned about the increasing number of feral hogs, an exotic fauna species that have been found to forage in oak-hickory or oak-hickory-pine forest on and around the Refuge. Feral hogs compete with native wildlife and destroy habitat used by native species. In addition, they damage riparian habitat and reduce bank stabilization in bottomlands. Feral hogs are currently found on the Sally Bull Hollow Unit in Adair County and moving north toward Delaware and Ottawa Counties, where the Refuge has four units. Feral hog hunting occurs year round on private lands, state lands, and tribal lands, however, currently, the Refuge does not allow any hunting. The Refuge would like to permit hunting of nuisance feral hogs, pending the development of an Integrated Pest Management Plan.



Hothouse millipede, a potential threat to native cave species. (Credit: G.McCormack / CINHP)

In addition, the Refuge recognizes that feral cats prey on bats and migratory birds. Feral cats are currently found on most Refuge units, although the Refuge does not currently document feral cat occurrences.

The Refuge is also concerned about the hothouse millipede, another exotic species abundantly occurring on the Refuge. They may compete with native cave species as consumers of limited energy sources within caves. This species should be studied further to assess its impacts on cave species.

Introduced predatory fish in Ozark streams, such as trout, compete with native fish and may also compete with and forage on cavefish and cave crayfish and other aquatic species.

Strategies:

- Promote cost-share or incentives programs for private landowners and Tribal Nations to encourage them to control invasive and exotic fauna species
- Work with landowners, NGOs, cities, universities, states, Tribal Nations, and federal agencies to identify (survey), document, and monitor all non-native wildlife species occurring on and near the Refuge including feral hog, feral cat, hothouse millipede, and non-native fish populations
- Work with landowners, NGOs, cities, universities, states, Tribal Nations, and federal agencies to conduct studies to evaluate impacts of non-native fauna species (where scientific data is lacking, i.e., hothouse millipede) on cave, stream, riparian forest, bottomland and upland forest communities
- Identify and prioritize the non-native species causing the greatest (negative) impacts to native T&E species, species of concern, and/or representative species on and near the Refuge
- Develop and implement management strategies (in an Integrated Pest Management Plan) to control non-native species causing greatest impacts to ecosystem in order to meet Refuge objectives (such as biological pest control, minimum use of pesticides, trapping, spaying, neutering, hunting, etc.) in cooperation with county personnel
- Work with Service I&M to develop a monitoring program to evaluate the effectiveness of these control measures and to assess the ecological impacts caused by the use of biological pest management, chemical pesticides (if used), and trapping/hunting, and use adaptive management accordingly
- Develop educational programs and materials about the ecological damage caused by invasive pests and non-native wildlife species

4.3 Goal 3: Visitor Services

Provide safe, high quality, compatible, wildlife dependent use opportunities for visitors, students, and nearby residents, to give them an understanding of the importance and value of Ozark cave, spring, aquifer, stream, wetland, watershed, groundwater recharge areas, and forest wildlife habitat conservation efforts.



Environmental education community circle at the Looney Unit. (Credit: Shea Hammond)

4.3.1 Objective 1: Establish a Friends Group and Increase Volunteers.

Within the lifetime of this CCP, establish an official Friends group and recruit and support additional volunteers to assist in management and outreach activities.

Rationale: Currently, the Refuge has approximately 25 individuals as part-time, non-resident volunteers and maintains a relationship with approximately 10 to 15 organizations, including several hundred individuals, that offer volunteer services and labor for Refuge management activities such as cave mapping, cave gates construction/repair/maintenance, environmental education (EE), interpretation, invasive plant removal, trail maintenance, litter and trash cleanup, cabin renovation and maintenance, chimney repair, 2010 Ozark Summit administration and support, research and citizen science, and

wildlife inventorying and monitoring. This adds up to approximately 5,000 to 10,000 person hours total per year. However, increased support is needed to meet all future management objectives as stated in this chapter of the CCP. An official Friends group not only could play a major role in outreach, land acquisition, EE, interpretation, and getting community members more informed and involved, but they could help fundraise for some of these Refuge projects. Currently, the Refuge does not have an official Friends group established.



Salamander food availability study. (Credit: Shea Hammond)

Strategies:

- Coordinate with unofficial Friends group volunteer members, current partners, and other members in the community to encourage the formation of an organized and official Friends group
- Perform outreach to local landowners, NGOs, schools, universities, and Tribal Nations to increase part-time, non-resident volunteers to approximately 10,000 to 20,000 person hours per year
- Train Friends and other volunteers to perform their job/role in a safe, quality, and efficient manner to include citizen science, EE, interpretation, outreach, cave, stream, and forest management, cave rescue and perform other actions as needed
- Work with the Tulsa Regional Oklahoma Grotto, the local chapter of the NSS, and other grottos to maintain a volunteer program to assist with cave mapping, clean up, cave gate construction, and biological surveys
- Continue to work with Ozark Tracker Society volunteers to design and lead EE programs on the Refuge
- Keep Friends and other volunteers “in the loop” on current issues and solutions regarding karst and cave management and other Refuge resources
- Continually show appreciation, respect, and gratitude for Friends and volunteers (verbally, in letters and awards, and by hosting dinners, parties, banquets, etc.)

4.3.2 Objective 2: Increase Public Awareness via Outreach.

Throughout the lifetime of this CCP, utilize a variety of outreach methods to increase public awareness of the ecological importance of Ozark caves, karst environments, aquatic habitats, and forests and the species that live within them, in addition to awareness of the National Wildlife Refuge System, the existence of Ozark Plateau National Wildlife Refuge and its purposes, and opportunities to engage in its wildlife-dependent uses.



Hoppin' on the social media bandwagon.
(Credit: wizmarketings.com, 2012)

Rationale: Increased urbanization in northwest Arkansas and in northeastern Oklahoma is having detrimental effects on natural resources of the Ozark ecoregion. Most people are not conscious of their direct impacts to the land, water, and air, and how those, in turn, affect themselves. Many people in the area are also unaware of the large and delicate Ozark caves and groundwater aquifer (subterranean) ecosystems and native wildlife species that lie underneath their feet. The Refuge recognizes that making people aware of their local environment and their connection to it, is an important first step. Aside from this, in the past,

the Refuge has not offered many public use opportunities in order to focus on wildlife management and protect its fragile cave and karst resources. However, as stated throughout this whole CCP, the Refuge certainly cannot manage to protect these resources alone. It will require various types of partnerships on a landscape-level, in addition to public support and involvement. The Refuge has spent a great deal of time performing outreach with surrounding landowners and State, Tribal, and Federal agencies to successfully cooperate on land conservation efforts. However, most people in the region are unaware of the existence of Ozark Plateau NWR. Public outreach is vital in order to make people aware of who Ozark Plateau NWR is, what the Refuge is doing and why, and lastly, how the public can contribute to its conservation efforts or participate in one of its wildlife-dependent uses. Gaining public support will not only help the Refuge achieve its goals, but will also help the National Wildlife Refuge System achieve its mission.

Strategies:

- Update and maintain Refuge websites and create a Facebook page (<http://www.fws.gov/southwest/refuges/oklahoma/Ozark/>; and <http://www.fws.gov/refuges/profiles/recEdMore.cfm?ID=21645>) to inform the public of current and upcoming visitor use/conservation project volunteer opportunities, including Refuge contact and location information (while cave

locations continue to remain confidential, stating that there is a no-entry cave policy due to concerns about WNS)

- Use social media and blog sites to connect to the public regarding current and upcoming visitor use/conservation project opportunities, share any “fun facts”/news/updates, and provide a virtual space that inspires story-telling of outdoor experiences in the Ozarks
- Create and email e-newsletters updating the public what current projects are going on at the Refuge, including personal stories, upcoming programs/activities, and “fun facts” about cave species and other species on the Refuge
- Create and distribute fliers/brochures to advertise visitor services opportunities at Ozark Plateau NWR
- Design and distribute promotional materials including merchandise (shirts, hats, flashlights, headlamps, coffee mugs, water bottles, etc.) to promote the Refuge and its resources
- Inform visitors as to why there is at present a no-entry cave policy due to concerns about WNS
- Encourage visitors to “spread the word” about their experience visiting the Refuge
- Visit local public, private, and home-school K-12 classes to teach about Ozark Plateau NWR’s conservation efforts and encourage teachers and kids to visit the MMLERC for EE and interpretive programs
- Coordinate and partner to conduct public outreach regarding WNS by visiting schools, discussing the issue with local landowners, producing exhibits at the MMLERC and at festivals, conferences, and schools, and include information on WNS in EE and interpretation programs
- Develop educational materials (pamphlets, posters, handouts, etc.) for landowners, schools, educators (i.e., State Park interpreters), and the general public that highlight the value (i.e., ecological and economic) of the ecology of hardwood trees and Ozark forests, aquatic/riparian areas and aquifers, caves, and bats
- Develop and distribute informational materials with guidance on adaptive sustainable land, cave, and water management practices and recommendations to landowners, utility companies, Tribal Nations, and other governmental agencies (reassess/update and redistribute when necessary)
- Work with partners to distribute educational materials about the ecological damage caused by invasive and exotic species (flora, fauna, and introduced plant diseases), while offering practical methods to prevent spread and/or control

4.3.3 Objective 3: Collaborate to Increase Program Opportunities for Environmental Education.

Throughout the life of this CCP, continue collaborating with many NGOs and partner agencies to increase opportunities for place-based environmental education (EE) programs. These programs would be offered by special use permit only and follow curriculum utilizing Refuge resources including on-site, field-based classes and experiences at the Mary & Murray Looney Education & Research Center (MMLERC) and in Ozark forests, riparian areas, and karst environments. EE programs would be taught to approximately 50-100 people per week, with 3-4 visits per week in spring, fall, and summer, and approximately 10-20 people per week with 1-2 visits per week in winter.

Rationale: Increased urbanization in northwest Arkansas and in northeastern Oklahoma is having detrimental effects on natural resources of the Ozark ecoregion. Most people are not conscious of their direct impacts to the land, water, and air, and how those, in turn, affect themselves. Many people in the area are also unaware of the large and delicate Ozark caves and groundwater aquifer

(subterranean) ecosystems and native wildlife species that lie

underneath their feet and how they are connected to them. EE programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and understand the importance of their local ecosystems, and be able to pass on that knowledge to future generations. The Refuge was also established with the purpose to “...provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks”. In addition, during scoping, many locals and Tribal Nations expressed interest in having more EE programs on the Refuge.

Strategies:

- Continue to conduct EE programs on the Looney Unit, by permit only, in cooperation with multiple local partners such as local residents, NGOs, public, private, and homeschools, cities, universities, state agencies, Tribal Nations, and other federal agencies and continue to foster various EE partnership opportunities as they become available



*Learning natural deer tanning techniques at the MMLERC.
(Credit: Shea Hammond)*

- Continue to write grants, oversee contracting, and do all that is necessary to provide funding to its partnering NGOs in order to provide all EE programming and staffing needs
- Develop a complete Visitor Services Plan within the life of the CCP
- Engage in the planning, development, leadership, and evaluation of EE programs in order to determine effectiveness of current programs and better design future EE programs regarding Ozark Plateau NWR resources
- Provide logistical support and assist partners in program instruction
- Provide material support, including field guides and other Ozark resource references, audio-visual equipment, and ensuring the proper functioning of the MMLERC for EE programs
- In conjunction with EE partners, develop curriculum and workbook documents for current and future EE programs
- Partner with NGO, Ozark Tracker Society to provide monthly Ozark Nature Connection Series programs at a low cost to the public at the MMLERC and in Ozark forests, riparian areas, and karst environments. These programs are designed to facilitate “deep nature-connection” (see Appendix H) via inquiry-based/mentorship pedagogy, which fosters a strong kinship between students and their environment, by utilizing a curriculum that focuses on primitive skills such as ethno-botanical knowledge, edible/medicinal identification/properties, tincture-making, bird language, primitive fire-making, primitive camping, “coyote mentoring” programs, increasing comfort in the wild (nature journaling, hazards identification), tracking (scat, tracks identification), tanning deer-hides, bow drill/hand drill-making, primitive shelter-making, and wilderness survival skills.
- Collaborate with additional partners to assist in sponsoring and leading other EE programs including, but not limited to: Boy Scouts of America (eagle scout projects, badges), Girl Scouts of America (badges), Campfire USA (cave safety, cave/karst biology week), the Missouri Chimney Safety Council (continuing education credits), TNC (wildlife identification, native seed collection education programs), Blue Thumb (water quality education monitoring program), and NSS/BCI (cave gate construction education), Wooten Woods (bird language, music and nature), 8-Shields Institute (art of mentoring), Greenway of the Cherokee Ozarks (local EE programs), CyberTracker (GIS/tracking skills), Wilderness Awareness School (connecting to nature/wilderness awareness), Land Legacy (conservation easement education and resources of Spavinaw Creek), ODWC (game wardens provide hunting education for licensure program), and NRCS (conservation easement education and resources of Spavinaw Creek)
- Develop programs with Blue Thumb, Land Legacy, and other NGOs as well as City of Tulsa, OWRB, Oklahoma Conservation Commission, and Oklahoma Department of Environmental Quality to utilize the Looney Unit as a water quality testing site (Spavinaw Creek, cave streams/springs, etc.) to conduct programs for youth to educate them about water quality and how that affects their

drinking water supply and wildlife, especially federally listed cave species and species of concern.

- Coordinate with local public, private, and home-school K-12 classes to utilize the Refuge and MMLERC for EE to provide quarterly programs that meet state curriculum standards
- Coordinate with participating universities (see Chapter 5, Table 5-1 for complete list) to conduct field-based collegiate-level classes, field trips on-site, and learning survey techniques using Refuge resources or in cooperation with adjacent landowners who allow the classes on private lands
- Work with educational partners to provide a Teacher Continuing Education and General Education Credits Program on the Refuge
- Partner with Tribal Nations to provide tribal-hosted EE programs from a Native American cultural perspective for native youth and adults in their native language and English to share information regarding cultural and natural resources, local ethno-botanical knowledge, and healthy living and cooking using native/natural edible plants
- Collaborate with master gardeners and master naturalists to lead EE hands-on gardening programs on growing traditional foods and herbs (seeds provided by Cherokee Nation) in raised garden beds and landscape design using native plants (aesthetically-pleasing landscape, while also benefitting native wildlife such as birds and pollinators). MMLERC would also be utilized as a quarterly training and meeting site.
- Work with partners such as Wooten Woods, universities, Tribal Nations, and other professional artists of the community to offer curriculum-based art/EE programs to engage people with nature via the arts (outdoor music, photography, film-making, creative writing, basket-weaving, painting, dramatic arts, etc.)
- Conduct some EE programs off-site regarding karst and cave resources for private landowners, local schools, 4H groups, scouts, county officials, and Tribal Nations, etc.
- Incorporate discussions of WNS in EE programs (what it is, how it's affecting bats and entire ecosystems, and suggestions for prevention)
- Incorporate climate change discussions into EE curriculum (climate change awareness, how may it affect the wildlife and vegetation on the Refuge, etc.)
- Install photography blinds and primitive overlook areas on the Looney Unit (see Goal 3, Objective 7) or other units as deemed appropriate
- Develop curricula and conduct training for Service and other partner agencies' staff on effective EE methods based on "coyote mentoring" techniques (see Goal 4, Objective 1)
- Establish an official Friends group to assist in EE coordination/instruction

4.3.4 Objective 4: Collaborate to Promote and Conduct Interpretation Programs.

Throughout the life of this CCP, continue collaborating with many NGOs, tribes, and partner agencies to promote and conduct interpretation programs for approximately 25 people per month on-site at the Looney Unit, and five to several hundred people per month off-site (schools and events) in order to connect people to the natural world around them, especially the Ozark cave, karst, and forest resources representative of the Ozark Highlands ecoregion.

Rationale: Increased urbanization in northwest Arkansas and in northeastern Oklahoma is having detrimental effects on natural resources of the Ozark ecoregion. Most people are not conscious of their direct impacts to the land, water, and air, and how those, in turn, affect themselves. Many people in the area are also unaware of the large and delicate Ozark caves and



Boy interpreting nature in his journal. (Credit: Shea Hammond)

groundwater aquifer (subterranean) ecosystems and native wildlife species that lie underneath their feet and how they are connected to them. Interpretation programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and get a sense of the importance of their local Ozark ecosystems, and be able to share that experience with future generations.

Strategies:

- Continue to conduct interpretation discussions and programs on the Looney Unit, by permit only, and off-site, in cooperation with multiple local partners such as local residents, TNC, Land Legacy, Ozark Tracker Society, NSS, BCI, Becoming an Outdoors Woman, Boy Scouts of America, Girl Scouts of America, Campfire USA, Indian Nation and Tulsa Audubon Society, Blue Thumb, Oklahoma Academy of Science, the Wildlife Society, American Fisheries Society, Wilderness Awareness School, homeschoolers, local public and private schools, zoos and museums, Rogers State University, Northeastern State University, University of Arkansas, OSU, John Brown University, University of Oklahoma, ODWC, Oklahoma Department of Tourism and Recreation, Arkansas State Parks,

Tribal Nations, Natural Resource Conservation Service (NRCS), and other partnership opportunities for interpretation, as they become available

- Provide interpretive programs (aside from introductory interpretive discussions for most EE groups that visit the Refuge) that include short interpretive hikes and discussions that primarily interpret natural and cultural information regarding the Ozark ecoregion, karst ecosystem, geology, water resources, Native American cultural/paleo resources, ethnobotanical plants, federally listed T&E species, especially bats and other cave species, species of concern, game and nongame species, migratory birds (including bird language) and cave technology demonstrations (anabat acoustic detectors, real-time infrared and thermal videography, night vision, etc.)
- Develop a complete Visitor Services Plan within the life of this CCP
- Engage in the planning, development, leadership, and evaluation of interpretive programs in order to determine effectiveness of current programs and better design future programs regarding Ozark Plateau NWR resources
- Provide material support, including field guides and other Ozark resource references, audio-visual equipment, and ensuring the proper functioning of the MMLERC for interpretation programs
- Conduct visits off-site to local K-12 schools, (i.e. make presentations on bats during the Halloween season) to host interpretive talks using video, power point presentations with many visual photographs of Refuge resources, anabat acoustics, night vision, thermal videography, and/or table information booths (sometimes to include real-time thermal videography)
- Provide interpretive talks to other off-site venues or events, including civic centers, organizational meetings, state park events, festivals/fairs (Illinois River Festival), wildlife expos (Wildlife Expo in Central Oklahoma), and tribal pow-wows, using video, power point presentations with many visual photographs of Refuge resources, anabat acoustics, night vision, thermal videography, and/or table information booths (sometimes to include real-time thermal videography)
- Create a partnership with the City of Tulsa to develop an interpretive program focusing on Spavinaw Creek resources and the Tulsa water drinking supply
- Collaborate with master gardeners and master naturalists to lead interpretive programs on growing traditional foods and herbs (seeds provided by Cherokee Nation) in raised garden beds on MMLERC grounds, while discussing the benefits of landscaping using native plants (aesthetically-pleasing landscape, while also benefitting native wildlife such as birds and pollinators)
- Work with partners such as Wooten Woods, universities, Tribal Nations, and other professional artists of the community to offer interpretive opportunities to engage people with nature via the arts (music, craft-making, creative writing, basket-weaving, painting, dramatic arts interpretation, etc.)

- Promote sustainability on-site by showcasing green technologies and sustainable-living methods (i.e., solar panels to offset carbon, energy-efficient heating and cooling system and appliances, rainwater collection system for irrigation, permaculture gardening, drinking water filtration system, etc.) and incorporate these into interpretive talks regarding sustainability
- Incorporate discussions of WNS in interpretation talks (what it is, how it's affecting bats and entire ecosystems, and suggestions for prevention)
- Incorporate climate change discussions into interpretive talks (what is climate change, how may it affect the wildlife and vegetation on the Refuge, etc.)
- Install photography blinds and primitive overlook areas on the Looney Unit (see Goal 3, Objective 7) or other units as deemed appropriate
- Develop model (display) showing interconnectivity of ground and surface water at the MMLERC
- Develop a display on cave history, including historic cave photographs, caving equipment, cave maps, and cave exploration and ecology at the MMLERC
- Create other limited interactive displays of native plants and flowers (for identification and information) and other limited interpretive information
- Install limited interpretive signage on the nature trail at Looney Unit
- Stream a live video from the "bat cam" online, using a remote, fixed camera filming bats from the exterior of the caves at the maternity site during emergence and of bats from the interior of caves and/or pre-filmed and edited videos
- Establish an official Friends group to assist in leading interpretive talks/hikes

4.3.5 Objective 5: Promote Opportunities for Wildlife Observation & Photography.

Throughout the life of this CCP, promote opportunities for wildlife observation and wildlife photography on the Looney and Sally Bull Hollow Units, and on more acquired lands, as suitable, of Ozark Plateau NWR forests, streams, and limestone formations and their respective wildlife.

Rationale: Wildlife observation and photography on Ozark Plateau NWR is important in order for both urban and rural people of this region to have an opportunity to connect to nature, observe and appreciate the natural resources of the Ozarks including cave, karst, forests, and streams, and to be able to share that experience with others. Wildlife observation and wildlife photography are conducted at Ozark Plateau NWR because they are existing, compatible refuge uses and are identified as vital wildlife-dependent priority public uses for the National Wildlife Refuge System.

Strategies:

- Create opportunities for wildlife observation and photography (guided and by permit only), also within EE or interpretation programs, to view and/or photograph Ozark Plateau NWR's diverse habitats (i.e., Refuge forests, streams, and caves) and wildlife (i.e., migratory birds, sightings of mammal, fish, reptile, amphibian and insect and observing [not photographing] bat emergence from exterior of caves)
- Allow wildlife observation and photography on the Looney Unit and the Sally Bull Hollow Unit, once its boundaries are surveyed and marked (open to the public by walk-in access only, at all times of the year aside from hunting season)
- Develop a complete Visitor Services Plan within the life of this CCP
- Explore other opportunities for wildlife observation and photography on newly acquired lands that are compatible with Refuge purposes
- Install photography blinds and primitive overlook areas on the Looney Unit (see Goal 3, Objective 7) or other units as deemed appropriate
- Establish an official Friends group to assist in promoting wildlife observation and photography opportunities



*Interpreting bird language on Ozark Plateau NWR.
(Credit: Shea Hammond)*



*Bow hunter taking his aim.
(Credit: Paul Tessier/iStockphoto)*

4.3.6 Objective 6: Collaborate with ODWC to Provide Hunting Opportunities.

Within 5 years of the approval of this Plan, collaborate with the Oklahoma Department of Wildlife Conservation (ODWC) to allow walk-in, open-access hunting, according to state regulations, adjacent to the state Ozark Plateau Wildlife Management Area (WMA) on the Sally Bull Hollow Unit of the Refuge.

Rationale: Currently, the Refuge does not allow hunting. However, during scoping, many members of the public and the ODWC

expressed interest in having the Refuge open up hunting of Oklahoma State game species

(including deer, turkey, squirrels, quail, and rabbits), in accordance with State regulations. The ODWC requested specifically that the Refuge explore hunting opportunities on the Sally Bull Hollow Unit, adjacent to its Ozark Plateau Wildlife Management Area, which is also open for hunting. As long as the Refuge ensures that hunting will not affect the continuing existence and recovery of federally listed T&E cave species and the sustainability of other native wildlife populations, Ozark Plateau NWR has agreed to develop a step-down Hunt Plan to allow walk-in only access of this wildlife-dependent use, on the Sally Bull Hollow Unit adjacent to the State's hunting area (Ozark Plateau WMA).

Strategies:

- Contract surveyors to survey and mark the Sally Bull Hollow Unit
- Develop a Hunt Plan in collaboration with the ODWC to include details and impacts analysis of allowing walk-in only, open access hunting on the Sally Bull Hollow Unit, according to State regulations. The Hunt Plan would include hunting seasons, animals to hunt, arms/tools allowed, and stipulations, such as distance from caves, etc.
- Once hunting is allowed, inventory and monitor federally listed cave species on the Sally Bull Hollow Unit to identify whether this public use is causing any adverse effects
- If necessary, modify hunting regulations in cooperation with the ODWC to ensure that Refuge objectives are met
- Evaluate the feasibility of allowing hunting on other areas of the Refuge as lands are acquired (such as in the case of acquiring migratory waterfowl habitat, etc.)
- Develop a complete Visitor Services Plan within the life of this CCP

4.3.7 Objective 7: Create More Hiking/Nature-viewing Opportunities.

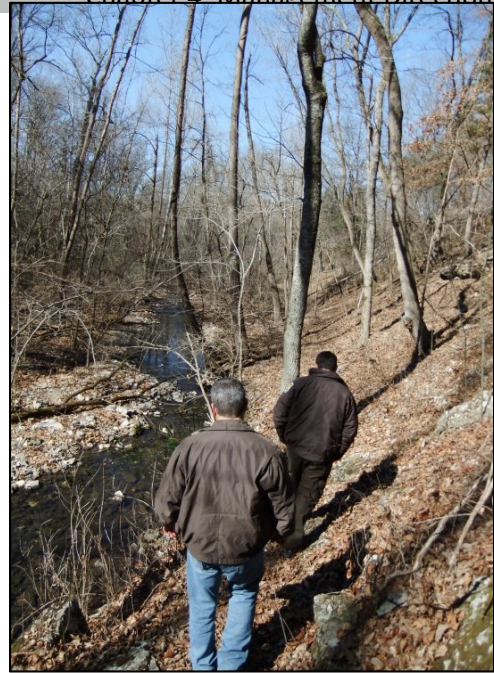
Within 5 years of this CCP, create more hiking/nature-viewing opportunities and install overlook areas for an anticipated increase in visitors to participate in place-based education programs by establishing and improving 2.7 miles of primitive trails on and around the perimeter of the Mary & Murray Looney Unit.

Rationale: Hiking trails are not adequate for the current number of people visiting the Refuge for EE and interpretation programs, let alone the amount of those anticipated in the future. Establishing more trails will make it safer for people to walk and will prevent damage to soils and vegetation. The trail from MMLERC to the pavilion is a paved path that has deteriorated and needs to be repaved. The path from the parking area to the MMLERC also needs to be an improved gravel walkway, approximately 3-feet wide, designed for heavy foot traffic. The remaining trails will be “primitive”. Creating and

maintaining “primitive” trails will provide a basic pathway within its natural surroundings, without involving much heavy trail construction or maintenance. In addition, establishing overlook areas and photography blinds will provide additional opportunities for visitors to connect with nature.

Strategies:

- Establish a 0.25-mile mostly primitive trail to connect the MMLERC Pavilion/Spavinaw Creek trail to the maintenance shop trail (move old concrete, some boulders)
- Build a new 2-mile primitive trail (no clearing or removing of trees or large shrubs, however some boulders may need to be removed and some small creek-crossing bridges may need to be built) around the perimeter of the Looney Unit to connect to the MMLERC-Pavilion-Spavinaw Creek trail, the maintenance shop trail, and the parking area trail
- Repave the 0.1-mile concrete path from the MMLERC cabin to the pavilion
- Improve the 0.25-mile trail with gravel from the Looney maintenance shop to the MMLERC
- Improve the 0.1 mile primitive trail with gravel from the parking/camping area on top of the hill down to the MMLERC to ensure safety
- Install 3 primitive overlook areas on the Looney Unit perimeter trail, to use as stopping points for wildlife observation and photography, environmental education, and interpretation
- Install photography blinds on Looney Unit, or other units as deemed appropriate
- Maintain and reassess primitive trails annually at the end of winter/early spring



Primitive nature trail next to the cave stream on the Looney Unit. (Credit: Sarah Catchot)

4.3.8 Objective 8: Design and Display Refuge Signs.

Throughout the lifetime of this CCP, work with the Division of Visitor Services to design and display Refuge signs marking pertinent visitor location areas on the Looney Unit nature trails, on the outside and inside of the MMLERC, near the maintenance shop, and at the new Refuge Headquarters site.



Sign posted at Ozark Plateau NWR caves. (Credit: S. Catchot)

Rationale: The Refuge does not currently have any public signs posted, except for outside of caves stating that they are closed to the public. The Refuge does not post any public signs that are not deemed absolutely necessary in order to maintain discretion of their unit locations and to keep caves confidential.

Nevertheless, signage on the Refuge will need to be improved throughout the lifetime of this CCP as needed, especially to accommodate the increase of EE programs at the MMLERC.

Many visitors get lost when visiting the Refuge and signage could help orient them. However, the Refuge will not post these signs until the MMLERC is completely secured (alarm system, permanent staffing, safes, etc.). Other interpretive signage on Refuge nature trails could provide a higher quality experience for EE and/or interpretation programs.

Strategies:

- Construct a sign at the MMLERC to say “Mary & Murray Looney Education & Research Center”
- Construct MMLERC sign at the county road entrance, when MMLERC is sufficiently secure
- Establish a Refuge Headquarters sign, once the new Refuge Headquarters is built/established
- Continue to maintain resources confidentiality by not posting public use signs at all other Unit entrances and/or on public access roadways
- Install limited interpretive signage on the nature trail at Looney Unit
- Install signs at all cave entrances to prohibit public entry and inform them about white-nose syndrome

4.3.9 Objective 9: Survey and Mark Refuge Boundaries.

Throughout the lifetime of this CCP, assure that all Refuge boundaries and their respective gates and fences are maintained and repaired, and that all unsurveyed and unmarked Refuge boundaries are properly surveyed and marked, while continuing to maintain the confidentiality of resources by not posting public use signs at unit entrances and/or on public access roadways.

Rationale: The Refuge must identify and mark their boundaries in order to know their physical limitations between adjacent private or public lands for performing management activities. This also increases public awareness of where refuge lands occur, which can help increase Refuge LE capabilities. Currently, there are over 60 miles of unit boundaries with a total of over 4 miles of fencing and 11 gates, that are maintained and

repaired by Refuge staff. Only two of the Refuge units have been completely surveyed and marked. The table below (table 4-1) shows an assessment of current Refuge boundary needs and infrastructure to maintain.

Table 4-1. Refuge Boundary Assessment (2012)

| Refuge Unit | Boundary | Surveyed? | Marked? | Fencing? | Gates? |
|----------------------|-----------|-----------|---------|----------|--------|
| Looney | >1.37 mi. | X | X | X | 2 |
| Liver | 3.14 mi. | X | X | - | 1 |
| Potter | 3.09 mi. | X | X | - | 1 |
| Sally Bull Hollow | 15.42 mi. | - | - | - | 4 |
| Gittin Down Mountain | 3.87 mi. | - | - | - | - |
| Varmint | 1.24 mi. | - | - | - | - |
| Boy Scout | 1.93 mi. | - | - | - | 1 |
| Beck | 2.99 mi. | - | - | X | 3 |
| Eucha | 2.51 mi. | - | - | - | - |

Strategies:

- Contract surveyors to survey all unsurveyed unit boundaries on the Refuge
- Install permanent boundary markers (standard metal post and sign) on all unit boundaries
- Maintain and repair existing gates, fencing and markers
- Construct a new road gate on the access road at the Beck Unit for access to the Krause House and on the MMLERC access road

4.4 Goal 4. Refuge Infrastructure & Administration

Provide administrative support and appropriate facilities required to ensure that Refuge goals and objectives are met through effective landscape conservation management of Ozark habitats, fish and wildlife, and visitor services and for the primary purpose of preventing extinction and recovering federally listed threatened and endangered Ozark cave species.

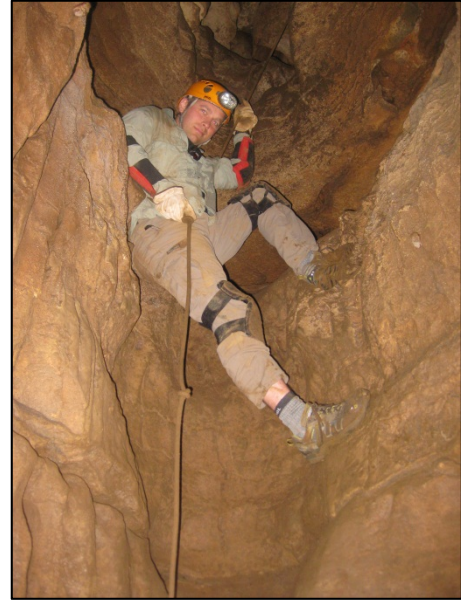
4.4.1 Objective 1: Ensure Workforce and Volunteer Training and Safety.

Ensure all staff, Friends, and volunteers are properly trained to perform their job in a safe, quality, and efficient manner.

Rationale: Ozark Plateau NWR’s management depends on the assistance of various interns, partners, contractors, Friends, and volunteers. In order to support the safety, wellbeing, and role of each contributor, the Refuge must ensure that each individual is properly trained, feels prepared, and knows the appropriate safety procedures for their job/task, especially if it involves caving.

Strategies:

- Implement Ozark Plateau NWR’s Station Safety Plan, Cave Safety Plan, and perform “job hazard analysis”, when appropriate, to identify risks and recommended protective measures for Refuge operation, including caving activities
- Create program to train fire departments, local chapters of NSS, and state and federal law enforcement agencies, as well as Refuge staff on cave safety, search & rescue, and first-responder medical training
- Train Friends and other volunteers to perform their job/role in a safe, quality, and efficient manner to include citizen science; EE; interpretation; outreach; cave, stream, and forest management; cave rescue; and perform other actions as needed
- Keep staff, Friends, volunteers and partners “in the loop” on current issues and solutions regarding karst, stream, forest, and cave management and other Refuge resources
- Develop curricula and conduct training for Service personnel and partners focusing on cave, karst, stream, forest, and bat management, using methods such as anabat acoustic detectors, infrared and thermal videography, mist-netting techniques and bat identification, cave gate construction, aquatic species surveys, recharge area delineation, and other resource management techniques
- Develop curricula and conduct training for Service and other partner agencies’ staff on effective EE methods based on “coyote mentoring” techniques (Young, et. al., 2010) that effectively accomplish goals associated with Connecting People With Nature (CPWN) and Youth in the Great Outdoors (YGO), using the Ozark resources as a vehicle and example. Coordinate curricula with Region 2 Regional Office Division of Visitor Services and NCTC. Training would be Refuge-based due to the proximity of four states, four FWS regions, the Ozark ecoregion common to all four states/regions, and other unique landscapes and facilities.



*Who ever said caving was easy?
(Credit: Steve Hensley)*

4.4.2 Objective 2: Protect and Survey Historical, Archeological, and Paleontological Sites.

Over the lifetime of this CCP, protect known and survey newly discovered historical, archeological and paleontological sites on the Refuge.

Rationale: There are many historical sites on Ozark Plateau NWR. For example, there is a wagon trail between Sallisaw and Tahlequah, which runs through the Potter Unit, as evidenced by old bridge abutments. This trail was main thoroughfare for local travelers, prior to the development of roads and highways. Crystal Cave on the Potter Unit was a commercial cave used for local dances in the 1920s. There is an old rock dam on the Potter Unit that was constructed to provide swimming opportunities dating back to pre-1916. In addition, cabins and infrastructure on the Looney Unit have historical significance to the caving community in the Ozarks because they were used by many caving experts to explore the first private cave preserve, January-Stansberry Cave, which was later donated to the Refuge (Graening, 2011). Short-faced bear, tapir, and dire wolf remains have been discovered in Refuge caves. Arrowheads, spear points, grinding stones, and other Native American tools used by the Caddo and Osage Tribes during pre-settlement times and also by tribes after they were relocated to Oklahoma, have been found on and near the Refuge. With the help of its partners, the Refuge would like to learn more about these known sites and discover additional historical, archeological, and/or paleontological sites to better understand the history of the land and its people and animals.



Comparison between a Short-faced bear, Kodiak bear, and Black bear. (Credit: carnivoraforum.com/ "boldchamp")

Strategies:

- Keep sites confidential (from public) and increase LE (from Sequoyah NWR) to provide security to known sites
- Partner with university faculty and/or students, Sam Noble Museum of Natural History archeologists, Tribal Nations, SHPO, and others to conduct archeological surveys to preserve and perform studies on known sites and any newly discovered sites
- Partner with university faculty and/or students, Sam Noble Museum of Natural History paleontologists, SHPO, Tribal Nations, and others to conduct paleontological surveys to preserve and perform studies on known sites and any newly discovered sites

- Partner with Oklahoma Historical Society, university faculty and/or students, SHPO, Tribal Nations, and others to conduct historical surveys to preserve and perform studies on known sites and any newly discovered sites
- As new sites are discovered, contact appropriate partners to learn and understand historical context and significance

4.4.3 Objective 3: Establish a Refuge Headquarters and Visitor/Education Center Site.

Within the lifetime of this CCP, construct a new building or purchase an existing building for a Refuge Headquarters incorporating a Visitor/Education Center, on a newly acquired site, close to the MMLERC. This site would provide a centralized office for approximately 10 anticipated staff members as well as provide a location for the public to visit and engage with Refuge staff.

Rationale: Currently, there are three full-time Refuge staff members, one Wounded Warrior, one SCA, and one part-time SCEP.

Refuge Headquarters is currently located at the MMLERC, which provides only one office and is primarily used for limited-use EE and interpretation programs. Due to limitations on office space at these headquarters, each of these staff members works out of either the Oklahoma ES Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR. This makes management coordination challenging due to the lack of a centralized Headquarters space. This situation also increases staff travel time, decreasing actual work time. In addition, in order to meet this CCP's objectives and strategies, additional staff is needed, including land management for acquisition of up to 15,000 acres of land. A centralized Headquarters space will make Refuge staff coordinate and communicate better and work more efficiently.

The incorporation of a Visitor/Education Center with this Headquarters site would provide general public access to the Refuge, as well as a quality educational experience for visitors to learn more about the Refuge's purpose, resources, and public use programs.

Strategies:

- Acquire up to 15,000 acres of land and conservation easements from willing sellers within the approved acquisition boundary (see Goal 1, Objective 3)
- Acquire buildings that could be retrofitted for a Headquarters/Visitor Center site
- Assess acquired lands near the Looney Unit for potential building sites
- Retrofit/remodel and/or build new Headquarters/Visitor Center site with adequate office and administrative space for anticipated staffing and general public access within the lifetime of this CCP

4.4.4 Objective 4: Renovate and Repair the MMLERC.

Within 5 years of this CCP, improve the Mary & Murray Looney Education & Research Center (MMLERC) through renovation and reparation work to provide a quality, comfortable, accessible, and low-carbon footprint education site for all visitors.



“Mary & Murray Looney Education & Research Center”, a.k.a., “MMLERC”. (Credit: Shea Hammond)

Rationale: The current MMLERC and its associated facilities need improvement. Originally, this cabin was used as a private summer resort from the early 1950s. The location of the cabin is a true gem that lies within a beautiful natural setting within the Ozark Highlands, providing a great space for the Refuge to use as an education and research center. The cabin is surrounded by crystal springs flowing from large caves from upland to

bottomland forests through mature oak, hickory, and pine trees and into Spavinaw Creek, a turquoise rocky bottom Ozark stream that crosses the boundary of two states, two Service regions and provides drinking water for the city of Tulsa. Nevertheless, due to the cabin’s antiquity, the design is inefficient, the building materials have deteriorated, and standards have subsequently changed overtime. The Mary & Murray Looney cabin had been abandoned for at least 10 years prior to Refuge restoration efforts. During this time, the interior and exterior of the building and the surrounding grounds have deteriorated. Initial renovation has already taken place inside the main MMLERC building so that it functions adequately for the Refuge Headquarters, housing for staff, volunteers, and/or guests, along with hosting multiple EE programs. Additional restoration, however, is still required to make the building more energy-efficient, water conservation-friendly, ADA accessible, secure, as well as to ensure adequacy of plumbing and electrical systems. The MMLERC’s concrete grounds and walkways must also be repaired for safety. And lastly, the pavilion structure needs to be renovated in order for it to be utilized as part of the MMLERC.

Strategies:

- Assure that all work orders are entered into SAMMS and update when necessary
- Renovate the roof
- Insulate the basement and attic
- Renovate the cabin exterior (replace logs and grout, seal the exterior, paint exterior trim, and repair the retaining wall behind the cabin)
- Renovate flooring of porch and ensure porch railing meets safety standards
- Renovate front door to be handicap accessible
- Renovate one bathroom in the MMLERC to include an accessible entrance and shower
- Install monitored alarm system in cabin
- Replace plumbing system, if necessary
- Replace electrical system, if necessary
- Replace propane gas lines, if necessary
- Install energy-efficient exterior storm windows
- Maintain water filter for drinking water to reduce energy and waste associated with bottled water
- Remove small cabin building (but retain existing fireplace) adjacent to MMLERC and replace with a 800 sq. ft. outdoor pavilion studio space (partially open, partially covered), that would also bridge the stream in a previously-disturbed site
- Install rainwater collection system for irrigation of the ethno botanical garden and landscaped areas surrounding Refuge buildings
- Collaborate with master gardeners and master naturalists to build raised garden beds and to re-landscape with native plants around the MMLERC, using permaculture methods
- Install solar panels on area with the most sunlight on the Looney Unit, to offset carbon and rely mostly on alternative energy sources
- Use energy-efficient heating and cooling system and appliances (geothermal heating and cooling system, insulation, double pane windows, stove, refrigerator, dishwasher, on-demand hot water, washer and dryer) on all Refuge buildings
- Maintain energy-efficient heating and cooling air duct systems and appliances
- Install audio/visual technology (i.e. ceiling-mounted projector, etc.) for modern methods of teaching EE programs (i.e., power points, etc.)

4.4.5 Objective 5: Improve and Widen Access Roads and Parking Areas.

Within 5 years of the CCP, improve and widen necessary access drives and parking area surfaces with gravel to prevent an increase in visitation from causing damage to the vegetation on the sides of the roads, help control soil erosion, and prevent flat tires.

Rationale: To get to the MMLERC, there is a MMLERC public access drive, which is currently 0.25-miles, unpaved and unimproved (dirt/rock), with a gate. There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available near the maintenance shop, next to the Guess House (150 yards). With the anticipation of an increase in visitation to the Looney Unit, the Refuge needs to widen the MMLERC access drive (on previously disturbed areas/previously wide areas) for cars to pass without having to drive up on the roadside soil/vegetation. In addition, road and parking area surfaces need to be improved with gravel to allow for a better established parking area, which will prevent visitors from parking in the grass, on the side of the road, and will help control soil erosion. In addition, Refuge staff needs a wider access road to the Beck Unit shop in turn-around area for Staff vehicles and trailers.



*Sawney Road on Ozark Plateau NWR.
(Credit: Steve Hensley)*

Strategies:

- Investigate Federal Highway Administration funding opportunities
- Work with Refuge personnel to widen the MMLERC access drive by 2 feet and improve with gravel, including parking area
- Work with Refuge personnel to improve road with gravel from county road to maintenance shop (next to Guess House) on the Looney Unit
- Improve parking area surfaces with gravel at both the overflow parking, near maintenance shop, and parking on top of MMLERC road
- Work with Refuge personnel to improve 0.3 miles of gravel road on the Beck Unit for Refuge management access
- Improve and/or maintain roads on newly acquired lands, where necessary

4.4.6 Objective 6: Construct Building Facilities Associated with Maintenance.



Looney Maintenance Shop. (Credit: Shea Hammond)

Within the lifetime of this CCP, use or construct appropriate building facilities and infrastructure to perform essential Refuge maintenance.

Rationale: Current maintenance facilities are inadequate. The Refuge needs additional maintenance facilities in order to store and maintain Refuge vehicles, supplies, and equipment used for management operations.

Strategies:

- Build additional 50'x100' metal building on concrete pad maintenance shop at new Headquarters site
- Construct an additional decontamination and storage facility/structure at the new Headquarters location to decontaminate caving equipment in accordance with the Service's WNS decontamination guidance (<http://www.fws.gov/WhiteNoseSyndrome/index.html>)
- Construct a separate ventilated building located next to maintenance shop at new Headquarters site for hazardous materials storage
- Outfit these facilities with appropriate maintenance equipment, heat, insulation, electricity, appropriate plumbing, lighting, etc.
- Construct a new fueling station for Refuge vehicles and equipment at new Headquarters location
- Reconstruct existing pole barn on the Beck Unit, near the Krause House
- Maintain all maintenance facilities and supplies

4.4.7 Objective 7: Provide Housing for Refuge Staff, Interns, Volunteers, Researchers, and Educators.

Throughout the lifetime of this CCP, provide adequate housing (Looney cabin, bunk housing, field house, RV pads, etc.) for volunteers, researchers, interns, educators, and Refuge staff while they are contributing to Refuge management, research, and education.

Rationale: The MMLERC only provides one bedroom used by volunteers, researchers, interns, educators, Refuge staff, and other guests. There are small cabins on private lands near the Potter Unit that may be available on a limited basis for Refuge volunteers, researchers, interns, educators, and Refuge staff. However, use of these would require landowner notification and may not always be vacant. The Refuge would like to provide more housing opportunities for the current number and future increase of volunteers and partners the Refuge has to work with in order to fully implement Refuge management. Housing for Refuge staff is currently limited to one house on the Looney Unit. Additional housing to accommodate an increase in Refuge staff will also be needed.



(Credit: Shea Hammond)

Strategies:

- Utilize MMLERC cabin to provide one guest room for volunteers, researchers, interns, educators, and/or Refuge staff
- Once new Headquarters is established, convert existing Refuge office to a second guest room at the MMLERC for volunteers, researchers, interns, educators, and/or Refuge staff
- Utilize Guess House on Looney Unit for long-term housing for Refuge staff and/or volunteers, researchers, interns, educators
- Construct and/or purchase two new residences (one staff, one volunteer/student) adjacent to the new Headquarters building location
- Construct two RV pads for volunteers at the new Headquarters site, to include utilities
- Construct an additional RV pad for a volunteer on the Looney Unit, adjacent to the maintenance shop next to the Guess house, to include utilities
- Include facilities for volunteers (lounge, kitchen, showers, etc.) in the site plan for the new Headquarters facility
- Once agreement with Leslie Krause is terminated (via donation), renovate Krause residence and use for staff/volunteer/student housing
- Maintain all Refuge housing



Cave salamander (Eurycea lucifuga).
(Credit: Shea Hammond)

Chapter 5: CCP Implementation and Monitoring

Plan implementation is the reason for the development of this CCP. It is where we see the results of all our vision and planning efforts.

A successful CCP...

- helps guide the Refuge to achieve its purposes and goals
- is highly utilized by Refuge Manager and staff
- contributes to resolution of controversial issues
- becomes a reference document
- outlines a flexible approach to achieving goals and purposes
- facilitates partnerships
- helps to obtain funding
- is realistic and achievable
- is transparent and written clearly (understood by staff and by public)
- has broad support
- gets implemented
- is monitored and evaluated
- is amended, if necessary



Building cave gate at Belles Bluff. (Credit: Richard Stark)

This chapter describes the various factors that affect the implementation of the management direction presented in Chapter 4 of this CCP. It also identifies factors for monitoring and evaluating Refuge success of meeting its goals and objectives outlined in Chapter 4.

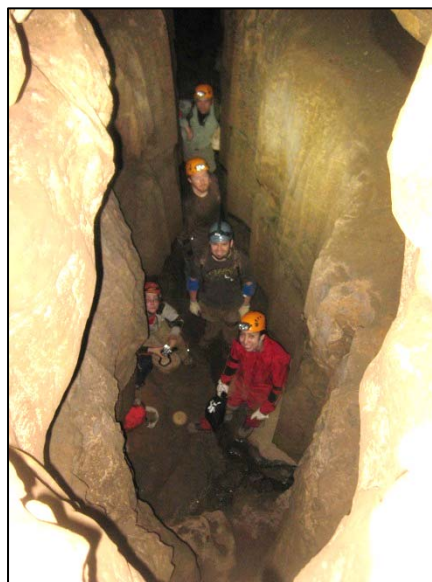
The following factors provide the outline of discussion within this chapter:

- Partnerships
- Appropriate refuge uses and compatibility
- Intra-Service Section 7 (Endangered Species Act Consultation)
- Funding & staffing
- Current and future Refuge projects and associated funding and staffing needs
- Step-down plans
- Monitoring & evaluation of the CCP
- Amendment & revision of the CCP

5.1 Partnerships

As described throughout this CCP, partnerships continue to be an integral part of the Refuge's actions to acquire, manage, and conserve lands, inventory and monitor, conduct research, assist in protecting and restoring habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation. Ozark Plateau NWR has worked extensively with private, NGO, university, state, tribal, and federal partners over the past 30 years and would not have accomplished what it has without the cooperative effort. Table 5-1 lists the partners Ozark Plateau NWR has and would like to continue to work with. It is extremely important that this partnering effort continue in the future for the Refuge to accomplish its assigned purpose.

Future plans for protecting caves and other habitat in karst areas used by listed cave species, will probably involve agreements with The Nature Conservancy (TNC), Land Legacy, National Speleological Society (NSS) and their local chapters (grottos), Bat Conservation International (BCI), development of a memorandum of understanding (MOU) with the Cherokee Nation and other Tribes, working with the Oklahoma Department of Wildlife Conservation (ODWC) to protect cave and karst resources on some of their Wildlife Management Areas, cooperating with the Natural Resource Conservation Service (NRCS) to implement their Healthy Forest Reserve Program, and working with the U.S. Army Corps of Engineers, among others. These actions and different combinations of them are some of the options the Service is already using to protect cave and karst sites in the seven-county project area. However, it has become clear over the years that we must continue to increase our landscape- level partnership efforts and support one another's conservation projects in order to accomplish Refuge goals, wildlife targets, and the mission of the U.S. Fish and Wildlife Service.



*Cave volunteers.
(Credit: Steve Hensley)*

As described in the *Conserving the Future* vision document for national wildlife refuges and the next generation,

“Just as we cannot overcome the management challenges of the future alone, neither can we overcome the scientific challenges alone. We must embrace communication and collaboration in all fields if we are to achieve our goals. In the realm of conservation science, that means we must both lead and be strong partners. If we coordinate research and monitoring projects with our partners and communicate the results to the conservation community, we will improve our ability to leverage assistance; enhance our opportunities to share ideas, plans and strategies; and maximize our changes to capitalize on shared interests and opportunities.”



*Sharing discoveries of human and nature “interconnectedness”.
(Credit: Shea Hammond)*

Table 5-1. Ozark Plateau NWR Partners

Internet Groups:

- Yahoo: Greenway of the Cherokee Ozarks

Volunteers and (unofficial) Friends Group

Landowners

Non-governmental organizations (NGOs):

- American Fisheries Society
- Audobon Society
- Bat Conservation International (BCI)
- Becoming an Outdoors Woman (BOW)
- Blue Skywater Society
- Blue Thumb
- Boy Scouts of America (BSA)
- Campfire USA
- Central Hardwoods Joint Venture
- Ducks Unlimited
- Girl Scouts of America (GSA)
- Land Legacy
- Master Gardeners of Oklahoma
- Master Naturalists of Oklahoma
- Missouri Chimney Safety Council
- National Speleological Society (NSS)
- Northwestern Arkansas Beekeepers' Association
- Oklahoma Academy of Science
- Oklahoma Historical Society
- Oklahoma State Historic Preservation Office (SHPO)
- Ozark Subterranean Biodiversity Project
- Ozark Tracker Society (OTS)
- Partners in Flight
- Sam Noble Museum of Natural History
- Southeastern Bat Diversity Network
- Student Conservation Association (SCA)
- The Nature Conservancy (TNC)
- Tulsa Regional Oklahoma Grotto
- Tulsa Zoo and Living Museum
- Western Bat Working Group
- Wild Turkey Federation
- Wilderness Awareness School
- Wildlife Federation
- The Wildlife Society

Private Businesses:

- Contractor agencies
- Private utility companies
- Private research lab/institutions

Schools:

- Local public K-12 schools
- Local private K-12 schools
- Local K-12 homeschools

Universities:

- Arkansas State University
- John Brown University
- Missouri State University
- Northeastern State University (NSU)
- Oklahoma State University (OSU)
- Rogers State University (RSU)
- Southeastern OK State University (SEOSU)
- Tulsa University
- University of Arkansas (UA)
- University of Central Arkansas
- University of Central Oklahoma (UCO)
- University of Missouri
- University of Oklahoma (OU)
- University of Southern Mississippi

Cities:

- City Fire Departments
- Jay
- Stillwell
- Tahlequah
- Tulsa

Counties:

- Adair
- Cherokee
- Craig
- Delaware
- Mayes
- Ottawa
- Sequoyah

State agencies:

- Arkansas State Parks
- Grand River Dam Authority (GRDA)
- Oklahoma Conservation Commission
- Oklahoma Department of Environmental Quality (DEQ)

- Oklahoma Department of Tourism and Recreation
- Oklahoma Department of Wildlife Conservation (ODWC)
- Oklahoma Scenic Rivers Commission
- Oklahoma State Forestry Division
- Oklahoma State Parks
- Oklahoma Water Resources Board (OWRB)
- Oklahoma Natural Heritage Inventory

Native American Tribal Nations:

- Caddo Nation
- Cherokee Nation
- Choctaw Nation
- Chickasaw Nation
- Delaware Nation
- Eastern Shawnee Tribe of Oklahoma
- Miami Nation
- Modoc Nation
- Muscogee (Creek) Nation
- Osage Nation
- Peoria Tribe of Indians of Oklahoma
- Ottawa Tribe of Oklahoma
- Quapaw Tribe of Oklahoma
- Seneca-Cayuga Tribe of Oklahoma
- Shawnee Tribe
- United Keetoowah Band of Cherokee Indians
- Wyandotte Nation

Federal:

- Bureau of Land Management (BLM)
- Environmental Protection Agency (EPA)
- National Park Service (NPS)
- Natural Resources Conservation Service (NRCS)
- The U.S. Forest Service (USFS)
- U.S. Army Corps of Engineers
- U.S. Fish & Wildlife Service (FWS)
- United States Geological Survey (USGS)

5.2 Memorandums of Understanding and Other Agreements

During the establishment and continuing management of Ozark Plateau NWR, a number of memoranda of understanding (MOU), memoranda of agreement (MOA), conservation agreements, and other agreements have been used. These were with private, municipal, county, state, tribal, and federal agencies and organizations and used by the Refuge to accomplish its purpose of protecting and preventing the extinction of federally listed threatened and endangered and other important cave, karst, and trust resources of the Ozarks.

The Service has a national MOU with the NSS developed on April 4, 1992 to increase public awareness of the value cave resources and the concern that those resources be managed and protected for future generations. Also, it provides a source of volunteers and expertise needed to inventory, protect, and assist with the management of cave resources. It recognizes the shared concerns and benefits of cooperation between the NSS and the Service and establishes guidelines for volunteer agreements. Also the Service has a MOU with BCI to establish a framework for cooperation and participation in conservation of bat species that are federally listed or proposed for listing as threatened or endangered, or are candidates for placement on the federal list of threatened and endangered wildlife (50 CFR 17.11). It promotes cooperation in activities necessary to maintain or increase the productivity of bats and their habitat on lands managed by the Service, and on other lands as appropriate.

In addition, there is an interagency agreement among the National Park Service, Bureau of Land Management, Forest Service, and Fish and Wildlife Service for implantation of the Federal Cave Resource Protection Act. A specific interagency agreement to coordinate cave inventory and management was developed between the Ozark Plateau NWR and the Ozark National Forest that borders the Refuge to the east in Arkansas and Region 4 of the Service.

Also conservation agreements have been developed between the Cherokee Nation and Ozark Plateau NWR and the City of Tulsa and Ozark Plateau NWR allowing the Refuge to help with cave and forest management on two important tracts of land.

The Refuge also has entered into an agreement with Natural Resource Conservation Service and the Service's Oklahoma Ecological Services Field Office to help implement the Healthy Forest Reserve Program to protect federally listed endangered and threatened Ozark cave species.

Lastly, the Refuge works closely with the ODWC through Section 6 of the Endangered Species Act agreements and TNC and Land Legacy through a conservation easement to implement additional cave, karst, and forest management.

5.3 Appropriate Refuge Uses and Compatibility

5.3.1 Appropriate Refuge Uses

All uses of a national wildlife refuge over which the Service has jurisdiction must be determined to be appropriate under the Appropriate Refuge Uses policy (603 FW 1). If an existing use is not appropriate, the refuge manager will deny the use without determining compatibility (see Section 5.2.2). An appropriate use of a national wildlife refuge is a proposed or existing use that meets at least one of the four following conditions:

- 1) The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act (i.e., hunting, fishing, wildlife observation and photography, and environmental education and interpretation);
- 2) The use contributes to fulfilling the refuge purposes, the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Refuge Improvement Act was signed into law;
- 3) The use involves the take of fish and wildlife under State regulations;
- 4) The Refuge Manager has evaluated the use following guidelines in the Service Manual 603 FW 1.11 and found it appropriate.

5.3.2 Compatibility

In accordance with the Refuge Improvement Act of 1997, no uses for which the Service has authority to regulate may be allowed on a unit of the National Wildlife Refuge System unless it is determined to be compatible. A compatible use is a proposed or existing wildlife-dependent recreation use, or any other use of a national wildlife refuge that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes pertaining to the national wildlife refuge.

Aside from wildlife-dependent recreation uses, compatibility determinations are not required for other refuge management activities (e.g., conducting bird surveys) except economic activities (e.g., haying). Economic uses of a natural resource must contribute to achieving refuge purposes and the Refuge System mission. They are also not required where statute directs mandatory approval of the activity, as in the case of facilities for national defense. If a use is found to be incompatible, the Refuge will follow normal administrative procedures for stopping the action.

Compatibility determinations for existing hunting, fishing, wildlife observation and photography, and environmental education and interpretation must be re-evaluated with the preparation or revision of a comprehensive conservation plan or at least every 15 years. Compatibility determinations for all other uses must be re-evaluated every 10 years or earlier if conditions change or significant new information relative to the use and its effects becomes available. Refuge managers must complete a written compatibility determination for each use, or collection of like-uses, that is signed by the manager and the Regional refuge chief.



Primitive camping as part of environmental education programs offered on the Refuge. (Credit: Shea Hammond)

Appendix B contains five compatibility determinations that have been developed as part of this comprehensive conservation planning effort, including:

- Environmental Education
- Interpretation
- Hunting
- Wildlife Observation & Photography
- Wood Harvesting

5.4 Intra-Service Section 7 (Endangered Species Act Consultation)

An Intra-Service Section 7 consultation was conducted for the implementation of this CCP's objectives and strategies with the Oklahoma Ecological Services Field Office (see Appendix F).

5.5 Funding & Staffing

In the previous chapters, Ozark Plateau NWR has outlined a vision for the future management of the Refuge and included the objectives and strategies needed to realize that vision. Current financial resources available to the Refuge will not adequately provide the means to protect habitat and wildlife, and improve the condition of visitor services through the life of the CCP. In fact, the Refuge constantly seeks funding through grants and elsewhere to implement many of their environmental education and interpretation programs as well as to perform their cave and karst resource management activities. Similarly, pre-CCP staff levels do not allow adequate interactions with the public for welcoming, education, interpretation, information, safety, or enforcement purposes; nor are the wildlife and habitat management strategies described in this

plan achievable at minimum staffing levels. The rate at which each refuge achieves its full potential of contributing to local, regional, and national conservation goals depends on the resources provided for those purposes.

Increased funding and staffing will result in preventing extinction and aid in recovering federally listed threatened and endangered cave species and provide long-lasting protection, maintenance, and enhancements to Ozark cave and aquatic habitats, Ozark forests, Ozark species, migratory birds, visitor experiences, and the education of future conservationists.

The operations and maintenance budget provide funds for routine, day-to-day costs on the Refuge. These costs include utilities, upkeep of offices and structures, required safety inspections, maintenance of Refuge facilities, and cave monitoring activities. Currently, the operations and maintenance costs for the Refuge are fairly moderate because of the Refuge's small size, and because habitat in many acquisition areas is still relatively intact. However, land acquisition funds and other options to protect identified lands occur outside the normal operations and maintenance funding process for refuges. On a national level, Ozark Plateau NWR does not rank high in the Service's objective-based Land Acquisition Priority System (LAPS), because of the 200-point limitation for each category, preventing full consideration of Ozark Plateau NWR's extremely high value for federally listed threatened and endangered Ozark cave species.

Refuge staff remain committed to seeking new opportunities for funding support for implementation of various conservation projects (scientific and educational) as well as acquisition support and options for land protection – both from within the Service and from external sources.

This CCP does not constitute a commitment for additional staffing or increases in operational and maintenance resources. These decisions are at the discretion of Congress in overall appropriations, and in budget allocation decisions made at the national and regional levels of the U.S. Fish and Wildlife Service.

5.6 Refuge Projects



Repairing a cave gate. (Credit: Steve Hensley)

This CCP outlines an ambitious course of action for the future management of Ozark Plateau NWR. The Refuge will need appropriate and consistent operational and maintenance funding and staffing to implement each of the objectives and strategies outlined in Chapter 4 of this CCP. In Table 5-2, we have compiled a list of current and future “projects”, which we define not only as specific efforts to help us achieve our objectives within the lifetime of this CCP, but also that require substantial staffing and/or

funding to implement. Some projects are and may always be ongoing. For this reason, we have included current staffing and funding and future staffing and funding within the same project rows for easy reference. At the bottom of the table, you will see the totals for number of projects, staff, and costs.

In Table 5-2, projects are divided into the following five color categories:

| | |
|-----|-----------------------|
| LL | = Landscape-Level |
| HAB | = Habitat Management |
| WL | = Wildlife Management |
| VS | = Visitor Services |
| IN | = Infrastructure |

Table 5-2. Refuge projects, staffing, and funding required for implementation.

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|--|--|--|---|----------------------|---|
| L L | Maintain and Increase Partnerships | Perform outreach, coordinate, build and maintain long-term relationships and enter into conservation easements and agreements with the public, willing landowners, NGOs, businesses, cities, states, tribes, and federal agencies | Goal 1, Obj. 1; Goal 1, Obj. 2; Goal 1, Obj. 3; Goal 1, Obj. 4; Goal 1, Obj. 5; Goal 1, Obj. 6; Goal 1, Obj. 7; Goal 3, Obj. 1; Goal 3, Obj. 2 | \$5K/yr. | <ul style="list-style-type: none"> .25 FTE Refuge Manager (GS 11/12) and/or .25 FTE Wildlife Refuge Specialist (GS 07/09) | \$10K/yr. | <ul style="list-style-type: none"> .25 FTE Refuge Manager (GS 12/13) and/or .25 FTE Wildlife Refuge Specialist (GS 07/09/11) and .20 FTE Biologist (GS 07/09/11) .20 FTE Outdoor Rec Planner (GS 07/09/11) .10 FTE Maintenance Worker (WG 07/08) .20 FTE Administrative Assistant (GS 05/07/09) |
| L L | Acquire up to 15,000 Acres of Land | Acquire up to 15,000 acres of land and conservation easements from willing sellers within the approved acquisition boundary and enter into conservation agreements with private landowners, conservation organizations, state, Tribal Nations, and other federal agencies | Goal 1, Obj. 1; Goal 1, Obj. 2; Goal 1, Obj. 3; Goal 1, Obj. 4; Goal 1, Obj. 5; Goal 1, Obj. 6; Goal 1, Obj. 7; Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 4 | \$140/acre (1985) up to \$2K/acre (2012) | <ul style="list-style-type: none"> .20 FTE Refuge Manager (GS 11/12) | \$3K/acre | <ul style="list-style-type: none"> .20 FTE Refuge Manager (GS 12/13) and/or .20 FTE Wildlife Refuge Specialist (GS 07/09/11) |
| L L | Lead and/or Participate in Landscape Level Conservation Projects and Conferences | Lead and/or participate in conservation conferences, research, environmental education projects, interpretive projects, habitat management that involve multiple partners across boundaries on the landscape-level; Share and present data, surveys, and research with landscape-level conservation partners as appropriate for effective conservation | Goal 1, Obj. 1; Goal 1, Obj. 2; Goal 1, Obj. 3; Goal 1, Obj. 4; Goal 1, Obj. 5; Goal 1, Obj. 6; Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 2, Obj. 8; Goal 3, Obj. 2 | \$5K/yr. | <ul style="list-style-type: none"> .10 FTE Refuge Manager (GS 11/12) and/or .10 FTE Wildlife Refuge Specialist (GS 07/09) | \$15K/yr. | <ul style="list-style-type: none"> .10 FTE Refuge Manager (GS 12/13) and/or .10 FTE Wildlife Refuge Specialist (GS 07/09/11) and/or .10 FTE Biologist (GS 07/09/11) and/or .10 FTE Outdoor Rec Planner (07/09/11) |
| L L | Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/ Implementation | Educate landowners about incentives such as the Service's Partners for Fish & Wildlife Program, Section 6 of Endangered Species Act, NRCS Healthy Forest Reserves Program, and others and assist with implementation to help private landowners implement natural resource management | Goal 1, Obj. 1 Goal 1, Obj. 5; Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 3, Obj. 2 | n/a | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 11/12) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) | n/a | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and .02 FTE Wildlife Refuge Specialist (GS 07/09/11) .05 FTE Biologist (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|--|--|-----------------------|---|---|---|
| L L | Implement Climate Data Loggers Program | Partner with universities to implement a long-term data logger program to collect air temperature, humidity, light, cave rock temperature, groundwater elevation, and cave stream temperature data at cave, surface and groundwater locations on each unit | Goal 1, Obj. 4 | \$2K/yr. | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09) (+ .02 SCA Intern) | \$15K/initial cost + \$5K/yr. | <ul style="list-style-type: none"> .02 FTE Wildlife Refuge Specialist (GS 07/09/11) and .05 FTE Biologist (GS 07/09/11) (+ .05 SCA Intern) |
| L L | Locate Additional Caves | Use geological records and coordinate with partners to locate additional caves within the ecoregion by “ridge walking”; Map searched and unsearched geological areas that are conducive to cave formation on- and off-Refuge to assess overlying land use and prioritize areas to be searched; Investigate the use of technologies such as satellite and aerial imagery (to look for features indicative of having a cave opening), thermal imagery (to locate potential hot or cold zones), radio telemetry (track bats to unknown roost sites) | Goal 1, Obj. 1; Goal 1, Obj. 3; Goal 2, Obj. 4 | \$12K/yr (contractor) | <ul style="list-style-type: none"> .10 FTE Refuge Manager and/or .10 FTE Wildlife Refuge Specialist | \$15K for geologist/yr. \$10K for GIS undergrad mapping project \$60K/project (out of 3) w/ university master’s student | <ul style="list-style-type: none"> .10 FTE Refuge Manager (GS 12/13) and/or .10 FTE (GS 07/09/11) Wildlife Refuge Specialist and .06 FTE Biologist (GS 07/09/11) |
| L L | Install Weather Stations | Install permanent weather stations at the Mary and Murray Looney, Boy Scout, and Sally Bull Hollow Units, and any appropriate new areas | Goal 1, Obj. 4 | → | → | \$30K/initial cost + \$1K/yr. | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and/or .01 FTE Biologist (GS 07/09/11) |
| L L | Coordinate Across FWS Regional Boundaries to Manage Ozark Cave Species | Coordinate with FWS Region 3 and 4 to help manage Logan Cave NWR, Cavefish NWR and Pilot Knob NWR as units of Ozark Plateau NWR in cooperation with Mingo NWR in Region 3 and Holla Bend NWR in Region 4; Coordinate with FWS Region 6 to manage federally listed Ozark cave species in cooperation with Ozark Plateau NWR; Establish new acquisition areas within the landscape level of Service Regions, 3, 4, and 6 to include a larger range of all federally listed Ozark cave species | Goal 1, Obj. 2; Goal 2, Obj. 6 | n/a | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) | TBD | TBD |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|-------------|--|---|---|---|--|---|--|
| H A B | Prevent Unauthorized Cave Entry | Increase cave monitoring, especially as more lands are acquired (up to 15,000 acres), using alarm systems, light data recorders, secure cave gates, and utilize LE support, to assist when needed, to prevent unauthorized entry and to monitor cave and karst resources; Build and maintain cave gates | Goal 1, Obj. 6; Goal 2, Obj. 3 | \$7.5K/yr. (includes contractor) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and .02 FTE Wildlife Refuge Specialist (GS 07/09) .01 FTE Law Enforcement Officer (GS 09) (on-call) based out of Sequoyah NWR .03 FTE Maintenance Worker (WG 07/08) | \$15K/yr. (alarm/video + contractor) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Wildlife Refuge Specialist (GS 07/09/11) .20 FTE Law Enforcement Officer (GS 09) based out of Sequoyah NWR (routine visits + on-call) .06 FTE Maintenance Worker (WG 07/08) |
| H A B | Implement Water Quality Monitoring Program | Install small water quality measurement devices (semi-permeable membrane), submerge them in cave water, leave them for one month, send results to a laboratory for analysis, monitor, repeat every 5 years in Refuge streams and caves and off-Refuge | Goal 1, Obj. 5; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 5 | n/a (university monitors 2 caves) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09) | \$10K/yr. (includes 2 devices, analysis & contractor) | <ul style="list-style-type: none"> .02 FTE Biologist (GS 07/09/11) |
| H A B | Implement Water Quantity Monitoring Program | Install water quantity devices permanently, to record data constantly, reviewing results every two years to establish baseline data on water levels and identify trends in water levels on and off-Refuge | Goal 1, Obj. 5; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 5 | → | → | \$5K/initial cost + \$500/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .02 FTE Biologist (GS 07/09/11) |
| H A B | Map Groundwater Recharge Areas | Contract with private companies, universities, and the United States Geological Survey (USGS) to use dye-tracing methods to delineate groundwater recharge areas within the acquisition area, in and around all Refuge units, including private lands, specifically where cavefish are present | Goal 1, Obj. 5; Goal 2, Obj. 5 | \$10-15K / recharge area (includes contract w/ University) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09) | \$15-25K /recharge area (min. 10) (includes contract w/ university + USGS + private contractors) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|-------------|--|--|--|--|---|--|--|
| H A B | Use Prescribed Fire on 1/3 of total Refuge lands per year | Develop a Fire Management Plan (FMP) for all Refuge Units, including burn plans and a training program for Refuge staff, to increase the use of prescribed fire to approximately 1,000 acres per year in 3 to 5 year rotations. This acreage would increase to about 1/3 of the total Refuge acreage per year as land is acquired; Assess effects on cave and bird species | Goal 2, Obj. 1; Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 2, Obj. 8; Goal 2, Obj. 9 | \$16K/yr. (funding from RO Fire Fund) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09) .10 FTE Prescribed Fire Specialist (GS 11) based out of Oklahoma/North-Texas Fire Management District | \$40K/yr. + \$2.50/acre burned for additional lands acquired | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .01 FTE Biologist (GS 07/09/11) .30 FTE Prescribed Fire Specialist (GS 11) based out of Oklahoma/North-Texas Fire Management District |
| H A B | Identify and Map the Distribution and the Condition of Forest Habitat | Work with FWS Inventorying & Monitoring (I&M) on GIS projects to identify and map the distribution and the condition of forest, woodland, and savannah habitats on- and off- Refuge to establish baseline conditions on a landscape-level and evaluate effectiveness of forest management | Goal 2, Obj. 1; Goal 2, Obj. 9 | → | → | \$1K/yr. | <ul style="list-style-type: none"> .10 FTE Biologist (GS 07/09/11) and/or (+.10 Intern) |
| H A B | Map Subterranean Extent of Known Caves | Partner with local cavers, NSS, universities, Tribal Nations, I&M, USGS and other organizations or agencies to map full subterranean extent of known caves and identify all surface cave entrances | Goal 2, Obj. 3; Goal 2, Obj. 4; Goal 2, Obj. 6 | \$500/yr. avg. (contract w/ NSS) | <ul style="list-style-type: none"> .05 FTE Refuge Manager (GS 12) | \$10K/yr. (contract w/ NSS) | <ul style="list-style-type: none"> .10 FTE Refuge Manager (GS 12/13) and/or .10 FTE Wildlife Refuge Specialist (GS 07/09/11) and/or .10 FTE Biologist (GS 07/09/11) |
| H A B | Identify & Survey Plant Species | Work with partners such as landowners, NGOs, universities, state agencies, tribal nations, and federal agencies to identify, document, and monitor all plant species (native and non-native) occurring on all units of the Refuge | Goal 2, Obj. 9 | \$3K/survey (every 5 years) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$3K/survey (every 5 years) | <ul style="list-style-type: none"> .02 FTE Biologist (GS 07/09/11) and .01 Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|-------------|---|--|-----------------------------------|--------------------------|--|--|---|
| H A B | Monitor Impacts of Non-Native Flora Species | Work with landowners, NGOs, cities, universities, states, tribal nations, and federal agencies to conduct studies to evaluate impacts of non-native plant species on stream, riparian forest, bottomland and upland forest communities; Identify which non-native flora species are causing the greatest negative impact to T&E, species of concern and/or representative species | Goal 2, Obj. 9 | → | → | \$3K/yr. | <ul style="list-style-type: none"> .05 FTE Biologist (GS 07/09/11) |
| H A B | Monitor & Reintroduce Chestnut Blight-resistant Chinquapin | Monitor and/or reintroduce chestnut blight-resistant chinquapin (<i>Castanea ozarkensis</i>) | Goal 2, Obj. 1; Goal 2, Obj. 9 | → | → | \$100K/study (includes contract w/ grad student + seedlings) | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .02 FTE Biologist (GS 07/09/11) |
| H A B | Implement Adaptive Management to Control Non-Native Invasive Flora | Based on impacts research, develop an Integrated Pest Management Plan to control species causing greatest harm to ecosystem using prescribed burns (see HAB project above), the application of minimal herbicide spot treatments, and removal of invasive plants with mechanical treatments such as hand tools, chainsaws, and mowing with a tractor; Develop an I&M program to evaluate the effectiveness of these control measures and use adaptive management accordingly | Goal 2, Obj. 1; Goal 2, Obj. 9 | → | → | \$10K (contract w/ invasive removal crew) | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .02 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |
| W L | Bio-inventory Cave Fauna | Participate on cave fauna bio-inventory projects on Refuge units and private lands, such as the Ozark Subterranean Biodiversity Project, with TNC and other NGOs, universities, state agencies, Tribal Nations, US Forest Service (USFS), National Park Service (NPS), and other agencies | Goal 2, Obj. 6; Goal 2, Obj. 7 | \$8K/yr. (+ ES funds) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) | \$15K/yr. (+ ES funds) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09/11) and .05 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|---|--|---|--|--|---|
| W L | Monitor for White-nose Syndrome | Identify and monitor important roost trees, caves, and foraging habitats of bat species that have been known to be affected by WNS (i.e. northern long-eared, big brown, and tri-colored bats); Track movement and occurrence of WNS, search for physical signs of WNS-affected bats, sample soil and cave substrate, search for bat mortality in caves | Goal 1, Obj. 6 | \$1K/yr. (+ .05 SCA intern) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 11/12) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) (+ ES staff) | \$3K/yr. (+.05 intern) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09/11) and .05 FTE Biologist (GS 07/09/11) (+ ES staff) |
| W L | Prevent White-nose Syndrome from Occurring on the Refuge | Perform education, outreach, decontaminate caving gear & clothing, dedicated site-specific cave equipment, control access to caves | Goal 1, Obj. 6; Goal 2, Obj. 6 | \$10K/initial cost (decon. site) + \$4K/yr. (gear & supplies) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 11/12) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) | \$10K/new decon. site + \$8K/yr. (gear & supplies) | <ul style="list-style-type: none"> .05 FTE Refuge Manager (GS 12/13) and/or .05 FTE Wildlife Refuge Specialist (GS 07/09/11) and .10 FTE Biologist (GS 07/09/11) .05 FTE Outdoor Rec Planner (GS 07/09/11) |
| W L | Reduce and/or eliminate White-nose Syndrome from affected bats and/or sites | Coordinate with wildlife health organizations, zoos, universities, state, Tribal Nations, ES and other agencies to assist in the recovery of impacted species and implement effective mitigation strategies, (i.e., environmental manipulations, vaccines, captive management program, etc.) to reduce or eliminate <i>G. destructans</i> from affected bats or sites, as they are identified | Goal 1, Obj. 6; Goal 2, Obj. 6 | → | → | TBD May require substantial funding | TBD May require substantial staffing & assistance from partners |
| W L | Conduct Genetic Sampling | Conduct genetic sampling to identify which populations are genetically isolated | Goal 1, Obj. 6; Goal 1, Obj. 7; Goal 2, Obj. 6; Goal 2, Obj. 7; | n/a | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 11/12) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09) (University research project/ special use permit) | \$60K/study (includes grad student researcher) (2-4 studies/15 yrs.) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .02 FTE Administrative Assistant (GS 05/07/09) .02 FTE Biologist (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|--|---|--------------------------|--|--|---|
| W L | Identify Migration Corridors of Bat, Bird, or other Wildlife Species | Utilize various methods (i.e., conduct acoustic route monitoring, banding, tagging, and using radio transmitters, radar technology, GIS mapping, and other technology) to identify and delineate migration corridors of bat, bird or other wildlife species | Goal 1, Obj. 3; Goal 1, Obj. 6; Goal 1, Obj. 7; Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 2, Obj. 8 | \$8K/yr. | <ul style="list-style-type: none"> .50 PT SCEP and .01 FTE Wildlife Refuge Specialist | \$60K/study (4 studies/15 yrs.) (grad student) | <ul style="list-style-type: none"> .25 FTE Biologist (GS 07/09/11) and .07 FTE Wildlife Refuge Specialist (GS 07/09/11) .50 PT SCEP |
| W L | Conduct Species Surveys | Conduct surveys of invertebrates, herpatofauna, fish, birds, and mammals to identify and document all wildlife species occurring on all units of the Refuge and within potential acquisition areas | Goal 1, Obj. 4; Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 2, Obj. 8; Goal 2, Obj. 10 | \$3K/yr. | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 11/12) and/or .02 FTE Wildlife Refuge Specialist (GS 07/09) (+ contract universities) | \$10K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .10 FTE Biologist (GS 07/09/11) (+ contract universities) |
| W L | Monitor Bat Population Trends | Partner to monitor bat maternity colonies and hibernacula annually (conduct exit count as bats emerge from caves, thermal videography, infrared videography, guano pile measurements, acoustic surveys) | Goal 1, Obj. 4; Goal 2, Obj. 6; Goal 2, Obj. 7 | \$30K/yr. | <ul style="list-style-type: none"> .20 FTE Refuge Manager (GS 11/12) and/or .20 FTE Wildlife Refuge Specialist (GS 07/09) (+ .50 Intern & contract Geologist) | \$50K/yr. (includes contractor + .50 intern) | <ul style="list-style-type: none"> .125 FTE Refuge Manager (GS 12/13) and .05 FTE Wildlife Refuge Specialist (GS 07/09/11) .30 FTE Biologist (GS 07/09/11) |
| W L | Monitor Bat Response to Cave Habitat Conditions | Implement climate data loggers program (see LL project) and develop an I&M program to monitor existing cave habitat conditions trends and determine bat cave habitat preferences; Assess the effects of forest and cave management practices (i.e. prescribed fire/thinning, etc.) on species' cave habitat selection, foraging, movement, breeding behavior and population trends | Goal 2, Obj. 3; Goal 2, Obj. 6; Goal 2, Obj. 7 | \$500/yr. (grad student) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and/or .01 Refuge Wildlife Specialist (GS 07/09) | \$50K/5 yrs. (includes grad student contract) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 Refuge Wildlife Specialist (GS 07/09/11) and .10 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |
| W L | Identify Baseline Data regarding Bat Species & Distribution within Foraging Areas | Perform a permanent mobile acoustic survey program on designated routes within bat species' foraging areas to determine baseline data of species' presence, location, and distribution on and around Refuge management units, of listed and non-listed bats | Goal 2, Obj. 3; Goal 2, Obj. 4; Goal 2, Obj. 6; Goal 2, Obj. 7 | \$8K/yr. (SCEP) | <ul style="list-style-type: none"> .01 Refuge Wildlife Specialist (GS 07/09) | (see WL project, "Determine Bat Foraging Ecology & Habitat Use") | (see WL project, "Determine Bat Foraging Ecology & Habitat Use") |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|---|---|--|---|---|---|
| W L | Determine Bat Foraging Ecology & Habitat Use | Utilize radio tracking, a permanent mobile and stationary acoustic survey program, transects, insect surveys, guano dissection, vegetation surveys, and other methods to identify roost trees, determine foraging habitat preferences, habitat conditions that affect foraging ecology, and monitor trends overtime; work with I&M to create a database documenting these results; Use this data for adaptive management within forest habitat and other foraging habitats of bat species | Goal 2, Obj. 3; Goal 2, Obj. 4; Goal 2, Obj. 6; Goal 2, Obj. 7 | → | → | \$50K/5 yrs. (includes grad student contract) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 Refuge Wildlife Specialist (GS 07/09/11) and .10 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |
| W L | Install Cameras in Cave Interiors to Monitor Bat Activity/Behavior | Install permanent cameras inside January-Stansberry Cave and/or other appropriate caves to monitor bat activity to provide additional scientific information (i.e., seasonal use of the caves by the bats, observe bat behavior, etc.) and monitor human disturbance; Provide online web-streaming during the maternity season for interpretation purposes twenty-four hours per day | Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 3, Obj. 2; Goal 3, Obj. 4 | → | → | \$120K/camera + installation | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and/or .01 Outdoor Recreation Planner (GS 07/09/11) and .01 Administrative Assistant (GS 05/07/09) |
| W L | Monitor Cavefish & Cave Crayfish Population Trends | Perform annual monitoring count surveys of cavefish and cave crayfish and mark recapture to understand population trends | Goal 2, Obj. 6; Goal 2, Obj. 7 | \$2K/yr. (+ \$9.5K/yr. from ESA Section 6/ODWC) | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12) and .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$10K/yr. (unless receive funding from ESA Section 6 / ODWC) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Refuge Wildlife Specialist (GS 07/09/11) .02 FTE Biologist (GS 07/09/11) |
| W L | Research Ecology of Ozark Cavefish | Work with landowners, conservation agencies, universities, Tribal Nations, and scientific agency partners to develop research projects to record and monitor the distribution, abundance, habitat preference, and breeding ecology of Ozark cavefish | Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 6; Goal 2, Obj. 7 | → | → | \$50K/yr. (contract with FWS co-op unit or other universities) | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .01 FTE Biologist (GS 07/09/11) .01 Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|---|---|--------------|---|--|---|
| W L | Monitor Bird Population Trends & Identify Habitat Requirements | Work with partners to conduct bird point counts, banding, and nesting studies to monitor bird populations and establish data trends over time; identify habitat requirements for resident and migratory birds occurring on the Refuge and within the acquisition area | Goal 2, Obj. 7; Goal 2, Obj. 8 | (volunteers) | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$7K/yr. (contractor + volunteers) | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .20 FTE Biologist (GS 07/09/11) .01 Administrative Assistant (GS 05/07/09) |
| W L | Develop Habitat Suitability Index Model | Develop a habitat suitability index model to determine optimum forest and cave habitat requirements for Ozark big-eared bats, gray bats, Ozark cavefish, and cave crayfish | Goal 1, Obj. 4; Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 6; Goal 2, Obj. 7 | → | → | \$50K/species model (3 yrs. each) | (contract w/ FWS Co-op unit) |
| W L | Pesticide Sampling | sample prey insects in foraging areas, guano in summer caves, and surrogate bat species to monitor pesticide amounts to reoccur every 10 years | Goal 1, Obj. 5 | → | → | \$60K/study (includes ES and/or university contractor) | <ul style="list-style-type: none"> .02 FTE Biologist (GS 07/09/11) |
| W L | Monitor Impacts of Non-Native Fauna Species | Work with partners to conduct studies to identify, document, and monitor all non-native wildlife species occurring on and near the Refuge; evaluate impacts of these species on cave, stream, riparian forest, bottomland and upland forest communities | Goal 2, Obj. 10 | → | → | \$50K/hothouse millipede study (grad student) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .20 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |
| W L | Implement Adaptive Management to Control Non-Native Invasive Fauna Species | Based on impacts research, and if necessary, develop an Integrated Pest Management Plan to control species causing greatest harm to ecosystem using control measures such as trapping, shooting, spaying/neutering, etc.; Develop an I&M program to evaluate the effectiveness of these control measures and use adaptive management accordingly; Coordinate with and educate private landowners, state agencies, Tribal Nations, and federal agencies to encourage them to control invasive and exotic species | Goal 2, Obj. 10 | → | → | \$5K trapping of feral hogs/feral cats + TBD | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .20 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|---|---|---|---|------------------------------------|---|
| V S | Coordinate to Establish and Train Official Friends Group | Coordinate with unofficial Friends group volunteer members, current partners, and other members in the community to encourage the formation of an organized and official Friends Group; Educate Friends on current issues and solutions regarding karst and cave management and other Refuge resources; Train volunteers to perform their job/role in a safe, quality, and efficient manner to include citizen science, EE, interpretation, outreach, cave management and cave rescue and perform other actions as needed | Goal 1, Obj. 1; Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 6; Goal 2, Obj. 7; Goal 2, Obj. 8; Goal 3, Obj. 1; Goal 3, Obj. 2; Goal 3, Obj. 3; Goal 3, Obj. 4; Goal 3, Obj. 5 | → | → | \$5K/yr. | <ul style="list-style-type: none"> .05 FTE Refuge Manager (GS 12/13) and/or .05 FTE Refuge Wildlife Specialist (GS 07/09/11) and .05 FTE Outdoor Recreation Planner (GS 07/09/11) .02 FTE Biologist (GS 07/09/11) .01 FTE Administrative Assistant (GS 05/07/09) |
| V S | Develop a Visitor Services (step-down) Plan | Once Outdoor Recreation Planner is hired, develop a step-down VS Plan within 15 years of implementing the Comprehensive Conservation Plan to improve visitor experiences by planning time, energy, funding, content, approach, and evaluation of VS programs. | Goal 3, all objectives | → | → | \$10K (Planner contractor) | <ul style="list-style-type: none"> .02 FTE Outdoor Recreation Planner (GS 07/09/11) |
| V S | Ozark Nature Connection Series EE Programs | Maintain monthly Ozark Nature Connection Series (ONCS) in cooperation with partners, Ozark Tracker Society | Goal 3, Obj. 3 | n/a from Refuge budget (approx. \$11K/yr. from YOG and/or CPWN grants + \$30K from NGOs, participant fees) | <ul style="list-style-type: none"> .15 FTE Refuge Wildlife Specialist (GS 07/09) and .01 FTE Administrative Assistant (GS 05/07/09) | \$45K/yr. (including OTS contract) | <ul style="list-style-type: none"> .03 FTE Refuge Manager (GS 12/13) and .02 FTE Refuge Wildlife Specialist (GS 07/09/11) .25 FTE Outdoor Recreation Planner (GS 07/09/11) .03 FTE Biologist (GS 07/09/11) .02 FTE Maintenance Worker (WG 07/08) .04 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|---|--|--|--|---|----------------------|---|
| V S | Coordinate with Other Partners to Provide EE Programming | Provide MMLERC site for EE programs and logistical support/coordination in collaboration with many local NGOs, state, tribal and federal partners | Goal 1, Obj. 1; Goal 3, Obj. 1; Goal 3, Obj. 3 | n/a from Refuge budget (+ \$30K/yr. in grants) | <ul style="list-style-type: none"> .02 FTE Refuge Wildlife Specialist (GS 07/09) and .01 FTE Administrative Assistant (GS 05/07/09) | \$35K/yr. | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and .02 FTE Refuge Wildlife Specialist (GS 07/09/11) .10 FTE Outdoor Recreation Planner (GS 07/09/11) .03 FTE Biologist (GS 07/09/11) .02 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| V S | Partner with Tribal Nations to Conduct EE Programs for Tribal Youth | Partner with Tribal Nations to conduct an EE program for tribal youth on the Looney Unit to improve communication in native language and promote cultural resources, including healthy living and cooking using native/natural edible plants | Goal 3, Obj. 1; Goal 3, Obj. 3 | → | → | \$5K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Refuge Wildlife Specialist (GS 07/09/11) .05 FTE Outdoor Recreation Planner (GS 07/09/11) .02 FTE Administrative Assistant (GS 05/07/09) |
| V S | Partner with City of Tulsa and NGOs to Provide EE Program on Drinking Water Supply/Water Quality | Develop programs with Blue Thumb, Land Legacy, and other NGOs as well as City of Tulsa, Oklahoma Water Resources Board, Oklahoma Conservation Commission, and Oklahoma Dept. of Environmental Quality to utilize the Looney Unit as a water quality testing site (Spavinaw Creek, cave streams/springs, etc.) to conduct programs for youth to educate them about water quality and how that affects their drinking water supply | Goal 1, Obj. 1; Goal 3, Obj. 3 | → | → | \$5K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Refuge Wildlife Specialist (GS 07/09/11) .05 FTE Outdoor Recreation Planner (GS 07/09/11) .03 FTE Biologist (GS 07/09/11) .02 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|---|-----------------------------------|--------------|---|---|---|
| V S | Develop and Conduct Training for FWS Staff on the “Coyote Mentoring” EE Method | Develop curricula and conduct training for FWS and other partner agencies staffs on effective EE methods based on “coyote mentoring” techniques (Young, et. al., 2010), using the Ozark resources as a vehicle and example. Coordinate curricula with Region 2 Regional Office Division of Visitor Services and NCTC. Training would be Refuge-based due to the proximity of four states, four FWS regions, the Ozark ecoregion common to all four states/regions, and other unique landscapes and facilities | Goal 3, Obj. 3; Goal 4, Obj. 1 | → | → | n/a from Refuge budget (participants would pay a fee to include contract with NGO) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .02 FTE Refuge Wildlife Specialist (GS 07/09/11) .02 FTE Outdoor Recreation Planner (GS 07/09/11) .02 FTE Administrative Assistant (GS 05/07/09) |
| V S | Coordinate with Universities to Conduct Field Trips, Outdoor Classes and Continuing Education Credits on Refuge | Coordinate with participating universities to conduct field-based collegiate-level classes, field trips on-site, and learning survey techniques using Refuge resources or in cooperation with adjacent landowners who allow the classes on private lands; Provide a Teacher Continuing Education and General Education Credits Program on the Refuge | Goal 3, Obj. 2; Goal 3, Obj. 3 | n/a | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and .02 FTE Refuge Wildlife Specialist (GS 07/09) | n/a | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and .01 FTE Refuge Wildlife Specialist (GS 07/09/11) .02 FTE Outdoor Recreation Planner (GS 07/09/11) .02 FTE Biologist (GS 07/09/11) |
| V S | Work with K-12 Classes to Utilize MMLERC | Coordinate with local public, private, and home-school K-12 classes to utilize the Refuge and MMLERC for environmental education to provide quarterly programs that meet state curriculum standards | Goal 3, Obj. 3 | → | → | \$1K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .03 FTE Outdoor Recreation Planner (GS 07/09/11) .01 FTE Biologist (GS 07/09/11) |
| V S | Conduct EE Programs Off-site | Conduct some EE programs off-site regarding karst and cave resources to private landowners, at local schools, to 4H groups, scouts, county officials, and Tribal Nations, etc. | Goal 3, Obj. 3 | → | → | \$1K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .02 FTE Outdoor Recreation Planner (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|--|-----------------------------------|--------------|---|----------------------|--|
| V S | Hands-on Master Gardener/ Master Naturalist Permaculture EE Program | Collaborate with master gardeners and master naturalists to lead EE hands-on gardening programs on growing traditional foods and herbs (seeds provided by Cherokee Nation) in raised garden beds and landscape design using native plants (aesthetically-pleasing landscape, while also benefitting native wildlife such as birds and pollinators). MMLERC would also be utilized as a quarterly training and meeting site. Create limited signage of native plants and flowers within close proximity to the MMLERC | Goal 3, Obj. 3; Goal 3, Obj. 4 | → | → | \$1K/yr. | <ul style="list-style-type: none"> .02 FTE Outdoor Recreation Planner (GS 07/09/11) and .01 FTE Biologist (GS 07/09/11) |
| V S | Conduct Interpretation Programs On-site at MMLERC | Provide interpretive programs on the Looney Unit or at MMLERC to school and youth groups, civic organizations, naturalists/scientists, university faculty and students, Tribal groups, Service staff, and other agency staff, which may include short interpretive hikes and discussions that primarily provide information on natural, cultural, and biological resources of the Ozark ecoregion and promote sustainability on-site by showcasing green technologies and sustainable-living methods | Goal 3, Obj. 4 | n/a | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and .08 FTE Refuge Wildlife Specialist (GS 07/09) | \$500/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .08 FTE Outdoor Recreation Planner (GS 07/09/11) |
| V S | Conduct Outreach Off-site at Public Events | Perform outreach to off-site venues or events, including civic centers, organizational meetings, state park events, festivals/fairs wildlife expos and tribal pow-wows, using video, power point presentations with many visual photographs of Refuge resources, and/or table information booths | Goal 3, Obj. 2 | n/a | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$500/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .03 FTE Outdoor Recreation Planner (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|---|-----------------------------------|--------------|------------------|---|--|
| V S | Design and Install Interpretive Displays in MMLERC | Develop a display on cave history, including old cave photographs, caving equipment, cave maps, and cave exploration and ecology at the MMLERC; Develop model (display) showing interconnectivity of ground and surface water at the MMLERC | Goal 3, Obj. 8 | → | → | \$5K total | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .01 FTE Outdoor Recreation Planner (GS 07/09/11) |
| V S | Install Photography Blinds | Install photography blinds on Looney Unit, or other units as deemed appropriate | Goal 3, Obj. 5; Goal 3, Obj. 7 | → | → | \$4K total | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and/or .01 FTE Outdoor Recreation Planner (GS 07/09/11) and .01 FTE Maintenance Worker (WG 07/08) |
| V S | Coordinate with ODWC to Allow and Monitor Hunting | Develop a step-down Hunt Plan in collaboration with the ODWC to include details and impacts analysis of allowing walk-in only, open access hunting, according to State regulations on the Sally Bull Hollow Unit, once it has been surveyed and marked; Inventory and monitor federally listed endangered cave species to identify whether hunting is causing any adverse effects; If necessary, modify hunting regulations in cooperation with the ODWC; Evaluate the feasibility of allowing hunting on other areas of the Refuge as lands are acquired | Goal 1, Obj. 1; Goal 3, Obj. 6 | → | → | (see IN project, "Survey and Mark Refuge Boundaries") \$3K total | <ul style="list-style-type: none"> .10 FTE Outdoor Recreation Planner (GS 07/09/11) and .10 FTE LE Officer (GS 09) (based out of Sequoyah NWR) |
| V S | Perform Outreach w/ Social Media & Update Refuge Website(s) | Use social media tools and update Refuge websites to inform the public of current and upcoming EE, interpretation, wildlife photography & observation, and hunting opportunities, including visitor maps/directions; Stream live "bat cam" video online; Maintain and write online nature journal/blog | Goal 3, Obj. 2 | → | → | n/a | <ul style="list-style-type: none"> .03 FTE Outdoor Recreation Planner (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|---|--|--------------|--|----------------------|---|
| V S | Develop and Distribute Informational Materials | Develop and distribute informational materials with guidance on adaptive sustainable land and water management practices and recommendations to landowners, utility companies, Tribal Nations, and other governmental agencies; Develop educational materials and programs for schools and landowners that highlight the value (i.e., ecological and economic) of the ecology of cave, forest, and aquatic habitats of the Ozarks as well as volunteer opportunities | Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 2, Obj. 9; Goal 2, Obj. 10; Goal 3, Obj. 2 | → | → | \$3K/yr. | <ul style="list-style-type: none"> .03 FTE Outdoor Rec Planner (GS 07/09/11) |
| V S | Develop Flier/Brochure of Visitor Service Opportunities | Create a flier/brochure to advertise visitor services opportunities, including EE programs, interpretation, wildlife photography & observation, and hunting opportunities as well as volunteer opportunities | Goal 3, Obj. 2 | → | → | <\$500/yr. | <ul style="list-style-type: none"> .02 FTE Outdoor Recreation Planner (GS 07/09/11) |
| V S | Design and Distribute Merchandise and Other Promotional Materials | Design and distribute promotional materials including merchandise (shirts, hats, flashlights, headlamps, belt buckles, coffee mugs, water bottles, posters, etc.) to promote the Refuge and its resources | Goal 3, Obj. 2 | \$1K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$3K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and/or .01 FTE Outdoor Recreation Planner (GS 07/09/11) |
| V S | Establish and Maintain Walking Trails | Establish a 0.25-mile mostly primitive trail to connect the MMLERC Pavilion/Spavinaw Creek trail to the Looney maintenance shop trail; Improve the 0.25-mile trail with gravel from the Looney maintenance shop to the MMLERC; Build a new 2-mile primitive trail around the perimeter of the Looney Unit; Repave the 0.1-mile concrete path from the MMLERC cabin to the pavilion; Improve the 0.1 mile primitive trail with gravel from the parking/camping area to MMLERC; Maintain and reassess primitive trails annually at the end of Winter/early Spring | Goal 3, Obj. 7 | → | → | \$1.5K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .05 FTE Maintenance Worker (WG 07/08) + intern or temporary maintenance worker |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|--------|--|--|--|--------------------------|---|--|--|
| V S | Install Primitive Overlook Areas | Install 3 primitive overlook areas (with bench or sitting area) on the Looney Unit perimeter trail, to use as stopping points for wildlife observation and photography, environmental education, and interpretation | Goal 3, Obj. 7 | → | → | \$500 total | <ul style="list-style-type: none"> .01 FTE Maintenance Worker (WG 07/08) |
| V S | Construct and Install Refuge Signs | Construct a sign at the MMLERC to say "Mary & Murray Looney Education & Research Center"; Construct MMLERC sign at the county road entrance; Once established, post sign for new Refuge Headquarters; Install limited interpretive signage on the nature trail at Looney Unit; Install signs at all cave entrances to prohibit public entry and inform about WNS | Goal 3, Obj. 8 | → | → | \$2.5K total | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .02 FTE Maintenance Worker (WG 07/08) .01 FTE Outdoor Recreation Planner (GS 07/09/11) .01 FTE Biologist (GS 07/09/11) |
| V S | Survey and Mark Refuge Boundaries | Contract surveyors to survey and mark all unsurveyed and unmarked boundaries on the Refuge, using permanent metal boundary markers; Maintain and repair existing markers | Goal 2, Obj. 1; Goal 2, Obj. 2; Goal 2, Obj. 3; Goal 3, Obj. 6; Goal 3, Obj. 9 | n/a: surveying + marking | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .01 FTE Maintenance Worker (WG 07/08) | TBD (substantial cost for survey; \$10K to mark current units that have been surveyed); \$200K to survey/mark Sally Bull Hollow Unit; \$33K Gittin Down Mountain; \$27K Varmint Unit | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and/or .02 FTE Refuge Wildlife Specialist (GS 07/09/11) and .05 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) (+ .05 intern) |
| IN | Develop Training Program on Cave Safety and Search & Rescue | Create an EE program to train fire departments, grottos, and state and federal law enforcement agencies, as well as Refuge staff, on cave safety, search & rescue, and first-responder medical training | Goal 4, Obj. 1 | → | → | \$10K/yr. | <ul style="list-style-type: none"> .02 FTE Refuge Manager (GS 12/13) and .02 FTE Refuge Wildlife Specialist (GS 07/09/11) .02 FTE Outdoor Recreation Planner (GS 07/09/11) .02 FTE Biologist (GS 07/09/11) .02 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|----|---|---|-----------------|--------------|---|---|--|
| IN | Coordinate and Lead Cave/Karst/Bat Management Training | Coordinate and assist in leading a training and education workshop for inter-, intra-Service and collegiate partners focusing on cave, karst and bat management, using methods such as anabat acoustic detectors, infrared and thermal videography, mist-netting techniques and bat identification, cave gate construction, recharge area delineation, and other resource management techniques | Goal 3, Obj. 1 | \$2K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Wildlife Specialist (GS 07/09) | \$10K/yr. | <ul style="list-style-type: none"> .05 FTE Refuge Manager (GS 12/13) and .02 FTE Refuge Wildlife Specialist (GS 07/09/11) .01 FTE Outdoor Recreation Planner (GS 07/09/11) .10 FTE Biologist (GS 07/09/11) .02 FTE Administrative Assistant (GS 05/07/09) |
| IN | Establish Refuge Headquarters Site | Retrofit/remodel and/or build new headquarters site with adequate office and administrative space for anticipated staffing; Include facilities for volunteers (lounge, kitchen, showers, etc.) in the site plan | Goal 4, Obj. 3 | → | → | TBD | TBD |
| IN | Renovate MMLERC Roof | Remove cedar shingles and re-roof with new plywood and metal roof | Goal 4, Obj. 4 | → | → | \$25K total (includes contractor) Or \$15K (MAT) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .02 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | Renovate MMLERC Porch | Renovate flooring of porch and ensure porch railing meets safety standards | Goal 4, Obj. 4 | → | → | \$20K total (includes contractor) Or \$10K (MAT) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .02 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | Renovate MMLERC Exterior | Replace logs and grout, seal the exterior, paint exterior trim, and repair the retaining wall behind the cabin | Goal 4, Obj. 4 | → | → | \$40K initial + \$3K/yr. | <ul style="list-style-type: none"> .03 FTE Maintenance Worker (WG 07/08) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|----|---|--|--|------------------------------------|--|--|---|
| IN | Make MMLERC Handicap-accessible | Renovate front door to be handicap accessible; Renovate one bathroom in the EE center to include an accessible entrance and shower | Goal 4, Obj. 4 | → | → | \$20K total (includes contractor) or \$10K (MAT) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .03 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | Install Solar Panels | Install solar panels on Looney Unit and potentially on any newly acquired or developed buildings | Goal 1, Obj. 4; Goal 4, Obj. 4 | → | → | \$50K/initial cost/installation + \$1K/yr. maintenance | <ul style="list-style-type: none"> .01 Wildlife Refuge Specialist (GS 07/09/11) and .01 Maintenance Worker (WG 07/08) |
| IN | Make MMLERC Energy-Efficient | Install and maintain energy-efficient heating and cooling system and appliances (geothermal heating and cooling system, double pane windows, insulation, stove, refrigerator, dishwasher, on-demand hot water, washer and dryer) on all Refuge buildings | Goal 1, Obj. 4; Goal 4, Obj. 4 | \$3k/yr. | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and/or .02 FTE Maintenance Worker (WG 07/08) | \$40K/initial cost + \$2K/yr. | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) and .02 FTE Maintenance Worker (WG 07/08) |
| IN | Maintain Safe & Adequate Drinking Water Supply | Maintain water filtration system and replace filters at the MMLERC and other Refuge buildings to reduce energy and waste associated with bottled water; Test drinking water quality; Repair plumbing system, if necessary | Goal 1, Obj. 4; Goal 4, Obj. 4 | \$500/yr./system (2 systems total) | <ul style="list-style-type: none"> .01 FTE Wildlife Refuge Specialist (GS 07/09/11) | \$6K/filter system + \$500/yr./system | <ul style="list-style-type: none"> .01 FTE Maintenance Worker (WG 07/08) |
| IN | Install Rainwater Collection System | Install a rainwater collection system at the Looney Unit and the Guess house for irrigation purposes | Goal 1, Obj. 4; Goal 4, Obj. 4 | → | → | \$1K/initial cost | N/A |
| IN | Install Alarm System at MMLERC and Maintenance Shops | Install monitored alarm system in cabin and the Guess and Krause maintenance shops | Goal 4, Obj. 4 | → | → | \$5-10K/alarm system | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .01 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | Install Audio/Visual Technology in MMLERC | Install audio/visual technology (i.e. ceiling-mounted projector, etc.) for modern methods of teaching EE programs (i.e., power points, etc.) | Goal 3, Obj. 3; Goal 3, Obj. 4; Goal 4, Obj. 4 | → | → | \$6K total | n/a |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|----|--|---|-----------------|--------------|------------------|--|---|
| IN | Improve and Widen Access Roads and Parking Areas | Widen the MMLERC access drive by 2 feet and improve with gravel, including parking area; improve road with gravel from county road to maintenance shop (next to Guess House) on the Mary & Murray Looney Unit; improve 0.3 miles of gravel road on the Beck Unit; improve and/or maintain roads on newly acquired lands, where necessary | Goal 4, Obj. 5 | → | → | \$50K total supplies | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .03 FTE Maintenance Worker (WG 07/08) |
| IN | Protect and Survey Historical, Archeological, and Paleontological Sites | Partner with Oklahoma Historical Society, university faculty and/or students, Sam Noble Museum of Natural History, Tribes, SHPO, and others to conduct archeological, surveys to preserve and perform studies on known sites and any newly discovered sites | Goal 4, Obj. 2 | → | → | TBD (as per situation dictates) | TBD |
| IN | Construct & Maintain Maintenance Facilities | Build additional 50'x100' metal building on concrete pad maintenance shop at new Headquarters site; Construct a separate ventilated building located next to maintenance shop for hazardous materials storage; Construct an additional decontamination and storage facility/structure at the new Headquarters location; Outfit these facilities with appropriate maintenance equipment, heat, insulation, electricity, appropriate plumbing, lighting, etc.; Construct a new fueling station for Refuge vehicles and equipment at new Headquarters location; Reconstruct existing pole barn on the Beck Unit, near the Krause house; Maintain all maintenance facilities and supplies | Goal 4, Obj. 6 | → | → | \$250K initial + \$5K/yr. (including contractors) | <ul style="list-style-type: none"> .03 FTE Refuge Manager (GS 12/13) and/or .03 FTE Refuge Wildlife Specialist (GS 07/09/11) and .10 FTE Maintenance Worker (WG 07/08) .03 FTE Administrative Assistant (GS 05/07/09) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|----|--|---|-----------------|--------------|--|----------------------------------|---|
| IN | Provide Refuge Housing Adjacent to New HQ Site | Construct and/or purchase two new residences (one staff, one volunteer/student) adjacent to the new Headquarters building location | Goal 4, Obj. 7 | → | → | \$300-400K (approx.) | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .05 FTE Maintenance Worker (WG 07/08) .02 FTE Administrative Assistant (GS 05/07/09) |
| IN | Construct two RV Pads for Volunteers at new HQ site | Construct two RV pads for volunteers at the new Headquarters site, to include utilities | Goal 4, Obj. 7 | → | → | \$5K total | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .03 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | Renovate Krause Residence for Refuge Housing | Once agreement with Leslie Krause is terminated (via donation), renovate Krause residence and use for staff/volunteer/student housing | Goal 4, Obj. 7 | → | → | \$20K (contracted) or \$10K MATS | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12/13) and/or .01 FTE Refuge Wildlife Specialist (GS 07/09/11) and .10 FTE Maintenance Worker (WG 07/08) .01 FTE Administrative Assistant (GS 05/07/09) |
| IN | General Maintenance | General grounds upkeep, maintain and clean facilities, trash removal, vehicle maintenance, minor repairs, mowing, weeding, etc. | n/a | \$5K/yr. | <ul style="list-style-type: none"> .01 FTE Refuge Manager (GS 12) and .05 FTE Refuge Wildlife Specialist (GS 07/09) .45 FTE Maintenance Worker (WG 07/08) | \$7-10K/yr. | <ul style="list-style-type: none"> .50 FTE Maintenance Worker (WG 07/08) |
| IN | General Administration | General administration including: file-keeping, upkeep of paperwork, book-keeping, budget, contracting, data calls, SAMS, RONS, FBMS, online/safety trainings, etc. | n/a | n/a | <ul style="list-style-type: none"> .10 FTE Refuge Manager (GS 12) and .10 FTE Refuge Wildlife Specialist (GS 07/09) and .02 FTE Maintenance Worker (WG 07/08) and .30 FTE Administrative Assistant (GS 07) based out of Sequoyah NWR | n/a | <ul style="list-style-type: none"> .15 FTE Refuge Manager (GS 12/13) and .10 FTE Refuge Wildlife Specialist (GS 07/09) .35 FTE Administrative Assistant (GS 05/07/09) .02 FTE Maintenance Worker (WG 07/08) .02 FTE Biologist (GS 07/09/11) .02 FTE Outdoor Rec Planner (GS 07/09/11) |

| # | Project | Project Description | Ch. 4 Reference | Current Cost | Current Staffing | Future Cost Required | Future Staffing Required |
|---|---|---------------------|-----------------|--|---|---|--|
| | Total Projects | | | Current Cost | Current Total Staffing | Future Cost | Future Total Staffing Required |
| | <ul style="list-style-type: none"> • (08) Landscape Level • (11) Habitat Management • (19) Wildlife Management • (24) Visitor Services • (21) Infrastructure | | | Total Annual \$119,100 Total Initial \$25,000 Total Land Acquisition (4,000 acres) \$400,000 | <ul style="list-style-type: none"> • >1.0 FTE Refuge Manager (GS 12) • >1.0 FTE Refuge Wildlife Specialist (GS 07/09) • .50 FTE Maintenance Worker (WG 07/08) • .30 FTE Administrative Assistant (GS 07) <i>based out of Sequoyah NWR</i> • .10 FTE Prescribed Fire Specialist (GS 11) <i>based out of Oklahoma/North-Texas Fire Management District</i> | Total Annual \$447,600 Total Initial for 2013-2028 \$2,919,000 Total Land Acquisition (11,000 acres) + Boundary Marking approx. \$33,270,000 | <ul style="list-style-type: none"> • 1.0 FTE Refuge Manager (GS 12/13) • 1.0 FTE Refuge Wildlife Specialist (GS 07/09/11) • 3.0 FTE Biologist (GS 07/09/11) • 1.5 FTE Outdoor Recreation Planner (GS 07/09/11) • 1.5 FTE Maintenance Worker (WG 07/08) • 1.0 FTE Administrative Assistant (GS 05/07/09) • 0.3 FTE Law Enforcement Officer (GS 09) <i>based out of Sequoyah NWR</i> • .30 FTE Prescribed Fire Specialist (GS 11) <i>based out of Oklahoma/North-Texas Fire Management District</i> • .50 PT SCEP |

5.7 Step-Down Management Plans

Implementation of this CCP will be accomplished, in part, through various step-down management plans (see sections 5.7.1 and 5.7.2). Each step-down plan has its own program focus, identifying and directing the implementation of strategies (i.e., actions, techniques, and tools) designed to achieve programmatic objectives outlined in the CCP.

5.7.1 Current Step-Down Plans

Current Refuge step-down management plans and other plans referred to that guide Refuge management include:

- (Draft) Station Safety Plan (2012)
- (Draft) Cave Safety Plan (2012)
- Ozark Plateau NWR Fire Management Plan for the Looney Unit (2008)
- Ozark Plateau NWR Fire Management Plan for the Sally Bull Hollow Unit (2008)
- Ozark Plateau NWR Habitat Management Plan (2005)
- Ozark Plateau NWR Proposed Boundary Expansion EA, LPP, and CMP (2002; approved 2005)

5.7.2 Future Step-Down Plans

The following list of step-down management plans may be necessary to guide management of specific Refuge programs:

- Fire Management Plan (to include all Refuge Units)
- Hunt Plan
- I&M Plan
- Integrated Pest Management Plan
- Visitor Services Plan

5.7.3 Other Frequently Referenced Plans

- Ozark big-eared bat Revised Recovery Plan (1995)
- Ozark big-eared bat 5-Year Review (2008)
- Gray bat Recovery Plan(1982)
- Indiana bat Recovery Plan (2009)
- Ozark cavefish Recovery Plan (1989)
- Ozark cave crayfish Recovery Plan (1996)
- Oklahoma Comprehensive Wildlife Management Strategy (2005)
- The Nature Conservancy's Ozark Ecoregional Conservation Assessment (2003)
- The Central Hardwood Joint Venture Concept Plan (2003)

- Tri-State (Tar Creek) Superfund Site, Final Partial Restoration Plan and Environmental Assessment (2000)
- North American Landbird Conservation Plan (2004)
- A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (2011)
- White-nose Syndrome Response Plan for the State of Oklahoma
(http://www.wildlifedepartment.com/wildlifemgmt/Oklahoma_Response_Plan_WNS.pdf)

5.8 Monitoring and Evaluation of the CCP

Inventorying and monitoring helps the Refuge track the progress of implementing the CCP. The results of monitoring show how well objectives are being achieved and measure progress towards accomplishing overall Refuge goals. Table 5-3 is meant for the Refuge staff to utilize throughout the length of this CCP in order to monitor the effectiveness of their efforts as they correspond to their objectives identified in Chapter 4. This table is to be used as a practical stand-alone electronic monitoring data document. This provides Refuge staff with the flexibility to modify monitoring notes as frequently as needed, as well as the information (i.e. add a new scientific monitoring technique or an additional project), while saving it as an electronic file to be easily referenced. Refuge staff is responsible for consistently monitoring the progress of project implementation and especially, of whether objectives are being achieved. It is recommended that Refuge staff at least review these annually. This monitoring table will be refined throughout the lifetime of the CCP:

- as additional Refuge management units are acquired
- as management is adapted to meet changing conditions (see Chapter 4 introduction regarding *Adaptive Management*)
- as management is adapted to meet the identified needs and requirements of various habitats and wildlife species (see Chapter 4 introduction regarding *Adaptive Management*)
- as step-down management plans are drafted or revised
- as additional projects become necessary to implement (may require further NEPA documentation)



*Inventorying and monitoring DNA samples to learn more about genetic diversity of cave species.
(Credit: Shea Hammond)*

Table 5-3. 2013-2028 CCP Monitoring & Evaluation Table.

Goal 1. Landscape-level Context

Collaborate with multiple partners to implement Strategic Habitat Conservation on a landscape-level in order to prevent extinction and recover federally listed threatened and endangered Ozark cave species as well as prevent the need for listing other Ozark species of concern.

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|---|--|----------------------|-------------------------|
| 1 | Continue Building Landscape-Level Partnerships | 2013-2028 | # of partnerships, collaborate projects, co-hosted conferences, additional funding sources, increase capability, maximize strengths, work across state, regional, tribal, agency, and private organizational boundaries and involve private landowner to make best use of their authorities and capabilities. | track existing and any new partnerships, keep partners informed, maintain personal communications and visits, collaborate projects, and/or co-hosted planning and management teams, meetings, conferences, and websites. | ongoing | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Maintain and Increase Partnerships</p> <p><input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences</p> <p><input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/ Implementation</p> | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 2 | Coordinate Across FWS Regions to Better Manage Federally Listed Ozark Cave Species on a Landscape-Level | 2013-2028 | on-the-ground collaboration between distinct FWS regions to manage cave resources, population recovery of T&E cave species, increased scientific information/knowledge regarding cave species in the Ozarks | development of management agreement(s) to manage federally listed Ozark cave species across multiple FWS regions; evaluation of effectiveness of these management agreements | ongoing | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Coordinate Across FWS Regional Boundaries to Manage Ozark Cave Species</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|--------------------|--|--|----------------------|-------------------------|
| 3 | Expand Refuge Boundaries | 2013-2028 | 15,000 acres of land acquired Oklahoma, but yet to be determined in Arkansas, Missouri, and Kansas | land and conservation easements; conservation agreements with private, municipal, county, state, tribal, and federally landowners | ongoing | |
| <p>↓ Associated Projects (type date and progress details below each project):</p> <p><input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers</p> <p><input type="checkbox"/> Maintain and Increase Partnerships</p> <p><input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/ Implementation</p> | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 4 | Implement Climate Change Monitoring & Mitigation Program | 2018 | air, water, cave, rock, soil, and stream temp., % humidity, % light, precipitation, stream flow, groundwater elevation; % energy efficiency, % alt. energy use, and gallons of water conservation, migration patterns, shifts in both aquatic and terrestrial plant and animal species composition | record climate data, species movement and population base lines and measure trends over time; monitor and track energy efficiency levels, water use and alternative energy use | seasonally | |
| <p>↓ Associated Projects (type date and progress details below each project):</p> <p><input type="checkbox"/> Implement Climate Data Loggers Program</p> <p><input type="checkbox"/> Install Weather Stations</p> <p><input type="checkbox"/> Monitor and Reintroduce Chestnut blight-resistant Chinquapin</p> <p><input type="checkbox"/> Install Solar Panels</p> <p><input type="checkbox"/> Make MMLERC Energy-Efficient</p> <p><input type="checkbox"/> Maintain Safe & Adequate Drinking Water Supply</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|--------------------|--|--|---|-------------------------|
| 5 | Implement Water Quantity & Quality Monitoring & Management Program | 2018 | levels of contaminants of surface and groundwater quality in streams, lakes, aquifers, springs, and caves; water quantity (levels and flow) based on groundwater elevation and discharge of aquifers, springs, caves, streams, and lakes | record and compare results of water quality and quantity levels; compare results with population health of cavefish and cave crayfish and other surface and subterranean species | every 5 years for quality; every 2 years for quantity | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Implement Water Quality Monitoring Program</p> <p><input type="checkbox"/> Implement Water Quantity Monitoring Program</p> <p><input type="checkbox"/> Map Groundwater Recharge Areas</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|---|---|----------------------|-------------------------|
| 6 | Assist with White-nose Syndrome Research, Monitoring, Prevention, and Recovery | 2013-2028 | presence of <i>Geomyces destructans</i> ; if present, species type, severity of impact, and % of bat pop. affected by WNS; # of caves with WNS occurrences; # caves prevented from occurrence of WNS; # of Refuge- managed populations recovered from WNS | document mitigation measures; document all occurrences of <i>Geomyces destructans</i> and WNS, including species type and location; document prevention and recovery of WNS including species type and location | ongoing | |
| <p>↓ Associated Projects (type date and progress details below each project):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives and Assist w/Implementation <input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences <input type="checkbox"/> Coordinate beyond FWS Regional Boundaries to Manage Ozark Cave Species <input type="checkbox"/> Monitoring Cave Entry <input type="checkbox"/> Bio-inventory Cave Fauna <input type="checkbox"/> Monitor for White-nose Syndrome <input type="checkbox"/> Prevent White-nose Syndrome from Occurring on the Refuge <input type="checkbox"/> Reduce and/or eliminate White-nose Syndrome from Affected Bats and/or Sites <input type="checkbox"/> Conduct Genetic Sampling <input type="checkbox"/> Identify Migration Corridors of Bat, Bird, or Other Wildlife Species <input type="checkbox"/> Monitor Bat Population Trends <input type="checkbox"/> Monitor Bat Response to Cave Habitat Conditions <input type="checkbox"/> Monitor Cavefish & Cave Crayfish Population Trends | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|-----------------------|---|---|-------------------------|-------------------------|
| 7 | Identify Migration Routes/Habitat Corridors | 2018 | # of bat and bird species whose migration routes/habitat corridors have been identified | ID and map migration routes/habitat corridors/timing and update | every 5 years | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Maintain and Increase Partnerships</p> <p><input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences</p> <p><input type="checkbox"/> Identify Migration Corridors of Bat, Bird, or other Wildlife Species</p> | | | | | | |

Goal 2. Wildlife Habitat & Population Management

Protect, enhance, conserve and restore Ozark natural caves, springs, streams, aquifers, wetlands, watersheds, forests, and groundwater recharge areas to prevent extinction and recover federally listed cave species as well as prevent the need for listing other native species including migratory birds and other species of concern in the Ozarks to promote natural species diversity on a landscape-level.

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|--|---|-----------------------------------|-------------------------|
| 1 | Protect, Enhance, and/or Restore Forested Habitat | 2013-2028 | condition of forested habitat or habitat restored to forest (mod. stocked, open woodlands w/ herbaceous understory); # of acres protected, enhanced, and/or restored | observation, professional judgment, establish transects, and other sampling points to determine and monitor forest conditions; document # of acres acquired as forest or restored to forest; sustainability of Ozark big-eared bats and other forest-foraging or roosting species | as needed; at least every 5 years | |
| <p>↓ Associated Projects (type date and progress details below each project):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/Implementation <input type="checkbox"/> Use Prescribed Fire on 1/3 of Total Refuge Lands <input type="checkbox"/> Identify and Map the Distribution and the Condition of Forest Habitat <input type="checkbox"/> Identify & Survey Plant Species <input type="checkbox"/> Monitor Impacts of Non-Native Flora Species <input type="checkbox"/> Monitor & Reintroduce Chestnut Blight-Resistant Chinquapin <input type="checkbox"/> Implement Adaptive Management to Control Non-Native Invasive Flora <input type="checkbox"/> Determine Bat Foraging Ecology & Habitat Trends | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|--------------------|--|---|-----------------------------------|-------------------------|
| 2 | Protect, Enhance, and/or Restore Aquatic Habitat | 2013-2028 | Levels of contaminants of surface and groundwater quality and other habitat parameters in streams, lakes, aquifers, springs, and caves; pop. levels of cavefish and other surface and subterranean species | Record and compare results of water quality and quantity levels and other habitat parameters; compare results with population monitoring of cavefish and cave crayfish and other surface and subterranean species | As needed; at least every 5 years | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/Implementation <input type="checkbox"/> Implement Water Quality Monitoring Program <input type="checkbox"/> Implement Water Quantity Monitoring Program <input type="checkbox"/> Map Groundwater Recharge Areas <input type="checkbox"/> Identify & Survey Plant Species <input type="checkbox"/> Monitor Impacts of Non-Native Flora Species <input type="checkbox"/> Implement Adaptive Management to Control Non-Native Invasive Flora <input type="checkbox"/> Monitor Bat Response to Cave Habitat Conditions <input type="checkbox"/> Monitor Cavefish & Cave Crayfish Population Trends <input type="checkbox"/> Research Ecology of Ozark Cavefish | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|---|---|----------------------|-------------------------|
| 3 | Provide Undisturbed, Safe, and Protected Cave Habitat | 2013-2028 | # of cave vandalism incidents; frequency of monitoring human access to important caves; condition of existing cave gates; educated public (public aware of importance of not disturbing cave resources) | document cave vandalism incidents; document Refuge staff and LE cave surveillance visits (where and when); monitor condition of existing cave gates, construct new cave gates to control human access where needed, repair damaged or deteriorating cave gates; interact with public and EE/interp participants about importance of cave closures | annually | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/Implementation <input type="checkbox"/> Locate Additional Caves <input type="checkbox"/> Coordinate beyond FWS Regional Boundaries to Manage Ozark Cave Species <input type="checkbox"/> Monitoring Cave Entry <input type="checkbox"/> Install Cameras in Cave Interiors to Monitor Bat Activity/Behavior | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 4 | Locate Additional Caves | 2013-2028 | # and importance of new cave locations discovered; extensive ridge-walking efforts | continue search for important caves and map (and update map) of searched and unsearched geological areas conducive to cave formations | annually | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/Implementation <input type="checkbox"/> Locate Additional Caves <input type="checkbox"/> Coordinate beyond FWS Regional Boundaries to Manage Ozark Cave Species <input type="checkbox"/> Map Subterranean Extent of Known Caves | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|-----------------------|---|---|-------------------------|-------------------------|
| 5 | Delineate Recharge Area of Cavefish and Crayfish Caves | 2013-2028 | map total groundwater recharge areas of important caves | map ground water recharge and watershed areas based on results of dye tracing | update every 5 years | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers</p> <p><input type="checkbox"/> Map Groundwater Recharge Areas</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|--|--------------------|---|---|----------------------|-------------------------|
| 6 | Inventory & Monitor to Increase Scientific Knowledge Regarding Federally Listed Cave Species and Species of Concern | 2013-2028 | establishment of I&M program(s) that increases knowledge of pop. trends, density, distribution, genetic diversity, and habitat preferences of federally listed species and species of concern | documentation and presentation of current research; use of information in adaptive management; sustainability of cave species | as needed | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences <input type="checkbox"/> Coordinate beyond FWS Regional Boundaries to Manage Ozark Cave Species <input type="checkbox"/> Use Prescribed Fire on 1/3 of Total Refuge Lands <input type="checkbox"/> Bio-inventory Cave Fauna <input type="checkbox"/> Monitor for White-nose Syndrome <input type="checkbox"/> Conduct Genetic Sampling <input type="checkbox"/> Identify Migration Corridors of Bat, Bird, or other Wildlife Species <input type="checkbox"/> Conduct Species Surveys <input type="checkbox"/> Monitor Bat Population Trends <input type="checkbox"/> Monitor Bat Response to Cave Habitat Conditions <input type="checkbox"/> Identify Baseline Data regarding Bat Species & Distribution within Foraging Areas <input type="checkbox"/> Determine Bat Foraging Ecology & Habitat Trends <input type="checkbox"/> Install Cameras in Cave Interiors to Monitor Bat Activity Behavior <input type="checkbox"/> Monitor Cavefish & Cave Crayfish Population Trends <input type="checkbox"/> Research Ecology of Ozark Cavefish <input type="checkbox"/> Develop Habitat Suitability Index Model <input type="checkbox"/> Pesticide Sampling | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|---|--|----------------------|-------------------------|
| 7 | Inventory & Monitor to Increase Scientific Knowledge Regarding Migratory and Resident Non-T&E Species | 2013-2028 | establishment of I&M program(s) that acquires Refuge species list and increases knowledge of pop. trends, density, distribution, and habitat preferences of non-T&E species | documentation and presentation of current research; use of information in adaptive management; sustainability of non-T&E species | as needed | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences <input type="checkbox"/> Use Prescribed Fire on 1/3 of Total Refuge Lands <input type="checkbox"/> Bio-inventory Cave Fauna <input type="checkbox"/> Monitor for White-nose Syndrome <input type="checkbox"/> Conduct Genetic Sampling <input type="checkbox"/> Identify Migration Corridors of Bat, Bird, or other Wildlife Species <input type="checkbox"/> Conduct Species Surveys <input type="checkbox"/> Monitor Bat Population Trends <input type="checkbox"/> Monitor Bat Response to Cave Habitat Conditions <input type="checkbox"/> Identify Baseline Data regarding Bat Species & Distribution within Foraging Areas <input type="checkbox"/> Determine Bat Foraging Ecology & Habitat Trends <input type="checkbox"/> Install Cameras in Cave Interiors to Monitor Bat Activity Behavior <input type="checkbox"/> Pesticide Sampling | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|--------------------|--|---|----------------------|-------------------------|
| 8 | Monitor Migratory and Resident Bird Species utilizing the Refuge and Surrounding Landscape | 2013-2028 | establishment of I&M program(s) to identify migratory & resident birds and understand their habitat requirements | documentation and presentation of current research; use of information in adaptive management; sustainability of bird species | as needed | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lead and/or Participate in Landscape Level Conservation Projects and Conferences <input type="checkbox"/> Identify and Map the Distribution and the Condition of Forest Habitat <input type="checkbox"/> Identify Migration Corridors of Bat, Bird, or other Wildlife Species <input type="checkbox"/> Use Prescribed Fire on 1/3 of Total Refuge Lands <input type="checkbox"/> Conduct Species Surveys <input type="checkbox"/> Monitor Bird Population Trends & Identify Habitat Requirements | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|--|--------------------|---|---|----------------------|-------------------------|
| 9 | Map, Monitor, Research, and Implement Adaptive Management to Assess and Control Invasive Non-native Flora | 2013-2028 | establishment of I&M program(s) to identify non-native invasive plants on and surrounding every unit and understand impacts to native flora & fauna species | documentation and presentation of current research; use of information in adaptive management to control invasive flora; sustainability of native species | as needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/ Implementation <input type="checkbox"/> Use Prescribed Fire on 1/3 of total Refuge Lands per year <input type="checkbox"/> Identify and Map the Distribution and the Condition of Forest Habitat <input type="checkbox"/> Identify & Survey Plant Species <input type="checkbox"/> Monitor Impacts of Non-Native Flora Species <input type="checkbox"/> Monitor & Reintroduce Chestnut Blight-resistant Chinquapin <input type="checkbox"/> Implement Adaptive Management to Control Non-Native Invasive Flora | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 10 | Map, Monitor, Research, and Implement Adaptive Management to Assess and Control Invasive Non-native Fauna | 2013-2028 | establishment of I&M program(s) to identify non-native invasive wildlife species on and surrounding every unit and understand impacts to native flora & fauna species | documentation and presentation of current research; use of information in adaptive management to control invasive fauna; sustainability of native species | As needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Educate Landowners about Private Land Conservation Mgmt. Incentives & Assist w/ Implementation <input type="checkbox"/> Monitor Impacts of Non-Native Fauna Species <input type="checkbox"/> Implement Adaptive Management to Control Non-Native Invasive Fauna Species | | | | | | |

Goal 3. Visitor Services

Provide safe, high quality, compatible, wildlife dependent use opportunities for visitors, students, and nearby residents, to give them an understanding of the importance and value of Ozark cave, spring, aquifer, stream, wetland, watershed, groundwater recharge areas, and forest wildlife habitat conservation efforts.

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|---|--|----------------------|-------------------------|
| 1 | Establish a Friends Group and Increase Volunteers | 2013-2028 | establishment of official Friends Group; # of Friends and length of dedication/commitment; # of volunteer hours | assist in establishment of Friends Group; maintain "Friends Log" with contact info, each member's expertise, Friend role/job/expertise, and total volunteer hours; coordinate and lead meetings with Friends Group; train (job, education, safety) dedicated Friends members to then train new Friends members or volunteers; Host Friends appreciation events | seasonally | |
| <p>↓ Associated Projects (type date and progress details below each project):</p> <p><input type="checkbox"/> Coordinate to Establish and Train Official Friends Group</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|---|---|----------------------|-------------------------|
| 2 | Increase Public Awareness via Outreach | 2013-2028 | local public awareness of surrounding cave and karst resources; local public awareness of Ozark Plateau NWR; # of visitors from various surrounding communities as a result of outreach efforts | maintain “Outreach Log” of date, location, method, and audience type of conferences, festivals, schools, and other local events attended for public outreach; update “Outreach Log” when materials are produced and to whom they are distributed; visitor log/survey with Q: “how did you hear about us?” | As performed | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Coordinate to Establish and Train Official Friends Group <input type="checkbox"/> Conduct Outreach Off-site at Public Events <input type="checkbox"/> Perform Outreach w/Social Media & Update Refuge Website(s) <input type="checkbox"/> Develop Flier/Brochure of Visitor Services Opportunities <input type="checkbox"/> Develop and Distribute Informational Materials <input type="checkbox"/> Design and Distribute Merchandise and Other Promotional Materials | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|--|--------------------|--|--|----------------------|-------------------------|
| 3 | Collaborate to Increase Program Opportunities for Environmental Education | 2013-2028 | # of EE participants; # of visits per week; # and quality of collaborative EE programs with partners; # of repeat visits | achieving desired visitor numbers; feedback from participants (via pre- and post-program surveys, verbal communication, comments, evaluations) | seasonally | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ozark Nature Connection Series EE Programs <input type="checkbox"/> Coordinate with Other Partners to Provide EE Programming <input type="checkbox"/> Partner with Tribal Nations to Conduct EE Programs for Tribal Youth <input type="checkbox"/> Partner with City of Tulsa and NGOs to Provide EE Program on Drinking Water Supply/Water Quality <input type="checkbox"/> Develop and Conduct Training for FWS Staff on “Coyote Mentoring” EE Method <input type="checkbox"/> Coordinate with Universities to Conduct Field Trips, Outdoor Classes and Continuing Education Credits on Refuge <input type="checkbox"/> Work with K-12 Classes to Utilize MMLERC <input type="checkbox"/> Conduct EE Programs Off-site <input type="checkbox"/> Hands-on Master Gardener/Master Naturalist Permaculture EE Program <input type="checkbox"/> Install Audio/Visual Technology in MMLERC | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|--|---|----------------------|-------------------------|
| 4 | Collaborate to Promote and Conduct Interpretation Programs | 2013-2028 | # of interpretation program participants; # of visits per week; # and quality of collaborate interpretive programs with partners; # of repeat visits | documentation of visitor numbers and purpose of visit; feedback from visitors (via pre- and post- program surveys, verbal communication, comments, evaluations) | as needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Conduct Interpretation Programs On-site at MMLERC</p> <p><input type="checkbox"/> Conduct Interpretation Programs Off-site at Public Events</p> <p><input type="checkbox"/> Design and Install Interpretive Displays in MMLERC</p> <p><input type="checkbox"/> Install Audio/Visual Technology in MMLERC</p> | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 5 | Promote Opportunities for Wildlife Observation & Photography | 2013-2028 | # of participants observing wildlife and/or using cameras; displayed wildlife photographs by visitors in MMLERC; use of social media to share images taken on Refuge; # of repeat visits | documentation of visitor numbers and purpose of visit; feedback from visitors (via pre- and post- program surveys, verbal communication, comments, evaluations); log of identified wildlife species | as needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Install Photography Blinds</p> <p><input type="checkbox"/> Install Primitive Overlook Areas</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|--|---|----------------------|-------------------------|
| 6 | Collaborate with ODWC to Provide Hunting Opportunities | 2018 | development and completion of a step-down Hunt Plan + NEPA documentation in cooperation with the ODWC; Sally Bull Hollow Unit boundaries surveyed and marked | development of Hunt Plan in cooperation with the ODWC; once hunting is allowed, feedback from hunters on hunting on the Sally Bull Hollow Unit and if necessary, documentation of effects of hunting on important cave species and game species | as needed | |
| ↓ <i>Associated Projects (type date and progress details below each project):</i> <input type="checkbox"/> Survey and Mark Refuge Boundaries <input type="checkbox"/> Coordinate with ODWC to Allow and Monitor Hunting | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 7 | Create More Hiking/Nature-viewing Opportunities | 2018 | at least 2.7 miles of primitive trails on and around perimeter of Looney Unit established and/or improved; # of visitors using trails | feedback from visitors using trails (verbal communication, comments, surveys, evaluations); Ease and safety of trail use and views from trails | As needed | |
| ↓ <i>Associated Projects (type date and progress details below each project):</i> <input type="checkbox"/> Establish and Maintain Walking Trails <input type="checkbox"/> Install Primitive Overlook Areas | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 8 | Design and Display Refuge Signs | 2013-2028 | establishment of MMLERC sign at cabin and county road entrance; establishment of Refuge HQ sign; # of caves with signs prohibiting public entry | observation of visitors not getting lost and less illegal cave entry due to signage | As needed | |
| ↓ <i>Associated Projects (type date and progress details below each project):</i> <input type="checkbox"/> Construct and Install Refuge Signs | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|---|--------------------|---|--|----------------------|-------------------------|
| 9 | Survey and Mark Refuge Units' Boundaries | 2013-2028 | % of Refuge Units (boundaries) that have been surveyed and marked | track (Table 4-1 from Ch. 4) which Units have been surveyed and marked (and maintenance of markers, fences, gates); Prioritize survey and marking projects | Annually | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Survey and Mark Refuge Boundaries</p> | | | | | | |

Goal 4. Refuge Infrastructure & Administration

Provide administrative support and appropriate facilities required to ensure that Refuge goals and objectives are met through effective landscape conservation management of Ozark habitats, fish and wildlife, and visitor services and for the primary purpose of preventing extinction and recovering federally listed threatened and endangered Ozark cave species.

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|--|---|----------------------|-------------------------|
| 1 | Ensure Workforce and Volunteer Training and Safety | 2013-2028 | # of injuries; comfort level of staff in performing their job; time/energy efficiency to accomplish projects | document each employee or volunteer's trainings with dates, perform and save job hazard analysis ; observe staff on the job to evaluate knowledge, efficiency, and safety precautions; feedback from employee/volunteer evaluations | As needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <p><input type="checkbox"/> Coordinate to Establish and Train Official Friends Group</p> <p><input type="checkbox"/> Develop Training Program on Cave Safety and Search & Rescue</p> <p><input type="checkbox"/> Coordinate and Lead Cave/Karst/Bat Management Training</p> <p><input type="checkbox"/> Develop and Conduct Training for FWS Staff on the "Coyote Mentoring" EE Method</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|---|--|----------------------|-------------------------|
| 2 | Protect and Survey Historical, Archeological and Paleontological Sites | 2013-2028 | increased knowledge of newly discovered historical, archeological, and paleontological sites; Protection of known sites | monitor protection of known sites; Get information regarding newly discovered sites from partners' surveys | As needed | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <p><input type="checkbox"/> Protect and Survey Historical, Archeological and Paleontological Sites</p> | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 3 | Establish a Refuge Headquarters Site | 2013-2028 | establishment of central HQ site; increased efficiency in communication and coordination between Refuge staff members | n/a | n/a | |
| <p>↓ Associated Projects (<i>type date and progress details below each project</i>):</p> <p><input type="checkbox"/> Acquire up to 15,000 Acres of Land and Conservation Easements from Willing Sellers</p> <p><input type="checkbox"/> Establish Refuge Headquarters Site</p> | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|---|---|--------------------|--|--|----------------------|-------------------------|
| 4 | Renovate and Repair the MMLERC | 2018 | # of repairs and renovation projects completed (from Ch. 4 strategies) | feedback from MMLERC users/visitors' experience of the facility (verbal communication, comments, surveys, evaluations) | As needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Renovate MMLERC Roof <input type="checkbox"/> Renovate MMLERC Porch <input type="checkbox"/> Renovate MMLERC Exterior <input type="checkbox"/> Make MMLERC Handicap-accessible <input type="checkbox"/> Install Solar Panels <input type="checkbox"/> Make MMLERC Energy-efficient <input type="checkbox"/> Maintain Safe & Adequate Drinking Water Supply <input type="checkbox"/> Install Rainwater Collection System <input type="checkbox"/> Install Alarm System at MMLERC and Maintenance Shops | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 5 | Improve and Widen Access Roads and Parking Areas | 2018 | less damage to soil, tires, and roadside vegetation compared to previous road conditions | professional judgment | As needed | |
| <p>↓ <i>Associated Projects (type date and progress details below each project):</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Improve and Widen Access Roads and Parking Areas | | | | | | |

| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
|--|--|--------------------|--|---|----------------------|-------------------------|
| 6 | Construct Building Facilities Associated with Maintenance | 2013-2028 | ability to perform maintenance; utilization of maintenance facilities | effectiveness and usefulness of all maintained and newly established facilities associated with maintenance | As needed | |
| ↓ <i>Associated Projects (type date and progress details below each project):</i> <input type="checkbox"/> Construct & Maintain Maintenance Facilities | | | | | | |
| Obj. # | Objective | Implement by year: | Effectiveness Measures | Monitoring Techniques | Monitoring Frequency | Date & Monitoring Notes |
| 7 | Provide Housing for Refuge Staff, Interns, Volunteers, Researchers, and Educators | 2013-2028 | ratio of available rooms/RV/house to permanent and temporary staff members, volunteers, interns, researchers, and/or educators | feedback from housed guests and those that need to find alternative housing | As needed | |
| ↓ <i>Associated Projects (type date and progress details below each project):</i> <input type="checkbox"/> Provide Refuge Housing Adjacent to New HQ Site <input type="checkbox"/> Construct two RV Pads for Volunteers at New HQ Site <input type="checkbox"/> Construct RV Pad for Volunteers on Looney Unit <input type="checkbox"/> Renovate Krause Residence for Refuge Housing | | | | | | |

5.9 CCP Amendment and Revision

In order for the CCP to remain as a useful guide and tool for monitoring Refuge success of meeting its overall goals, the CCP must be reviewed and updated throughout its lifetime. It is the Refuge staff's responsibility to revise the CCP while preparing annual work plans. It may also be reviewed during routine inspections or programmatic evaluations. Results of these reviews may indicate a need to modify the CCP.

In an unpredictable environment where fish and wildlife populations, user groups, adjacent land activities, and climates are constantly fluctuating - often in unforeseen ways - Refuge staff will most likely need to adjust sections of this CCP accordingly. In addition, if desired results for CCP implementation are not being achieved, management will also need to be adapted accordingly. If these management changes are substantial, Refuge staff is responsible for making amendments to CCP. The project leader will determine the level of public involvement and associated NEPA documentation regarding any amendment(s). This CCP will be formally revised at least every 15 years.



Wet and dry stones at Spavinaw Creek. (Credit: Sarah Catchot)

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Appendix A. Environmental Assessment

Ozark Plateau National Wildlife Refuge Comprehensive Conservation Plan



Caving equipment at Ozark Plateau NWR. (Credit: Richard Stark, 2009)

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APPENDIX A: ENVIRONMENTAL ASSESSMENT (EA)

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Chapter 1: Introduction and Scoping Issues of EA

1.1 Introduction

The United States Fish and Wildlife Service (Service) proposes to implement a Comprehensive Conservation Plan (CCP) for the Ozark Plateau National Wildlife Refuge (NWR), which will guide Refuge management direction for the next 15 years. This CCP includes a clear vision, goals, and objectives that will help the Refuge achieve its purposes of establishment. This Environmental Assessment (EA) is being prepared to evaluate the effects associated with this proposal and complies with the National Environmental Policy Act (NEPA) in accordance with Council on Environmental Quality regulations (40 CFR 1500-1509) and Department of the Interior (516 DM 8) and Service (550 FW 3) policies (see Section 1.7 for a list of additional regulations that this EA complies with). NEPA requires examination of the effects of proposed actions on the natural and human environment. In the following chapters, we describe two alternatives for future Refuge management, the environmental consequences of each alternative, and our proposed management direction. Each alternative was designed to contain a reasonable combination of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities consistent with the Refuge System Improvement Act and specific Refuge purposes.

The environmental benefits and consequences of each alternative are described below and form the basis for selection of the proposed action (Alternative B). This Environmental Assessment was designed to cover NEPA compliance for the environmental benefits and consequences for most future management actions and current facilities on the Ozark Plateau National Wildlife Refuge. However, some future actions that are not described site-specifically or in sufficient detail below may require further NEPA documentation.

1.1 Location

Ozark Plateau NWR lies in northeastern Oklahoma, within an approved seven-county acquisition boundary of up to 15,000 acres of land within Sequoyah, Adair, Cherokee, Mayes, Delaware, Craig, and Ottawa Counties. There are currently nine units managed by the Refuge within this boundary including the Beck (Krause), Boy Scout, Gittin Down Mountain, Lake Eucha, Liver, Mary and Murray Looney (Looney), Mutt Potter (Potter), Sally Bull Hollow, and Varmint Units; however, as lands are acquired over the lifetime of this CCP, the number of management units will increase. (See Chapter 1 of the CCP, Figure 1-1, for *Map of Ozark Plateau NWR Management Units and Acquisition Boundary*).

The seven-county area is located within Bailey's Oak-Hickory Forest Ecoregion in eastern Oklahoma along the southwest edge of Omernik's Ozark Plateau and Boston Mountains near the Arkansas border (Bailey, 1989) (Omernik, 1987). The area is in a region of karst topography, eroded to form steep hills, incised valleys, and prominent bluffs. Much of the drainage is underground resulting in a number of caves and springs. In addition, the clear rocky bottom streams, ground water recharge areas, wetlands, and large continuous stands of oak-hickory forest, support a diverse array of vertebrate and invertebrate species that not only are endemic to the Ozark Plateau, but are sometimes unique to each cave or spring because of their isolation from one another. Because cave and spring ecosystems often develop their own endemic species complements, it is possible that numerous undescribed and uncatalogued fauna may exist in the recently discovered, or yet undiscovered, caves. For example, three new species of insects have recently been identified from one Refuge cave. These caves also provide habitat for three federally listed endangered bat species and one threatened cavefish species. The forested areas

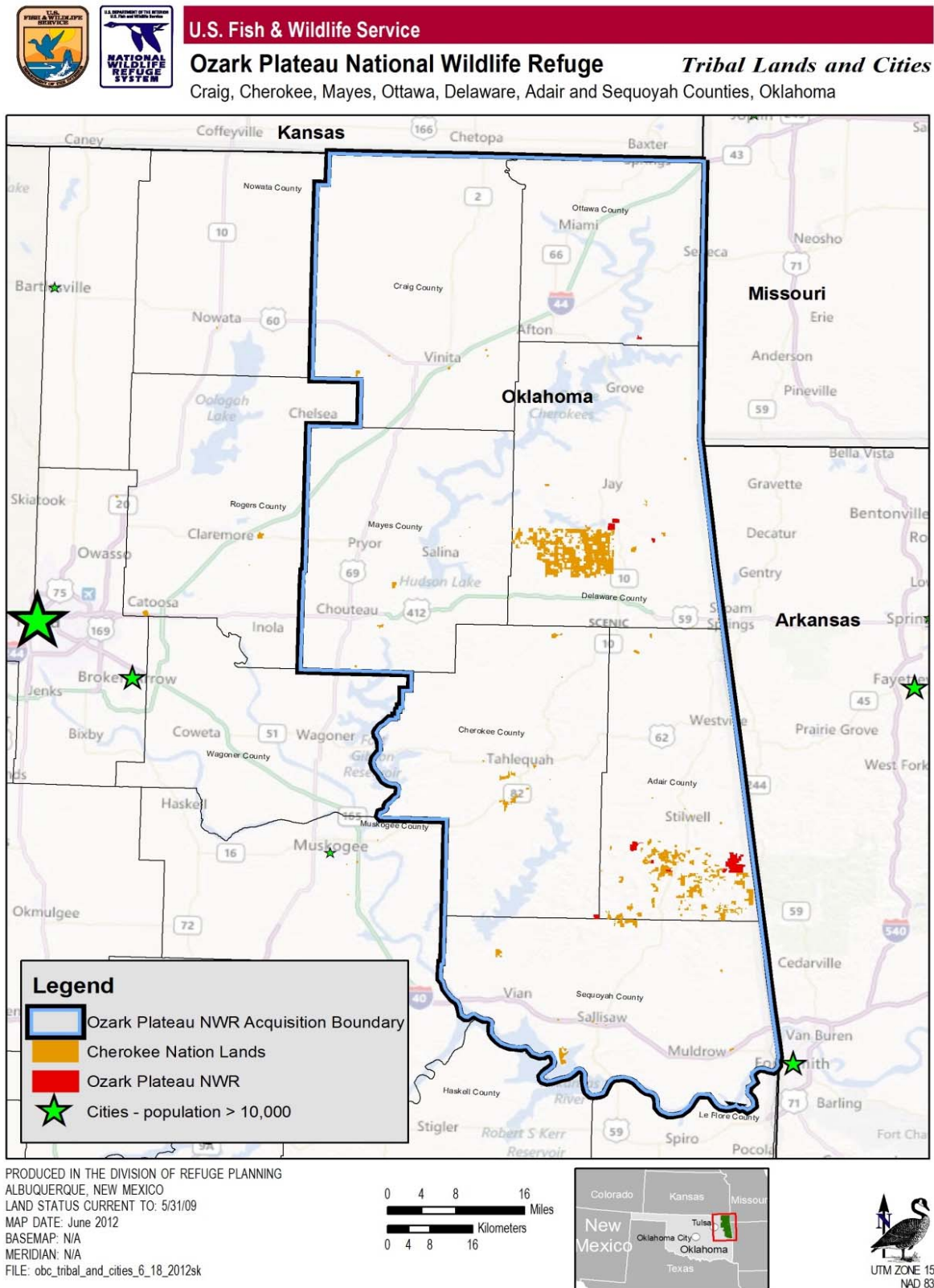


surrounding the caves are also important for bat foraging as well as for breeding and migrating Neotropical birds that need unfragmented tracts of forest to support their basic needs for food, water, and cover.

According to the 2010 Census Bureau, the seven-county acquisition boundary area has a total population of 241,684 people (61,794 or 26% of which are Native American), and accounts for 6.4% of Oklahoma's total population. Within 20 miles of Mayes County lies the city of Tulsa, Oklahoma, which has the largest population in the surrounding area of approximately 600,000 (Census Bureau, 2010).

*Typical topography of the Ozark Plateau NWR.
(Credit: Shea Hammond)*

Figure A-1. Ozark Plateau NWR within proximity to urban and tribal populations.



1.3 Background

Ozark Plateau NWR was established April 1, 1986 by a joint effort of a number of partners including private landowners, private conservation and caving organizations, universities, tribes, and state and federal conservation agencies primarily to protect and recover federally listed cave species. Over the past 20 years, these partners have been instrumental in developing and managing the Refuge. Ozark Plateau NWR is a prime example of the need to implement Strategic Habitat Conservation on a landscape level in order to achieve the Refuge's purpose(s) of establishment (see Section 1.4).

Ozark Plateau NWR presently consists of nine management units, totaling 4,093 acres, in four counties in the Ozarks of eastern Oklahoma near the borders of four states (Arkansas, Kansas, Missouri, and Oklahoma) and four Service Regions (2, 3, 4, and 6). Political boundaries mean little to the trust fish and wildlife resources that Ozark Plateau NWR was established to protect and manage, so it is extremely important that the Refuge operate on a landscape-level across state and regional boundaries.

On February 9, 2005, the Service approved the Ozark Plateau NWR's NEPA and planning documents including an Environmental Assessment, Land Protection Plan, and Conceptual Management Plan to expand the Refuge. The Refuge was approved to acquire additional land or easements from willing sellers and donors, of up to 15,000 acres in Adair, Delaware, Ottawa, Cherokee, Craig, Mayes, and Sequoyah Counties, Oklahoma.

The area encompasses the known distribution of the federally listed endangered Ozark big-eared bat (*Corynorhinus townsendii ingens*), gray bat (*Myotis grisescens*), and threatened Ozark cavefish (*Amblyopsis rosae*) and a portion of the endangered Indiana bat (*Myotis sodalis*) range in eastern Oklahoma and the Service's Southwest Region (Region 2). In addition, two federal species of concern - Oklahoma cave crayfish (*Cambarus tartarus*) and Delaware County cave crayfish (*Cambarus subterraneus*) - use caves in the area. Essential caves, movement corridors, and foraging habitat for the bats and ground water recharge areas supplying water to the aquifers used by the cavefish and cave crayfish are found in the Ozark Plateau NWR's seven counties approved acquisition area as well as across nearby State and Service regional boundaries. This is reflected in Ozark Plateau NWR's project goals of implementing a landscape approach for protection of habitats for a number of Service trust resources and the natural biological diversity in the Ozarks.

Existing Refuge units and the approved acquisition area occurs within the known range of American burying beetle (*Nicrophorus americanus*), a federally listed endangered species. Surveys specifically targeting this species on the Refuge have not occurred. However, the results of all presence/absence surveys conducted in close proximity to existing Refuge units (i.e., within 5 miles) have been negative and suggest that occurrence on the Refuge also is unlikely.

The American burying beetle likely does not occur on Refuge tracts or occurs in very low abundance due to the rocky soils and karst topography (i.e., thin soils over bedrock) of these areas.

Bald eagles (*Haliaeetus leucocephalus*) now have been delisted from federally endangered due to recovery and are found on the Refuge in northeastern Oklahoma because of the abundant rivers and reservoirs. The longnose darter (*Percina nasuta*), a federal species of concern, is found in one stream in the area (Lee Creek). Other federal species of concern found in the area include the eastern small-footed bat (*Myotis leibii*), the southeastern big-eared bat (*Corynorhinus rafinesquii*), the southeastern bat (*Myotis austroriparius*), the bat cave isopod (*Caecidotea macropoda*), the Bowman's cave amphipod (*Stygobromus bowmani*), the Ozark cave amphipod (*Stygobromus ozarkensis*), and Ozark chinquapin (*Castanea pumila* var. *ozarkensis*).

1.4 Purpose

The purpose of developing the CCP for Ozark Plateau National Wildlife Refuge is not only to comply with the Refuge Improvement Act of 1997, but to have a well-developed plan that will guide management so that the Refuge can best achieve its purpose(s) of establishment, vision, and goals (see below) as well as contribute to the mission of the National Wildlife Refuge System (see Chapter 1, Section 1.3.1) ; adhere to relevant Service policies and mandates (see Chapter 1, Section 1.3.2.1); address key conservation and public issues (see Chapter 2, Section 2.3); and incorporate sound principles of fish and wildlife science.

Ozark Plateau NWR Purpose(s) of Establishment:

- Assure the continuing existence, and aid in recovery of federally listed endangered and threatened Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to migratory interior forest birds; and
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

Ozark Plateau NWR Vision:

(See page *i* of the CCP).

Ozark Plateau NWR Goals:

Goal 1: Landscape-level Context

Collaborate with multiple partners to implement Strategic Habitat Conservation on a landscape-level in order to prevent extinction and recover federally listed threatened and endangered Ozark cave species as well as prevent the need for listing other Ozark species of concern.

Goal 2: Wildlife Habitat & Population Management

Protect, enhance, conserve and restore Ozark natural caves, springs, streams, aquifers, wetlands, watersheds, forests, and groundwater recharge areas to prevent extinction and recover federally listed cave species as well as prevent the need for listing other native species including migratory birds and other species of concern in the Ozarks to promote natural species diversity on a landscape-level.

Goal 3: Visitor Services

Provide safe, high quality, compatible, wildlife dependent use opportunities for visitors, students, and nearby residents, to give them an understanding of the importance and value of Ozark cave, spring, aquifer, stream, wetland, watershed, groundwater recharge areas, and forest wildlife habitat conservation efforts.

Goal 4. Refuge Infrastructure & Administration

Provide administrative support and appropriate facilities required to ensure that Refuge goals and objectives are met through effective landscape conservation management of Ozark habitats, fish and wildlife, and visitor services and for the primary purpose of preventing extinction and recovering federally listed threatened and endangered Ozark cave species.

As NEPA requires, this CCP/EA evaluates reasonable management alternatives and describes their anticipatable impacts on the physical, biological, socioeconomic, cultural, and environments in the project area. We designed each alternative with the potential to be fully developed into a Final CCP.

Developing a CCP is vital for the future management of every national wildlife refuge. The purpose of this CCP is to provide strategic management direction for the next 15 years by:

- providing a clear statement of desired future conditions for habitat, wildlife, visitor services, staffing, and facilities;
- providing state agencies, refuge neighbors, visitors, and partners with a clear understanding for the reasons for management actions;
- ensuring Refuge management reflects the policies and goals of the Refuge System and legal mandates;

- ensuring the compatibility of current and future public use;
- providing long-term continuity and direction for Refuge management; and,
- providing direction for staffing, operations, maintenance, and annual budget requests

The purpose of the EA is to evaluate current issues, determine management alternatives that will address these issues, and understand the benefits and/or consequences of each action in order for management to make wise and informed decisions. The Refuge is considering the proposed action because it best achieves the Refuge's purposes, vision and goals; contributes to the mission of the National Wildlife Refuge System; is consistent with principles of sound fish and wildlife management; and addresses relevant mandates as well as major issues during public scoping. The proposed management direction is well laid-out through a set of goals, objectives, and strategies in Chapter 4 of the CCP.

1.5 Need for Action

There are several reasons why we need this CCP. Foremost, the action is needed to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a CCP for all national wildlife refuges in the United States. More importantly, long-term management direction does not currently exist for the Refuge. Management is now guided by various general policies, short-term, program-specific plans or other outdated plans that do not reflect current conditions, present management issues, or recent scientific knowledge. The development of this CCP is important because it gives the Refuge an opportunity to take a comprehensive look at challenges and solutions to all its management actions including working with partners on a landscape-level, habitat management, wildlife management, visitor services and uses, infrastructure, and staffing and funding needs. In order to successfully implement Strategic Habitat Conservation to benefit Ozark habitats, wildlife including various threatened and endangered cave species, and local communities, Ozark Plateau NWR needs a Comprehensive Conservation Plan to guide present and future efforts in the right direction.

1.6 Decision to be Made

The Regional Director for the Southwest Region (Region 2 of the U.S. Fish and Wildlife Service) will make two decisions based on this EA: (1) select which alternative the Refuge will implement, and (2) determine if the selected alternative is a major federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement (EIS), or whether implementation of the Proposed Action can proceed. The planning team has recommended Alternative B to the Regional Director. Assuming no significant impact is found, the Final CCP will include a Finding of No Significant Impact (FONSI) statement explaining why the selected alternative will not have a significant effect on

the quality of the human environment. This determination takes into consideration the Service and Refuge System mission, the purpose(s) for which the Refuge was established, and other legal mandates. Once the FONSI is signed, the CCP will be implemented, monitored annually, and revised when necessary.

1.7 Regulatory Compliance

National wildlife refuges are guided by the mission and goals of the National Wildlife Refuge System (NWRS), the purposes of an individual refuge, Service policy, and laws and international treaties. Relevant guidance includes the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, Refuge Recreation Act of 1962, and selected portions of the Code of Federal Regulations and Fish and Wildlife Service Manual.

The CCP's overriding consideration is to carry out the purpose for which the Refuge was established (see Section 1.4). Refuge purposes are stated in the laws that established the Refuge and provided the funds for acquisition. Fish and wildlife management is the first priority in refuge management, and the Service allows and encourages public use (wildlife-dependent recreation) as long as it is compatible with, or does not detract from, Refuge purposes.

This EA was prepared by the Service and represents compliance with applicable Federal statutes, regulations, Executive Orders, and other compliance documents. Appendix G of the CCP contains a list of the key laws, orders and regulations that provide a framework for the proposed action.

Further, this EA reflects compliance with applicable State of Oklahoma and local regulations, statutes, policies, and standards for conserving the environment and environmental resources such as water and air quality, endangered plants and animals, and cultural resources. An ESA Section 7 Consultation would be completed for inclusion in the CCP (see Appendix F).

Comprehensive Conservation Plans include a review of the appropriateness and compatibility of existing refuge uses and of any planned future public uses. If a use is determined to be an 'Appropriate Refuge Use' by a refuge manager, it is then taken through the 'Compatibility Determination' process. Compatibility determinations (CDs) have been completed for the following activities and are provided in Appendix B of the CCP. For more information on Appropriate Refuge Uses and Compatibility Determinations, including a list of currently approved CDs, see Chapter 5, Section 5.3.2 of the CCP.

1.8 Stakeholder Involvement and Issues Identified

In accordance with Service guidelines and NEPA recommendations, public involvement has been a crucial factor throughout the development of the Draft CCP and EA. The formal planning process began with the scoping period, which involves a thorough assessment of issues, concerns, opinions, thoughts, ideas, concepts, and visions for the Refuge.

Formal scoping began with publication of a notice of intent to prepare a CCP and EA, which was published in the Federal Register on June 19, 1998 (Volume 63, Number 118, pp. 33693-33694). After *Planning Update #1* (a newsletter and issues workbook) was published in November 2009, three public open house scoping meetings were held in December 2009, as advertised in the update and local newspapers (see Table A-1). The first meeting was held in the central part of the Refuge boundary expansion area, in Tahlequah, Oklahoma, at the Cherokee Nation Tribal Headquarters building, from 6:30 to 8:00pm on December 1st. The second meeting was held the following evening near the southern units of the Refuge in Stilwell, from 6:30 to 8:00pm. The third meeting was held near the northern units in Jay at the Delaware County Library also from 6:30 to 8:00pm on December 8th. Comments were accepted through January 4, 2010.

Table A-1. Location, Attendance, and Dates of Public Scoping Meetings.

| Community Center | Attendance | Meeting Date |
|---|-------------------|----------------------------|
| Tahlequah: Tribal Headquarters, Cherokee Nation of Oklahoma | 17 | Tuesday, December 1, 2009 |
| Stilwell: Senior Center | 9 | Thursday, December 3, 2009 |
| Jay: Delaware County Library | 9 | Tuesday, December 8, 2009 |

The *Planning Update #1* was also sent to the Oklahoma Department of Wildlife Conservation (ODWC) as well as seven Native American Tribes on October 27, 2009. Both the State and all affected tribes were invited to meet one-on-one with the Refuge. After attending one of the three public open house meetings, the Cherokee Nation Environmental Protection Commission indicated a desire to meet bilaterally with the Planning Team and a meeting was held at the Cherokee Nation Headquarters and Administration complex on March 3, 2010 to review issues and preliminary alternatives concerning the tribe's perspective. The following day, the core planning team met with ODWC staff at the Porter Office in Oklahoma on March 4, 2010, also to review issues and preliminary alternatives concerning the State's perspective.

Collectively, all stakeholders expressed a wide range of issues, concerns, and opportunities during the planning process, and the alternative selected for analysis reflect all of the issues, concerns, and opportunities expressed by the planning participants. These issues and concerns provided the basis for developing the Refuge's management direction and played a role in

determining desired conditions for the Refuge. The following issues, concerns, and opportunities were consolidated into the following broad categories: landscape-level, habitat management, wildlife management, public use opportunities, cultural resources, facilities & infrastructure, and administration. These issues are also explained in Chapter 2 of the CCP.

Issues identified during Scoping

1.8.1 Landscape-level Issues

Ozark Habitat Loss & Fragmentation

Some timber harvesting in the region involves the clearing of forested areas and converts them to cattle and other agricultural uses, resulting in the loss of mature tree forests, increasing understory growth, increasing water runoff, and decreasing groundwater recharge. Mining operations near the Refuge remove trees and reduce habitat for bat foraging and other species. Current and projected agricultural uses on the landscape result in a patchwork mosaic of open rangelands, further fragmenting the Ozark forests. The region is also experiencing increasing road and right-of-way construction and other infrastructure development.

The construction of reservoirs over the years has resulted in the loss of some Ozark caves and riparian forests in the ecoregion. Some caves near the reservoirs are flooded periodically, depending on rainfall and lake levels because of hydropower generation and flood control operations, making them inaccessible and uninhabitable by bats. Land acquisition could prevent similar negative effects from occurring in the future.

Ozark habitat loss and fragmentation due to development and encroachment was the primary concern among the public, the State, tribal members, and Refuge staff during scoping. Many suggested that maintaining or improving relationships with surrounding landowners and tribes could help counteract this issue - through communication and agreements to cooperatively perform sustainable land management practices for habitat and wildlife conservation in the Ozarks. The State also recommended that the Refuge look into acquiring as much land as possible (in fee title, easements, or other means) before land prices increase again.

Climate Change

Data provided by Climate Wizard (www.climatewizard.org, accessed June 2010) indicates that within the area of the Refuge the temperature is expected to warm by about 5 degrees F, while moisture is anticipated to decrease between now and 2050. Changes in climate in and around caves may affect their suitability for different bat species (Newson et al., 2009). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for bats (Newson et al., 2009). It has also been observed on the Refuge that there are temporal variations on migration and birthing of Ozark big-eared bats and gray bats, however, more literature is needed to document this. Warmer and drier conditions may affect surface and

groundwater availability, fire regimes, and shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area. Because of the unprecedented scope of affected landscapes, the Service must work together with other private landowner partners, local state, tribal, and federal governments, and Landscape Conservation Cooperatives (LCCs) to develop landscape-level strategies for understanding and responding to climate change impacts.

The Refuge and the public would like to know more about how climate change is affecting the Ozark Plateau's habitats and species (currently and in the future). Monitoring climate change in relation to habitat and wildlife changes could be useful so that the Refuge may best adapt management appropriately for the benefit of Ozark resources.

Surface and Groundwater Quality & Quantity

In the northern part of the Refuge acquisition area, abandoned lead and zinc mines including the Tri-State Superfund Site (the former Tar Creek Superfund Site expanded to include areas in Oklahoma, Missouri, and Kansas), have contaminated surface and groundwater resources. Increasing deforestation and conversion to urban and agricultural land uses in the region is also increasing the volume of water run-off and decreasing the capability of the watershed to filter this run-off. Unfiltered water contains a higher volume of both contaminants and nutrients, such as nitrogen, phosphorus, metals, pesticides, pharmaceuticals, and plasticizers.

Habitat degradation and pollution due to these agricultural and mining activities and development pose serious risks not only to the groundwater quality but are primary threats to aquatic cave fauna such as the threatened Ozark cavefish (Crunkilton, 1984; Culver et al, 2000; Graening and Brown, 2003; USFWS, 2010). The karst environments (i.e. an area of limestone that is marked by caves, sinkholes, springs, and other features and that has special drainage characteristics due to limestone's greater solubility) in which the cavefish occur, are highly vulnerable to groundwater pollution. Contaminated surface water can enter the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (i.e. a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. These karst features provide for only minimal natural filtration processes. Once underground, the subterranean network of caves and conduits also allow for additional rapid water movement. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances (Green et al. 2006).

In addition, the quantity of surface and groundwater of the aquifer surrounding the Refuge is being affected by agriculture and increasing urbanization. These wet karst environments that

provide habitat for cavefish and cave crayfish dwell in the same groundwater tapped by wells for local water supply. Spavinaw Creek Basin provides the water supply for the City of Tulsa. Impervious surfaces and man-made drainage systems are preventing surface water to seep through the ground and recharge the aquifer in the natural manner that it used to. There has also been an increase in water consumption due to an increasing population in growing urban areas nearby. These contributing factors are lowering surface and groundwater levels, which consequently affect subterranean and aquatic habitats and their respective species on the Refuge and surrounding areas.

The public, the State, tribal members, and the Refuge expressed high concerns regarding the degradation of surface and groundwater quality. One representative of the Seneca-Cayuga Tribe of Oklahoma stated that the “tribe’s livelihood is tied to Grand Lake and that water quality and maintaining healthy wetlands is crucial to their former reservation lands”.

White-nose Syndrome

Conservation organizations, the State of Oklahoma, Tribal Nations, the Refuge, and other federal agencies are extremely concerned with White-nose syndrome (WNS), a disease caused by the fungus *Geomyces destructans*, which is responsible for unprecedented mortality in cave-hibernating bats in the northeastern and central U.S and eastern Canada (Lorch et al, 2011). This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to cave-hibernating bats throughout North America. More than 5 million hibernating bats have died since 2007 (Froschauer, 2012). Biologists with state and federal agencies and organizations across the country are still trying to figure out how to minimize the spread and impacts of the disease and recover impacted populations. To date, seven bat species are known to be affected by the disease: the little brown bat *M. lucifugus*, eastern small-footed bat *M. leibii*, Indiana bat *M. sodalis*, northern long-eared bat *M. septentrionalis*, big brown bat *Eptesicus fuscus*, gray bat *M. grisescens*, and the tri-colored bat *Perimyotis subflavus*. Four of these species, the northern long-eared, big brown, gray, and tri-colored bat occur on the Refuge. Although the fungus *Geomyces destructans* was found on a cave *myotis* in northwestern Oklahoma in 2010, the disease WNS has not yet been documented on the Refuge. However, scientists predict that WNS will continue to spread, making it even more critical to address the issue in the future management direction.

Wind Energy Farms

The Refuge is concerned about the impacts of wind energy farms on migration routes because they cause mortality in migratory bird and bat species due to direct strikes and barotrauma from turbine blades (Johnson et al, 2002). Energy farms also increase habitat fragmentation with the construction of large fields of turbine towers and the networks of connecting power line infrastructure. These wind energy farms could be placed astride bat and bird migration corridors.

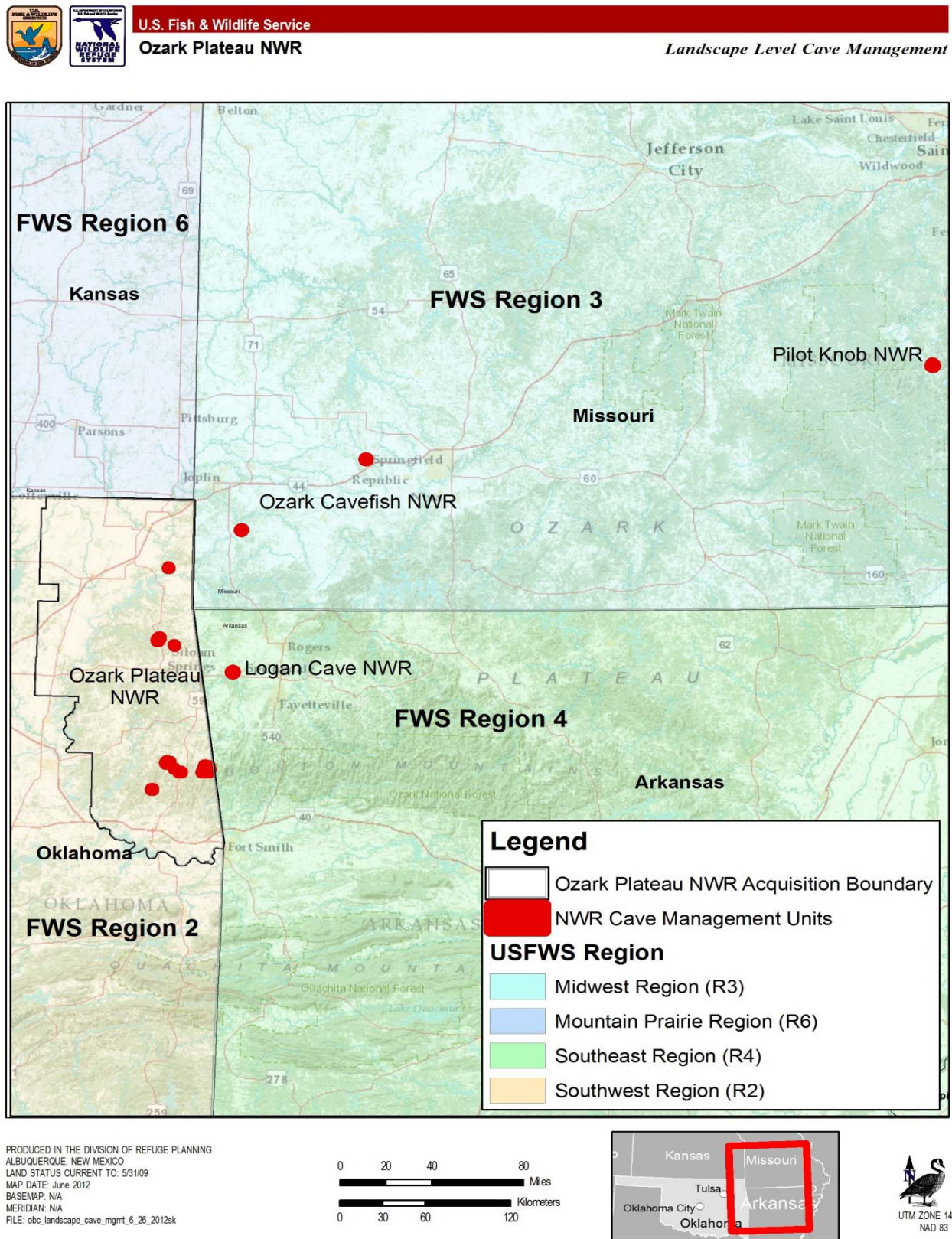
Knowledge of specific migratory routes would be beneficial during early planning stages of development projects in order to minimize the impacts to migratory species.

Coordinate Beyond Service Regional Boundaries to More Effectively Manage Federally Listed Cave Species on a Landscape Level

Ozark Plateau NWR has a unique conservation location because the Refuge lies in northeast Oklahoma amidst surrounding state borders of Missouri, Arkansas, and Kansas, which correspond to the Service Regions 2, 3, 4, and 6 (see Figure A-2). The distribution of the federally listed threatened and endangered Ozark cave species (Ozark big-eared bat, gray bat, Indiana bat, and Ozark cavefish) that Ozark Plateau NWR was established to protect and recover, cross several State and Service regional boundaries. Steps have been made within its own Region (2) to implement Strategic Habitat Conservation. Aside from building and maintaining strong partnerships across the landscape-level with various landowners, conservation organizations, cities, universities, state, tribal and other federal agencies, in 2005, Ozark Plateau NWR was authorized to expand its acquisition area from about 3,000 acres up to 15,000 acres in seven counties in northeast Oklahoma of Service Region 2. These partnerships and acquisition of land and conservation easements from willing sellers has lead the Refuge one step further in accomplishing conservation objectives. However, to fully implement the recovery tasks of protecting essential habitat as identified in the recovery plans for the Ozark big-eared bat (1995), gray bat (1982), Indiana bat (2009), Ozark cavefish (2010), and Ozark cave crayfish (1986), it will be necessary to expand beyond the approved acquisition area or develop new acquisition areas across State and Service regional boundaries into Arkansas, Missouri, and Kansas.

Currently, Logan Cave NWR in northwest Arkansas protects an important federally listed gray bat, Ozark cavefish, and Ozark cave crayfish cave and is managed as a satellite of Holla Bend NWR, in Region 4 of the Service. Similarly, Cavefish NWR in southwest Missouri was established to protect the federally listed Ozark cavefish and Pilot Knob NWR in south central Missouri was established to protect an important federally listed Indiana bat hibernaculum; both are managed as satellites of Mingo NWR in Region 3 of the Service. Management of these satellite cave refuges is challenging due to a lack of dedicated staff and funding as well as unique wildlife and habitat needs. Consequently, over a number of years there has been a cooperative effort among Holla Bend NWR, Mingo NWR, and Ozark Plateau NWR to work together to plan and implement Strategic Habitat Conservation cave and karst management practices on a landscape level on and surrounding these refuges. This cooperation has been beneficial for accomplishing some recovery tasks for Ozark federally listed cave species through adaptive management; however no formal management agreement is currently in place to ensure that it continues.

Figure A-2. Cave management coordination opportunities at the landscape-level.



Because Ozark Plateau NWR's authorized purpose is to prevent extinction of federally listed Ozark cave species, help assure their recovery, prevent the need for listing additional species, and because the Refuge has dedicated funds and staff with experience in cave and karst management, it would be most effective for Ozark Plateau NWR to manage Logan Cave, Cavefish, and Pilot Knob NWRs as additional management units across state and regional boundaries. However, Strategic Habitat Conservation could also be accomplished across state and regional borders by establishing refuges similar to Ozark Plateau NWR in Regions 3 and 4. Details on management logistics on such a large landscape scale regarding staffing and funding may initially be bureaucratically challenging, however, coordination efforts across these Service Regions should prove more effective at protecting and recovering Ozark cave wildlife species.

1.8.2 Habitat Management Issues

Degradation of Cave, Stream, and Forest Habitat

Early descriptions of the Ozark region of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). However, since European settlement, suppression of the natural fire regime has led to overcrowded forest conditions. In addition, many fragments of forest were cut for commercial logging. As a result, today's remaining forest areas mostly consist of exceedingly high densities of even-aged stands with an excessive fuel load and a lack of well-developed understory. Current conditions not only lead to unnatural and uncontrollable wildfires, but they are also not ideal for native vegetation and wildlife to thrive as they once had. Forest habitat restoration measures (such as prescribed fire, thinning, native planting, etc.) that mimic the historic fire regime and maintain a natural mosaic of plant communities representative of the ecosystem will reduce the risk of unplanned, high-intensity wildfires while also supporting a greater diversity of native flora and fauna. Ozark big-eared bats and gray bats depend on an open, regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) as important flight corridors and foraging habitat. Large continuous stands of mature Ozark forest are also essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that must nest some distance from an edge. The forest also plays an important role in preventing degradation of water quality in caves used by the Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish.

Degradation of habitat and water quality has been identified as a major threat to aquatic cave species (USFWS Cavefish 5-year Review, 2010). Conventional agriculture run-off and increasing urban development result in decreased quantity of surface and groundwater of the aquifer as well as contaminated surface water, which freely enters groundwater with limited natural filtration in areas of karst topography such as in the Ozarks, adversely affecting cavefish, cave crayfish, and other species. (See also 1.8.1 *Surface and Groundwater Quality & Quantity*).

Human disturbance and vandalism are the leading factors in the degradation of cave habitats and decline in bat populations. In recent years, people have vandalized cave gates, destroyed and removed cave formations, modified passageways, littered, graffitied, and damaged the caves with smoke from fires. The Refuge routinely repairs cave gates about three or four times per year due to vandalism and unauthorized entry. Disturbance of hibernating bats causes the loss of critical fat stores and increases the probability of starvation during winter, while disturbance at maternity roosts can result in a loss of young (Tuttle, 1979). Protection of caves from human disturbance and destruction are identified as the most important recovery need of the three federally listed cave species known to occur on the Refuge (USFWS Ozark big-eared Bat Recovery Plan, 1995 ; USFWS Gray Bat Recovery Plan, 1982 ; USFWS Ozark Cavefish Recovery Plan, 1989).

Similarly to Ozark habitat loss and fragmentation, degradation of cave, stream, and forest habitat were some of the highest concerns that the public, the State, and tribal members had during scoping. One member of the public commented that the most important role of the Refuge is to protect these habitats.

Lack of Detailed, Scientific Cave Habitat Data

The State and the Refuge would like to know more information on cave, and forest/surface habitat requirements and feeding/foraging ecology of federally-listed bats, cavefish, and other cave-dwelling organisms (see 1.8.3 Wildlife Management Issues). Cherokee Nation members expressed that caves and the land they are located on are very valuable resources to the tribe and suggest that the Refuge coordinate with them to continue mapping caves.

Invasive Flora

Non-native invasive plants alter natural habitat conditions, which consequently affect native wildlife species. Evaluation of invasive and exotic plants that are detrimental to native flora and fauna species and maintenance of natural biodiversity is very important to the Refuge for the overall health and function of natural ecosystems within the Ozarks. Some non-native invasive species that may outcompete and displace native plants within hardwood forests and/or riparian areas of the Refuge include: *Sericea lespedeza*, tall fescue, Chinese privet, Japanese honeysuckle, Johnson grass, kudzu, beefsteak plant, Nepalese browntop, mimosa trees, among others. A vegetation survey from 2003 found that 8.7% of all plant species occurring on the Sally Bull Hollow Unit of the Refuge were non-native flora (Hayes). A new survey is needed to reassess how this has changed as well a baseline assessment of non-native species occurring on all other Refuge Units. These invasive plant species may have some effect on bats' prey, including moths and other insects; however, no research has been done on this. Songbirds and migratory birds depend on native plants, shrubs, and trees for nesting, perching, and hosting a multitude of insects for prey. Consequently, non-native invasive flora also affects bird niches. In addition,

exotic tree pathogens are affecting native Ozark chinquapin and flowering dogwood, which may also be altering forest structure and diversity.

Invasive flora was an issue that the public and the State felt should be addressed.

Fire Management

As mentioned above, early descriptions of the Ozark regions of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). However, since settlement, loss of the natural fire regime has resulted in overcrowded forest conditions. This has left remaining forested areas in an over-abundance of uneven age stands of oak-hickory and oak-hickory-pine forest. Ozark big-eared bats and gray bats depend on an open, regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) as important flight corridors and foraging habitat. Therefore, mimicking the natural fire regime would benefit these species as well as migratory interior forest nesting birds. The Refuge currently has a Fire Management Plan; however only for two of its nine management units.

The public, the State, and Tribal Nations expressed that they would like to see more well-managed prescribed burns used as a management tool in the forested areas on the Refuge. The State and Tribal Nations want to coordinate with the Refuge to do a number of controlled burns simultaneously.

1.8.3 Wildlife Management Issues

Threatened and Endangered (T&E) Species and Species of Concern

The Refuge was established to prevent the extinction and recovery of federally-listed Ozark cave species, which include the Ozark big-eared bat (*Corynorhinus townsendii ingens*), gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and Ozark cavefish (*Amblyopsis rosea*). The Refuge also currently protects nine species of concern to prevent the need for future listing. There are nine species of concern on the Refuge, including the Oklahoma cave crayfish (*Cambarus tartar*) and Delaware County cave crayfish (*Cambarus subterraneus*). Currently, there is little known about these Ozark cave species: their habitat requirements, genetics, effects of climate change, and how WNS will affect entire cave ecosystems. The Refuge would like to address scientific knowledge gaps regarding forest, surface, and cave habitat requirements and breeding ecology of cave species occurring on the landscape level to better assess and manage for their needs. The State is also concerned with insufficient knowledge regarding these species.

Ozark Big-eared Bat & Gray Bat

The Ozark big-eared bat is endemic to the Ozark Highlands and Boston Mountains Ecoregions (Omernik, 1987) where it occurs in oak-hickory hardwood forests (Clark, 1991; Leslie and Clark, 2002; and U.S. Fish and Wildlife Service, 1995). The Ozark Highlands Ecoregion is

under considerable development pressure and is one of the fastest growing areas in the country due to relatively inexpensive land prices and the aesthetics of the area. For example, the human population of Washington and Benton County, Arkansas, and Adair and Cherokee Counties, Oklahoma, increased 39.0 percent, 59.0 percent, 14.2 percent, and 24.9 percent, respectively, from 1990 to 2000. Over the same period, the human population within the states of Oklahoma and Arkansas, and within the United States increased by only 9.7 percent, 13.7 percent, and 13.2 percent respectively (U.S. Census Bureau, 2001). The Oklahoma Department of Commerce (ODOC) projects the human population of Adair and Cherokee counties, Oklahoma, to grow by about 35 percent over the next 23 years (ODOC, 2002).

Vandalism and unauthorized human activity at maternity roosts and hibernacula still occur even at gated and signed caves, prohibiting entry. Therefore, human disturbance remain a serious threat. The disparity between summer and winter counts indicates there likely are more caves of importance to the Ozark big-eared bat of which the bat conservation community is not yet aware. A prerequisite to protecting these sites is knowledge of their location, so the need to continue search efforts for unknown Ozark big-eared bat caves continues. Current and future human population growth and development within the Ozark big-eared bat's range will result in the loss and fragmentation of foraging habitat. In addition to protecting the caves used by the Ozark big-eared bat, it will become increasingly important to protect and restore foraging habitat around these caves as development pressures increase in the future (Leslie and Clark, 2002; Wethington et al., 1996).

Degradation of foraging habitat, protective flight corridors, and food resources also presents a major threat to the gray bat. Gray bats feed primarily on aquatic insects in riparian areas and over rivers, streams, and other water bodies. Gray bats also utilize forested areas for protection from predators such as screech owls as they travel between caves and foraging sites. Deforestation of wooded tracts and riparian zones in the vicinity of maternity caves (gray bats are known to forage up to 12 km from a summer cave) due to development and agricultural activities negatively impacts gray bats by reducing available foraging habitat and the wooded flight corridors that provide protection from predators (LaVal et al., 1977; USFWS, 1982). Practices that result in increased pollution, turbidity and siltation in waterways over which gray bats forage, such as development and agricultural activities and the clearing of woody riparian zones, can be detrimental by reducing the local abundance of important prey, especially species sensitive to aquatic pollution such as mayflies, caddisflies, and stoneflies (Tuttle, 1979; USFWS, 1982). In addition, natural flooding and impoundment of waterways has resulted in temporary impacts to some caves and the complete submersion and loss of other important cave sites (Barbour and Davis, 1969; LaVal et al., 1977; Tuttle, 1979). Natural and man-made flooding remains a threat at some gray bat sites.

Although additional essential caves have been discovered and protected since the time of listing the Ozark big-eared bat and gray bat, not all known caves have been afforded some form of protection (e.g., a cave gate/grill, signs, fee-title purchase, conservation easement, landowner agreements, etc).

Climate change could have a significant impact on all temperate region bats, including the Ozark big-eared bat and gray bat species. Projected changes in climate could impact bats by adversely affecting their food supply and the internal roosting temperature of caves (Bogan, 2003). The Ozark big-eared bat preys on a wide diversity of moth species, but most of the moth species are dependent upon woody forest plants as a host. Climate change may affect the Ozark big-eared bat by impacting plant resources which could alter the timing and abundance of moth prey. Ozark big-eared bats have specific cave microclimate requirements. Only those caves with appropriate microclimates are used as maternity roosts and hibernacula. Changes in the internal roosting temperature of caves may change the suitability of certain caves. Changes in food resources and cave microclimates may affect hibernation periods, and the birth and survival of pups.

The fungus associated with WNS recently has been found (Spring 2010) in close proximity to the range of the Ozark big-eared bat (northwestern Oklahoma and Missouri). WNS threatens to spread to the range of the Ozark big-eared bat in the near future. Should WNS move into the range of the Ozark big-eared bat, the potential impact could be severe due to the high mortality rate of affected bats to date, and the small population size and limited distribution of the Ozark big-eared bat. Subsequently, the fungus associated with WNS was in fact documented on gray bats in Missouri (spring 2010). Mortality attributable to WNS has not occurred in any gray bat populations to date. However, the discovery of the fungus on gray bats is cause for concern. A large percentage of the gray bat population hibernates in a limited number of caves. Mortality rates reported from hibernacula in the northeastern United States are unprecedented (e.g., 90% mortality in affected caves and over 1,000,000 bats estimated to have died due to WNS). Therefore, should gray bats develop WNS, disease transmission could occur rapidly and the resulting impacts could be severe.

Ozark Cavefish

The construction of impoundments historically may have impacted the Ozark cavefish (Graening et al. 2009). Several caves within the Spavinaw Creek Basin of Oklahoma, the current range of the cavefish in Oklahoma, were completely inundated by the construction of Lake Eucha (Looney, 1972). Several impoundments constructed in Arkansas and Missouri on the White River inundated extensive cave systems that occur within the range of the cavefish (Graening et al., 2009).

Habitat degradation and pollution due to agricultural activities and development currently are considered primary threats to the Ozark cavefish. The karst environments (i.e., a landscape underlain with limestone that is marked by caves, sinkholes, springs, and other features and has special drainage characteristics due to the greater solubility of limestone) in which the cavefish occur are highly vulnerable to groundwater pollution. Water enters the groundwater systems rapidly in karst areas as it passes through sinkholes and cracks and crevices in the ground surface, losing streams (i.e., a stream with a bed that allows water to flow directly to the groundwater system), or fractured limestone under thin layers of permeable soils. Groundwater in karst areas can travel as quickly as a few thousand feet to over a mile per day. Degradation of sensitive, underground habitats used by the cavefish can, therefore, occur rapidly. These characteristics of karst ecosystems make the underground environment relatively fragile and highly susceptible to disturbances.

Agriculture is considered the primary threat within the recharge zone (i.e., areas involved with input of water into the cave system) of 17 out of 35 active sites (David Kampwerth, Service Recovery lead, pers. comm.). Various agricultural activities can threaten groundwater quality (Aley and Aley, 1997). Chemicals and fertilizers that are applied on agricultural lands can rapidly infiltrate groundwater and cave systems during rain events due to the karst topography of the Ozark Highlands. As forested areas are harvested or lands are converted from forest to pasture, valuable canopy cover for ground temperature regulation and soil moisture retention is lost. In 1968, 59% of the Logan Cave recharge zone was forested. By 1987 the amount of forested land was about 43%, representing a 17% decrease (David Kampwerth, Service Recovery lead, pers. comm.).

Confined animal feeding operations (CAFOs) also are believed to pose a threat (Aley and Aley, 1999). Metals and other contaminants pass through poultry and other livestock and can reach groundwater through land application of wastes. Aley and Aley (1999) identified CAFOs as the greatest threat within the recharge area of Long's, McGee's, and Engelbrecht Caves in Oklahoma. CAFOs also are believed to be a threat to the water quality of Cave Springs Cave and Logan Cave in Arkansas (Graening and Brown, 2003). The 11 square mile recharge zone of Logan Cave alone contains approximately 50 hog and poultry facilities (Aley and Aley, 1987).

Urbanization and development are considered primary threats within the recharge areas of 17 cavefish caves (David Kampwerth, Service Recovery lead, pers. comm.). As development and associated impervious surfaces (e.g., roads, parking lots, etc.) increase, areas that otherwise would allow natural infiltration and percolation are lost or significantly diminished. Increased groundwater withdrawals for home, community, and agricultural use also can deplete groundwater and limits available habitat.

Unauthorized human entry also continues to be a threat at protected sites and at sites with no protection measures in place. Gates/fences have been vandalized with evidence of recent human access. Use at ungated caves is occurring based on evidence such as new paint, foot prints, and writing found during biannual monitoring surveys. Human entry causes increased turbidity decreasing cavefish sensory ability. Unauthorized human entry also increases the potential for direct trampling of individuals, and can interrupt feeding and breeding behaviors.

Migratory and Resident Bird Species

Maintaining continuous stands for interior forest Neotropical nesting birds continues to be a concern for the Refuge, primarily due to the loss of Ozark habitat and fragmentation as discussed in habitat issues (see Section 1.8.2). The Refuge implements the protection and management recommendations of the Central Hardwood Bird Conservation Region (www.partnersinflight.org). The Refuge is located on the western edge of the Ozarks Ecoregion and near the eastern edge of the Tallgrass Prairie Ecoregion, resulting in a “crossover” of eastern and western bird species found on the Refuge.

The public and organizations suggested that the Refuge establish a continuing monitoring program to keep track of migratory and resident bird population trends and changes.

Resident Non-T&E Species

Non-T&E bat species are found on the Refuge but the Refuge is just beginning to collect information on these species. With WNS as a threat, this information could be valuable in identifying the impacts to non-T&E bat species and assist in efforts to address WNS. Also, the Refuge is concerned about collecting information on other cave species, especially with the threat of WNS potentially resulting in a large decline of bat species that provide a major energy source for a number of cave fauna.

Invasive Fauna Species and Pest Management

The Refuge is concerned about the increasing number of feral hogs, an exotic fauna species that has been found to forage in oak-hickory or oak-hickory-pine forest on and around the Refuge. Feral hogs compete with native wildlife and destroy habitat used by native species. In addition, they damage riparian habitat and reduce bank stabilization in bottomlands. Feral hogs are currently found on the Sally Bull Hollow Unit in Adair County and moving north toward Delaware and Ottawa Counties, within the Refuge’s acquisition area as well as near where four units of the Refuge. Feral hog hunting occurs year round on private, State and Tribal lands, however, currently, the Refuge does not allow any hunting. The Refuge would like to permit hunting of nuisance feral hogs, pending the development of a Hunt Plan (after Sally Bull Hollow Unit has been surveyed and marked) and/or an Integrated Pest Management Plan. In addition, the Refuge recognizes that feral cats prey on bats and migratory birds. Feral cats are currently found on most Refuge units, although the Refuge does not currently document feral cat occurrences. The Refuge is also concerned about the hothouse millipede, another exotic species

abundantly occurring on the Refuge. Hothouse millipede may compete with native cave species as consumers of limited energy sources within caves. This species should be studied further to assess its impacts on cave species. Introduced predatory fish in Ozark streams, such as trout, compete with native fish and may also compete with and forage on cavefish and cave crayfish and other precious aquatic species. The State is also concerned with invasive exotic animal species on and around the Refuge.

1.8.4 Public Use Opportunities Issues

Hunting

Currently, the Refuge does not allow hunting. Prior to opening up any Refuge land units for hunting, the Refuge would need to survey and mark the appropriate boundaries. During scoping, members of the public and ODWC expressed interest in having the Refuge open up hunting of Oklahoma state game species (including deer, turkey, squirrels, quail, and rabbits), in accordance with State regulations. The ODWC requested specifically that the Refuge explore hunting opportunities on the Sally Bull Hollow Unit because it is adjacent to state-managed hunting area, Ozark Plateau Wildlife Management Area, and that they have consistent regulations. They also suggested that wildlife observation and photography not be permitted during hunting season on that Unit. ODWC is interested in the recent (2010) increase in black bears in Northeastern Oklahoma (since the public also has an interest in hunting them) and suggested that if any black bears occur on the Refuge in the future, that they be documented.

Fishing

The Refuge does not currently have any land units with fishing opportunities. Nevertheless, there is a conservation agreement with the City of Tulsa and ODWC to co-manage the Eucha Unit (approximately 130 acres) of Ozark Plateau NWR, in which the City and State manage recreational fishing on the upper end of Lake Eucha/Spavinaw Creek, while the Refuge manages the Unit's cave resources.

Environmental Education

Increased urbanization in northwest Arkansas and in northeast Oklahoma is having detrimental effects on the Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. Many people from these areas are also unaware of the large and delicate cave (subterranean) ecosystems, groundwater aquifers, and native wildlife species that lie underneath their feet as well as how they are connected to Ozark springs, streams, and forests, and other karst resources. Environmental education (EE) programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and understand the importance of their local ecosystems, and be able to pass on that knowledge to future generations.

In addition, during scoping, the public and members of Tribal Nations expressed a high level of interest in having more EE programs on the Refuge. Specifically, tribes would like to be more involved in sharing native knowledge through environmental education and interpretation programs on the Refuge including trapping, survival skills, identification and medicinal uses of culturally significant trees, plants, and wildlife in relation to various Tribal Nations in the four-states area. The Cherokee Nation specifically requested that traditional foods (or native foods) are served at the MMLERC in environmental education programs, especially those catered to tribal youth.

Interpretation

As described above, increased urbanization in northwest Arkansas and in northeastern Oklahoma is having detrimental effects on natural resources of Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. In addition, many people from these increasing urban areas do not get many opportunities to connect to nature and are also unaware of the large and delicate caves and groundwater aquifers (subterranean) ecosystems and native wildlife species that lie underneath their feet. Interpretation programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and get a sense of the importance of their local Ozark ecosystems, and be able to share that experience with future generations.

Various Native American Nations would like to be more involved in sharing native knowledge through both environmental education and interpretation programs on the Refuge including trapping, survival skills, identification and medicinal uses of culturally significant trees, plants, and wildlife in relation to various Tribal Nations in the four-states area. The Cherokee Nation specifically requested that Ozark Plateau NWR install interpretive plant placards next to culturally-significant “Cherokee plants”, both in English and in the Cherokee language.

Wildlife Observation & Photography

During scoping there were no publicly-expressed opinions regarding wildlife observation and photography on Ozark Plateau NWR. However, the Refuge would like to offer more opportunities for this wildlife-dependent use by providing more nature trails and possibly having some photography blinds in appropriate areas.

Wood Harvesting

In order for the Refuge to manage for a healthy forest for wildlife needs, some thinning and fuel reduction actions must be conducted, such as after ice or wind storms and forest management. The Refuge does not have the staffing or funding available to perform these necessary management activities including the removal of downed-trees.

ATV Use

The State was concerned about enforcing laws regarding illegal use of ATVs on State-managed lands and on Refuge lands. The Refuge is also concerned about illegal ATV use; at present it has not become a problem but potentially could in the future.

Public Outreach

The public commented that Ozark Plateau NWR does not provide much information regarding their Refuge. However, now that the Mary & Murray Looney Education & Research Center (MMLERC) is being renovated, the Refuge will do much to improve outreach efforts.

1.8.5 Cultural Resources Issues*Historical Sites*

There are several historical sites on Ozark Plateau NWR. For example, there is a wagon trail between Sallisaw and Tahlequah, which runs through the Potter Unit, as evidenced by old bridge abutments. This trail was main thoroughfare for local travelers, prior to the development of roads and highways. Crystal Cave on the Potter Unit was a commercial cave used for local dances in the 1920s. There is an old rock dam on the Potter Unit that was constructed to provide swimming opportunities dating back to pre-1916. In addition, cabins and infrastructure on the Mary & Murray Looney Unit have historical significance to the caving community in the Ozarks because they were used by many caving experts to explore the first private cave preserve, January-Stansberry Cave, which was later donated to the Refuge (Graening, 2011).

Archeological and Paleontological Sites

Short-faced bear, tapir, and dire wolf remains have been discovered in or around Refuge caves. Arrowheads, spear points, grinding stones, and other Native American tools probably used by the Caddo and Osage Tribes during pre-settlement times and/or by tribes after they were relocated to Oklahoma, have been found on and near the Refuge. With the help of its partners, the Refuge would like to learn more about these known sites and discover additional historical, archeological, and/or paleontological sites to better understand the history of the land and its people and animals.

1.8.6 Facilities & Infrastructure Issues*Mary & Murray Looney Education & Resource Center (MMLERC)*

The current MMLERC and its associated facilities need improvement. Originally, this cabin was used as a private summer resort in the early 1950s. Due to the cabin's antiquity, the design is inefficient, the building materials have deteriorated, and standards have subsequently changed overtime. The Mary & Murray Looney cabin had been abandoned for at least 10 years prior to Refuge restoration efforts. During this time, the interior and exterior of the building and the surrounding grounds have deteriorated. Initial renovation has already taken place inside the

main MMLERC building, through a Maintenance Action Project, so that it functions adequately for the Refuge Headquarters, housing for staff, volunteers, and/or guests, along with hosting multiple EE programs. Additional restoration, however, is still required to make the building more energy-efficient, water conservation-friendly, more accessible to handicap visitors, more secure, as well as to ensure adequacy of plumbing and electrical systems. The MMLERC's concrete grounds and walkways must also be repaired for safety. And lastly, the pavilion structure needs to be renovated in order for it to be utilized as part of the MMLERC.

Access Roads

To get to the MMLERC, there is a MMLERC public access drive, which is currently 0.25-miles, unpaved and unimproved (dirt/rock), with a gate. There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available near the maintenance shop, next to the Guess House (150 yards). However, many people that access these roads drive up on the side of the road over vegetation, also causing soil to erode, in order to have two cars pass one another. In addition, road and parking area surfaces need to be improved with gravel to allow for a better established parking area, which will prevent visitors from parking in the grass, on the side of the road, and will help control soil erosion. In addition, Refuge staff needs a wider access road to the Beck Unit shop in turn-around area for Staff vehicles and trailers.

Nature Trails and Overlooks

Hiking trails are not adequate for the current number of people visiting the Refuge for EE and interpretation programs, let alone the amount of those anticipated in the future. Establishing more trails will make it safer for people to walk and will prevent damage to soils and vegetation. The trail from MMLERC to the pavilion is a paved path that has deteriorated and needs to be repaved. The path from the parking area to the MMLERC also needs to be an improved gravel walkway, approximately 3-feet wide, designed for heavy foot traffic. The remaining trails will be "primitive". Creating and maintaining "primitive" trails will provide a basic pathway within its natural surroundings, without involving much heavy trail construction or maintenance.

In addition, establishing overlook areas and photography blinds will provide additional opportunities for visitors to connect with nature.

Public Use Signs and Interpretive Displays

The Refuge does not currently have any public signs posted, except for at the entrances of caves stating that they are closed to the public. The Refuge does not post any public signs that are not deemed absolutely necessary in order to maintain discretion of their unit locations and to keep cave locations confidential (as required by the Federal Cave Resources Protection Act). Nevertheless, signage on the Refuge will need to be improved throughout the lifetime of this CCP as needed, especially to accommodate the increase of EE programs at the MMLERC.

Many visitors get lost when visiting the Refuge and signage could help orient them. However, the Refuge does not want to post these signs until the MMLERC is completely secured (alarm system, permanent staffing, safes, etc.). Other interpretive signage on Refuge nature trails could also provide a higher quality experience for EE and/or interpretation programs.

Refuge Headquarters Site

Currently, there are three full-time Refuge staff members, one Wounded Warrior, one Student Conservation Association (SCA) intern, and one part-time Student Career Experience Program (SCEP) student. Refuge Headquarters is currently located at the MMLERC, which provides only one office and the facility is primarily used for EE and interpretation programs. Due to limitations on office space at these headquarters, each of these staff members works out of either the Oklahoma Ecological Services Field Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR. Due to the lack of a centralized Headquarters space, management coordination is challenging. This situation also increases staff travel time, decreasing actual work time. In anticipation of land acquisition in the near future, a centralized Refuge headquarters would help accommodate the potential increase in staff.

Maintenance Shops and Service Buildings

Current maintenance facilities are inadequate. The Refuge needs additional maintenance facilities in order to store and maintain Refuge vehicles, supplies, and equipment used for management operations. In addition, it is important that the Refuge have adequate decontamination sites for caving equipment in accordance with the Service's WNS decontamination guidance.

Refuge Housing

The MMLERC only provides one bedroom used by volunteers, researchers, interns, educators, Refuge staff, and other guests. There is also a house on the Mary & Murray Looney Unit formerly owned by Guess family known as the "Guess House" that provides housing for the one Refuge staff member through a rental agreement. In addition, there are small cabins on private lands near the Potter Unit that may be available on a limited basis for Refuge volunteers, researchers, interns, educators, and Refuge staff. However, use of these would require landowner notification and may not always be vacant. The Refuge would like to provide more housing opportunities for the current number and future increase of volunteers and partners. Additional housing to accommodate an increase in Refuge staff will also be needed.

Boundaries

The Refuge must identify and mark their boundaries in order to know their physical limitations between adjacent private, tribal, or public lands for performing management activities. Currently, there are over 36 miles of unit boundaries with a total of over 4 miles of fencing and 11 gates that are maintained and repaired by Refuge staff. Only two of the Refuge Units have

been completely surveyed and marked. The table below (Table A-2) shows an assessment of current Refuge boundary needs and infrastructure to maintain.

Table A-2. Refuge Boundary Assessment

| Refuge Unit | Boundary | Surveyed? | Marked? | Fencing? | Gates? |
|----------------------|-----------------|------------------|----------------|-----------------|---------------|
| Looney | >1.37 mi. | X | X | X | 2 |
| Liver | 3.14 mi. | X | X | - | 1 |
| Potter | 3.09 mi. | X | X | - | 1 |
| Sally Bull Hollow | 15.42 mi. | - | - | - | 4 |
| Gittin Down Mountain | 3.87 mi. | - | - | - | - |
| Varmint | 1.24 mi. | - | - | - | - |
| Boy Scout | 1.93 mi. | - | - | - | 1 |
| Beck | 2.99 mi. | - | - | X | 3 |
| Eucha | 2.51 mi. | - | - | - | - |

1.8.7 Refuge Administration Issues

Funding and Staffing

Tribal members and Refuge staff agree that a lack of staffing and funding is one of the Refuge's primary issues.

Volunteers/Friends Program

Currently, the Refuge does not have an official Friends group established. An official Friends group could play a major role in outreach, land acquisition, environmental education and interpretation programs, wildlife monitoring, informing and involving the community, as well as fundraising for Refuge projects.

Chapter 2: Management Alternatives of EA

2.1 Formulation of Alternatives

Alternatives are different approaches or combinations of management actions designed to achieve a refuge's purposes and vision, the goals identified in the CCP, the goals of the Refuge System, and the mission of the Service. Based on the issues, concerns and opportunities heard from the public, the State, Tribal Nations, and other agencies during the scoping process, the Planning Team developed two alternative management scenarios that could be used at Ozark Plateau NWR.

This EA considers these two alternatives in detail (see sections 2.3 and 2.4), which cover a practical and reasonable range of management possibilities that address all of the issues stated in Section 1.8. In addition, three other alternatives were considered but eliminated from detailed analysis for the reasons listed below (see section 2.2). The proposed alternative (Alternative B) represents a different approach or management scenario from current management (Alternative A) to address public concerns and improve management for the future protection, restoration, and management of the Refuge fish, wildlife, plants, habitats, and other resources, as well as compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions of Refuge habitats and analyzed the external relationships affecting each Refuge Unit. This information contributed to the development of Refuge goals and, in turn, helped formulate the alternatives, summarized in Table A-5. Alternatives will be examined in six broad issue categories:

- **Landscape-level:** How will the Refuge contribute to addressing landscape-level conservation-related issues in the Ozarks?
- **Habitat Management:** How will the Refuge manage habitats to ensure the protection of trust resources?
- **Wildlife Management:** How will the Refuge manage wildlife to ensure the protection of trust resources?
- **Public Use Management:** How will the Refuge manage wildlife-dependent public use opportunities and public use access to ensure the protection of fish, wildlife, and their habitats?
- **Cultural Resource Management:** How will the Refuge manage cultural and historical resources to ensure the preservation of ancient and recent history and culture?
- **Facilities & Infrastructure Management:** How will the Refuge provide infrastructure and related developments while ensuring the protection of trust resources?

2.2 Alternatives Considered But Dismissed From Detailed Analysis

During the public scoping period, many alternative actions for managing the Refuge were suggested. The majority of these suggestions were consistent with Refuge purposes and the mission of the Refuge System and were incorporated into the action alternative. Other actions were found to be infeasible for the reasons described below.

Fishing

The U.S. Fish & Wildlife Service requires that we consider each of the “Big 6” wildlife-dependent recreational uses, including fishing. However, the Refuge does not currently have any fishing opportunities nor proposes to consider this use because a) most of the Refuge must remain closed to the public to ensure the protection and conservation of fragile cave resources and b) the Refuge does not have any good fishing locations to provide. Nevertheless, there is a

conservation agreement with the City of Tulsa and ODWC to co-manage the Eucha Unit (approximately 130 acres), in which the City and State manage recreational fishing on the upper end of Lake Eucha/Spavinaw Creek, while the Refuge manages the Eucha Unit's cave resources.

Prohibit all Service Staff and Biologists from Cave Entry

There was a suggestion from internal Service staff that Refuge staff and cave biologists be prohibited to enter caves on the Refuge as long as WNS poses a threat to Refuge bat species. However, in order to identify whether WNS is affecting sites on the Refuge, to learn more about the disease, and to contribute to research regarding prevention of and recovery from WNS, it is essential for biologists and Refuge staff to continue monitoring caves and bat species for traces of the fungus, *Geomyces destructans*. The Refuge follows strict decontamination procedures (recommended by the WNS National Plan) of cave gear and equipment, which does not allow for the potential of humans to spread the fungus. These procedures will be taken by all Refuge staff and other scientific researchers who cooperate on scientific monitoring of cave habitat and fauna on and off Refuge. The Refuge follows guidance regarding all WNS monitoring and cave-related management activities in the most recent version(s) of the White Nose Syndrome National Plan (<http://www.Service.gov/whitenosesyndrome/pdf/WNSnationalplanMay2011.pdf>).

Management Activities across State and Regional Borders

In section 2.4.7 *Proposed Refuge Administration*, Ozark Plateau NWR proposes to coordinate to improve management of other “cave resource refuges” across State and Service regional boundaries, as well as expand their acquisition boundary into these areas to ensure successful Strategic Habitat Conservation. This is discussed in further detail in Alternative B below. This action sparked many ideas for more specific management activities throughout the landscape on these satellite refuges (Logan Cave NWR; Holla Bend NWR; Pilot Knob NWR; new acquisition areas within Service Region 3, 4, and 6, etc.) including:

- Refuge would partner with Service Region 3 and the State of Missouri to establish an expanded acquisition boundary in Southern Missouri's Ozark ecoregion
- Increase the monitoring programs for T&E and other species throughout species' ranges, across Service Regional boundaries and state lines, to achieve a more integrated ecoregional approach to data collection and management
- Expand EE opportunities to include school groups programs by permit only at Logan Cave NWR
- Establish an additional EE Center on new acquisitions on or near Logan Cave, Cave Fish, or Pilot Knob NWRs. The site would be acquired in an already-developed area, near the cave resources but not co-located with the caves.
- Expand wildlife observation opportunities with an observation deck at Logan Cave NWR
- Establish a 1-mile wildlife observation nature trail around the Pilot Knob NWR

Although these actions have great intentions and potential, it is not necessary to further analyze them at this time until an official management agreement has been made between these Service regional boundaries (Region 2, 3, 4 and 6) regarding management of cave resources.

Alternatives Analyzed in Detail

2.3 Alternative A – No Action (Current Management)

This alternative is the baseline for comparison with Alternative B (the Proposed Action or Proposed Future Management) because it describes how the Refuge currently manages for its fish & wildlife resources.

2.3.1 Current Landscape-level Management

Ozark Habitat Loss & Fragmentation

Land and Conservation Easement Acquisition from Willing Sellers and Conservation Agreements

The Refuge would continue current management to address habitat loss and fragmentation by acquiring land and conservation easements from willing sellers (up to 15,000 acres) and entering into conservation agreements with private landowners, conservation organizations, state, Tribal Nations, and other federal agencies. The Refuge would not build or permit the construction of any new roads or infrastructure on Refuge lands except for Refuge operation purposes and would continue its practices of maintaining and restoring forested habitat as resources allow.

Conservation agreements with the Cherokee Nation, City of Tulsa, and private landowners would continue to preserve forested and/or cave habitats.

Partnerships

Partnerships would continue to be an important part of the Refuge's actions to acquire, manage, and conserve lands, inventory and monitor, conduct research, assist in protecting and restoring habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation. The Refuge would continue working with landowners adjacent to and near the Refuge, private businesses, citizen science groups/projects, nongovernmental organizations (NGOs) (including The Nature Conservancy [TNC], Land Legacy, Tulsa Regional Oklahoma Grotto, Central Oklahoma Grotto, Arbuckle Mountain Grotto, National Speleological Society [NSS], Bat Conservation International [BCI], Ozark Tracker Society [OTS], Blue Skywater Society, Boy Scouts of America [BSA], Girl Scouts of America [GSA], Missouri Chimney Safety Council, Audubon Society, Wild Turkey Federation, Ducks Unlimited, Student Conservation Association [SCA], Wildlife Society, American Fisheries Society, Southeastern Bat Diversity Network, Western Bat Working Group, Wildlife Federation, Northwestern Arkansas Beekeepers' Association), universities (including Oklahoma State University [OSU], University of Oklahoma [OU], Northeastern State University [NSU], Rogers State University

[RSU], University of Arkansas [UA], Southwest Missouri State University, University of Missouri, Southeastern Oklahoma State University, University of Central Oklahoma, Tulsa University), cities (Tulsa, Stilwell, Tahlequah, Jay, Colcord), counties (County Commissions for Adair, Delaware, Ottawa, Cherokee, Sequoyah, Mayes, Craig Counties), State agencies (including the Oklahoma Department of Wildlife Conservation [ODWC], Department of Environmental Quality [DEQ], Oklahoma Conservation Commission, Oklahoma Water Resources Board, Oklahoma Scenic Rivers Commission, Oklahoma State Parks, Oklahoma State Forestry Services, Oklahoma Natural Heritage Inventory, Grand River Dam Authority [GRDA], Arkansas Game and Fish Commission, Arkansas Natural Heritage Inventory, Missouri Department of Conservation), Tribal Nations (Caddo, Cherokee, Eastern Shawnee, Miami, Modoc, Osage, Quapaw, Seneca-Cayuga, and Wyandotte), and other Federal agencies (including the U.S. Forest Service, Natural Resource Conservation Service [NRCS], National Park Service [NPS], U.S. Army Corps of Engineers, Bureau of Land Management [BLM], United States Geological Survey [USGS], Environmental Protection Agency [EPA]).

Restoration

The Refuge would continue to restore 70 acres of agricultural land to forested habitat at the Beck Unit (see *Invasive Flora* below). Additionally, the Refuge would maintain approximately 3,977 existing acres of forested habitat.

Climate Change

Monitoring

The Refuge staff and university partners would continue monitoring baseline cave microclimates with temperature and humidity loggers, which record data every fifteen minutes or every hour, everyday, year-round. The loggers are located in one Refuge cave and one cave managed jointly with TNC.

Service staff and university partners would also continue monitoring the known maternity colonies and hibernacula annually. Two techniques would be used to estimate colony size at these caves. The technique used at the maternity sites consists of conducting an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography. For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. Acoustic monitoring would also be used to gain insight on use of Refuge tracts and caves by bat species. The technique used at hibernacula consists of entering the cave and counting the bats. Monitoring bat population sizes on private, state and tribal lands provides baseline information for understanding how climate change is affecting populations.

The Refuge would continue contracting with universities and NGOs to monitor mammals, birds, herpetofauna, fish, cave invertebrates, terrestrial insects, and vegetation. The following table shows surveys that have been completed until 2012 on the Refuge Units listed below:

Table A-3. Species surveys completed on Ozark Plateau NWR until 2012.

| <i>Species Survey</i> | <i>Management Unit Surveyed</i> |
|----------------------------|---|
| Mammals | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Birds | <ul style="list-style-type: none"> • Sally Bull Hollow • Mary & Murray Looney • Eucha • Beck • Potter |
| Herpetofauna | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Fish | <ul style="list-style-type: none"> • Sally Bull Hollow |
| Cave invertebrates | <ul style="list-style-type: none"> • Sally Bull Hollow • Eucha • Beck • Gittin Down Mountain • Liver • Varmint • Mary & Murray Looney • Potter • Boy Scout |
| Terrestrial insects | <ul style="list-style-type: none"> • Sally Bull Hollow • Mary & Murray Looney |
| Vegetation | <ul style="list-style-type: none"> • Sally Bull Hollow • Gittin Down Mountain • Liver • Mary & Murray Looney |

Green Infrastructure

The Refuge would continue installing and maintaining energy-efficient appliances and an efficient heating and cooling system (stove, refrigerator, dishwasher, hot water heater, washer and dryer) at the MMLERC. Water filtration systems would also be maintained at the MMLERC and Guess House, thereby reducing the need to bring bottled water onto the Refuge.

Carbon Sequestration

The Refuge manages 3,977 acres of oak-hickory and oak-hickory-pine forest. The protection and management of these forested areas enhances carbon sequestration.

Surface and Ground Water Quality & Quantity

Land and Conservation Easements Acquisition from Willing Sellers

The Refuge would continue to acquire land and conservation easements from willing sellers to protect the land from development. In the past 25 years, the Refuge has purchased 3,572.35 acres in fee, 162 acres of conservation easements, manages 359 acre of conservation agreements, anticipates purchasing about 400 acres in the next few years, and is approved to acquire up to 15,000 acres from willing sellers in the future. Once acquired, the Refuge would implement appropriate forest management practices to control water run-off such as burning to control invasive species and thin the forest (see 2.3.2 *Fire Management*), planting native species, controlling unauthorized grazing, and monitoring the health of the forest and effects of management practices on wildlife species. The Refuge would continue these forest management practices on its existing 4,093.35 acres (and new areas acquired) of oak-hickory forest, grasslands, and riparian areas within recharge zones.

Groundwater Mapping

The Service and NGOs would continue to work with private landowners, universities, Tribal Nations, USGS, and Service Regional Hydrologist, Inventorying & Monitoring (I&M), and Contaminants personnel to map groundwater recharge areas within the acquisition area, in and around all Refuge units, including private lands, specifically used for locations where Ozark cavefish, cave crayfish, and other important aquatic cave organisms are present. The Refuge would continue to identify all landowners in determined and potential recharge zones and seek permission to perform delineation process, which consists of using fluorescent-dye tracing to determine recharge areas, general directions of groundwater flow, and minimum and maximum groundwater travel times in days and miles from losing streams as a result of dye tracing.

Monitoring

The Refuge would continue to partner with universities, Oklahoma DEQ, Oklahoma Water Resources Board, USGS, and EPA to monitor surface and ground water quality (amount of pesticides, nitrates, phosphates, pharmaceuticals, and heavy metals) on and around all units on the Refuge. Water sampling has taken place on the Looney Unit among others.

The Refuge would also continue to partner with local municipalities and water authorities to share information about water levels affecting the Refuge. The Refuge would continue to coordinate surface water quality monitoring in Spavinaw Creek with the City of Tulsa and the State of Oklahoma. Spavinaw Creek is a water supply source for the City of Tulsa. The Refuge and the City would continue to share this monitoring data.

Partnerships

The Refuge would continue to work with adjacent and nearby landowners (private, NGO, state, tribal, and federal) to implement conservation agreements, assist with wildlife management through the Partners for Fish and Wildlife program and Section 6 of the Endangered Species

Act, and provide technical assistance. These partnerships will continue to help improve habitat quality on adjacent or nearby lands and also will prevent and minimize habitat loss and fragmentation in the Ozarks.

White-nose Syndrome (WNS)

WNS National Plan

The Refuge would continue to implement the actions and standards in the current WNS National Plan (<http://www.Service.gov/whitenosesyndrome/pdf/WNSnationalplanMay2011.pdf>), as it is updated. At this time, the actions include controlling access to caves for only WNS research and monitoring needs, decontaminating process of all cave gear, and monitoring T&E and non-T&E bats to establish baseline data on Refuge and neighboring private-land caves.

Monitoring

The Refuge would continue to partner with universities, caving organizations and other NGOs, state agencies, Tribal Nations, USGS, and other federal agencies to monitor for WNS on- and off- Refuge. The Refuge would continue to coordinate with other agencies and wildlife health organizations to identify preventative measures and investigate potential captive holding facilities.

Public Outreach

The Refuge would also continue public outreach regarding WNS by visiting schools and leading educational or interpretive discussions about the topic- discussing the issue with local landowners and organizations, producing exhibits, and including information on WNS in EE programs held at the Refuge.

Cave Access Control

The Refuge would continue to post signs prohibiting public entry in all Refuge caves, construct and maintain cave gates to control access to caves, and receive on-call law enforcement (LE) support from Sequoyah NWR.

Wind Energy Farms

Monitoring and Research

The Refuge would continue to monitor baseline bird and bat populations in caves and on bat routes using mobile acoustic monitoring to identify high risk areas and locate areas that would minimize impacts for development projects such as wind energy farms.

2.3.2 Current Habitat Management

Degradation of Cave, Stream, and Forest Habitat

Cave Protection

The Refuge would continue its current activities with caving organizations and other volunteers to build, maintain, and repair approximately 50 cave gates on- and off-Refuge. The Refuge would continue to post signs prohibiting entry at cave locations and would continue its policy of maintaining confidentiality of cave locations. LE officers stationed at Sequoyah NWR and a Zone Officer at Washita NWR would continue to provide “on-call” response to investigate cave gate vandalism and consult on effective monitoring actions. The Refuge would continue to partner with local residents, TNC, GRDA, and State/Tribal Game Wardens to monitor for unauthorized entry to caves and report any sightings or violations to the Refuge staff. The Refuge staff would also continue to remove trash and graffiti from caves.

Fire Management

See *Fire Management* category below.

Boundaries

The Refuge would continue to survey and mark Refuge boundaries, as funding becomes available.

Partnerships

The Refuge would continue to consult with adjacent and nearby landowners about any illegal grazing issues and remove any illegal dump materials.

Lack of Detailed, Scientific Cave Habitat Data

Research and Monitoring

The Refuge would continue contributing its research efforts on the Ozark Subterranean Biodiversity Project, similar projects, and other cave fauna bio-inventories in collaboration with TNC and other NGOs, universities, state agencies, Tribal Nations, USFS, and NPS on all Refuge units and surrounding private lands. Additionally, the Refuge would continue annual monitoring surveys of bat hibernacula and maternity sites, as well as cavefish and cave crayfish surveys. The technique used at the maternity sites consists of conducting an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography. For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. Acoustic monitoring would also be used to gain insight on use of Refuge tracts and caves by bat species. The technique used at the hibernacula consists of entering the cave and counting the bats. The Refuge would also continue searching for additional cave locations and cave mapping efforts on known caves with Refuge staff, cavers, NSS and other partners. Cave mapping would also continue to inform the Refuge staff of overlying landowners and help to identify outreach efforts.

Invasive Flora

Fire Management

See *Fire Management* category below.

Herbicide Treatment

The Refuge does not currently use chemical treatments for invasive flora.

Mechanical Treatment

The Refuge would continue to remove invasive plants with handtools, chainsaws, and by mowing approximately 10 acres total approximately one time per year on the Krause, Looney, Sally Bull Hollow, and Eucha Units.

Partnerships

The Refuge would continue working in partnership with the City of Tulsa and Land Legacy for challenge cost-share for invasive plant control using handtools or mechanical treatment, plantings, and prescribed burning (see *Fire Management* below). The Refuge would also continue partnerships through agreements with private landowners for prescribed burns by Service personnel on approximately 50 acres per year. The Refuge would continue its vegetation inventory in partnership with OSU to monitor native and invasive plants.

Fire Management

Ozark Plateau NWR enhances its Fire Management Program through assistance provided by Service personnel of the Oklahoma/North-Texas Fire Management District (remotely located at Wichita Mountains Wildlife Refuge).

Wildfire Management

The Refuge typically experiences frequent, small-scale wildfires that normally range from a few acres to approximately 500 acres per year. Management would respond to a wildland fire on Refuge lands based on objectives established in the applicable Habitat Management Plan (HMP) or Fire Management Plans (FMP). A wildfire may be concurrently managed for more than one objective. Response to wildland fire would be based on ecological, social, and legal consequences of the fire. Responses to wildland fire would be coordinated with all affected agencies/tribes/cooperators regardless of the jurisdiction at the ignition point. The appropriate response to wildland fire would be dictated by:

- the circumstances under which a fire occurs;
- the likely consequences to firefighter/public safety and welfare; and
- the natural/cultural resource values to be protected

Initial response decisions and actions may include a management or initial decision to postpone taking action on the ground based on conditions, safety, and/or competing priorities. Initial

response to human-caused wildfires would be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Unplanned natural ignitions would be managed to achieve HMP and FMP objectives when risk is within acceptable limits. Wildland Fire Decision Support System has tools available to assist in these decision processes, 1) organizational needs assessment, 2) complexity analysis. Objectives established in applicable HMP and FMPs would direct strategy/tactics selected in response to wildland fires on federal land.

The Refuge would continue receiving wildfire suppression assistance from local fire departments, the Oklahoma Department of Agriculture, Food and Forestry – Oklahoma Forestry Services, Tribal Nations, and Service personnel and other federal agency personnel. The Refuge would pursue funding to implement 1) FireWise activities 2) coordination/training with adjacent volunteer fire departments and 3) community wildfire protection plan (CWPP-e) actions and fuel treatments.

Prescribed Fire Management

The Refuge would continue to implement their FMPs on the Looney and Sally Bull Hollow Units. Treatment goals for forest management are to maintain open understory, reduce fuel loads, and foster mature oak-hickory or oak-hickory-pine overstory, while increasing understory diversity through prescribed fire. Prescribed fire is planned on a 3 to 5 year rotation. Although actual acres treated per year will vary due to units selected for treatment and treatment boundaries, an annual average of approximately 400 acres per year is treated during the rotation cycle. Currently, the Refuge does not have a FMP to perform prescribed fire management on other Refuge units.

Monitoring

All projects would be monitored to determine if treatment objectives were met and to document weather, fire behavior, fuels information, and smoke dispersion. Evaluation reports would be completed and maintained in the project file and accomplishment reports (namely, FMIS and NFORS), as per agency requirements.

2.3.3 Current Wildlife Management

Threatened and Endangered (T&E) Species and Species of Concern

Monitoring and Research

The Refuge would continue contributing research efforts on the Ozark Subterranean Biodiversity Project, similar projects, and other cave fauna bio-inventories in collaboration with TNC and other NGOs, universities, state agencies, Tribal Nations, U.S. Forest Service, and NPS on all Refuge units and surrounding private lands.

Additionally, the Refuge would continue annual monitoring surveys of bat hibernacula and maternity sites, as well as cavefish and cave crayfish surveys. The technique used at the maternity sites consists of conducting an exit count as the bats emerge from the cave at night to forage using night vision optics, thermal videography, and infrared videography. For most gray bat maternity sites, guano pile measurements are taken in the fall or winter to estimate colony size. The technique used at the hibernacula consists of entering the cave and counting the bats. Radio telemetry and acoustic monitoring surveys would also be continued to gain insight on migration and movement corridors bat species utilize.

Partnerships

The Refuge would continue to partner with private landowners, NSS, TNC, the City of Tulsa, universities, GRDA, ODWC, and tribal governments to conduct monitoring and surveys on T&E species on- and off- Refuge. The Refuge would also continue partnering with OSU to perform genetic research on bat species to identify genetic diversity and gather information related to WNS.

Fire Management

See *Fire Management* above in 2.3.2 Current Habitat Management.

Migratory and Resident Bird Species

The Refuge would continue to conduct bird point counts during the spring and other migration seasons to monitor bird population and establish data trends over time. The Refuge would continue to use prescribed fire to promote ideal nesting/foraging habitat in Ozark forests for bird species (see *Fire Management* above in 2.3.2 Current Habitat Management). The Refuge would continue the policies of limited public use activities and maintaining continuous forest habitats to favor interior forest species.

Resident Non-T&E Species

Monitoring

The Refuge would continue to conduct mobile acoustic monitoring once or twice a month from the spring through fall from roadways and videography of cave entrances during the spring and summer to determine non-T&E bat population counts and habitat preferences. Collecting this information would allow the Refuge to continue assessing population declines due to WNS and habitat loss, focus conservation efforts on specific habitat types, and fulfill the Refuge's mission of preventing the listing of species.

Bioinventories

The Refuge would also continue approximately one bio-inventory in 2 or 3 caves every 5 years, determined by volunteers and other partners to monitor other cave species.

Invasive Fauna Species and Pest Management

As is currently, the Refuge would not manage for invasive fauna species or pests.

2.3.4 Current Public Use Management

Hunting

As is currently, the Refuge would not allow hunting.

Environmental Education (EE)

The Refuge would continue managing high quality, EE programs on the Looney Unit and at the MMLERC, by permit only. These programs would continue to be limited to 10-20 people, 2 or 3 times per month in the spring and fall, 1 or 2 times per month in the summer, and approximately once per month in the winter. These EE programs would be primarily “place-based” on Refuge resources- including on-site, field-based classes and experiences in Ozark forests, streams, riparian areas, and karst environments on the Looney Unit and/or on nearby private lands in cooperation with local residents.

EE programs would be hosted, sponsored, and lead in cooperation with multiple partners including: BCI, Blue Thumb, BSA, Campfire USA, Land Legacy, NSS, OTS, Tulsa Audubon Society, TNC, several universities and approximately 1,000 hours of volunteer time.

The Refuge would continue to coordinate Refuge-based collegiate-level classes and field trips, with the following universities: OSU, OU, RSU, NSU, UA, University of Southern Mississippi, University of Missouri, Missouri State University, John Brown University. As part of overnight EE programs, NGOs and university groups of approximately 30 people (50 maximum) would also continue “primitive” overnight camping in the designated area, by permit only, occurring approximately 12 weekends per year. Local K-12 school classes would continue to conduct site visits to the Looney Unit and MMLERC for resource education programs. In addition, the Refuge would continue to coordinate with tribal entities to provide tribal-hosted EE programs from a Native American cultural perspective in their Native language and in English to share information regarding cultural and natural resources, local ethno-botanical knowledge, and healthy living and cooking using native/natural edible plants.

Interpretation

The Refuge would continue to manage interpretive programs regarding cave and karst resources for approximately 25 people per month on-site at the Looney Unit and MMLERC, and five to several hundred people per month off-site at schools and events.

On-site interpretation programs would continue to be conducted in coordination with local residents, BCI, Blue Thumb, BSA, Campfire USA, Land Legacy, NSS, OTS, Tulsa Audubon Society, TNC, OSU, John Brown University, RSU, NSU, UA, and OU on the Looney Unit and

at the MMLERC. On-site programs (aside from introductory interpretive discussions for most EE groups that visit the Refuge) are primarily for school and youth groups, civic organizations, naturalists/scientists, university faculty and students, Tribal groups, Service staff, and other agency staff, and may include short interpretive hikes on primitive trails and discussions that interpret natural and cultural information regarding the Ozark ecoregion, karst ecosystem, geology, water resources, Native American cultural resources and paleo resources, federally listed T&E species, especially about bats and other cave species, species of concern, game and nongame species, migratory birds (including bird language), and cave technology demonstrations (Anabat acoustic detectors, real-time infrared and thermal videography, night vision, etc.). Refuge staff would also conduct visits to local K-12 schools, especially in October to make presentations on bats, usually during the Halloween season. In addition, Refuge staff would also continue hosting information booths and making presentations at public shows, such as the Illinois River Festival and the Wildlife Expo in central Oklahoma.

Wildlife Observation & Photography

The Refuge would continue to provide wildlife observation and photography opportunities by permit only on the Looney Unit, in conjunction with interpretive and/or EE programs, to view and/or photograph Ozark Plateau NWR's diverse habitats including Refuge forests, streams, and cave exteriors as well as wildlife including resident and migrating birds, mammals, fish, insects and butterflies, etc. There would be no opportunities for unescorted, unpermitted wildlife observation and photography.

Wood Harvesting

As is currently, the Refuge would not permit wood harvesting by the public.

Public Outreach

The Refuge would continue to maintain a Service website with limited information. Confidentiality would continue to be maintained to protect Refuge resources. As is currently, no pamphlets or fliers about the Refuge would be available.

2.3.5 Current Cultural Resource Management

Historical Sites

As is currently, the Refuge would protect historical sites by keeping areas confidential and limiting public access. The Refuge would continue partnering with SHPO and appropriate tribes to preserve these sites.

Archeological and Paleontological Sites

As is currently, four known archeological sites on Sally Bull Hollow, Potter, and Looney Units and short-faced bear and tapir remains on Gittin Down Mountain Unit would be kept confidential and public access to these sites would be limited. The Refuge would continue partnering with

SHPO, Sam Noble Museum archeologists and paleontologists (University of Oklahoma), and Tribal Nations to preserve archeological and paleontological sites.

2.3.6 Current Facilities & Infrastructure Management

Mary & Murray Looney Education & Research Center (MMLERC)

The Refuge would continue to operate and maintain the MMLERC, a 1,200 square feet, semi-renovated cabin with one meeting room, one office, 2 bathrooms, one sleeping room, and a kitchen. The MMLERC is ADA-accessible from the parking lot into the cabin. Adjacent to the MMLERC, there is an unrenovated outdoor pavilion consisting of 300 square feet enclosed studio space and a 200 square feet outdoor patio.

Access Roads

As is currently, the Refuge would continue to use and maintain a 0.25-mile, unpaved and unimproved (dirt/rock) access road to the MMLERC, with a gate. The Refuge would also utilize and maintain an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles near the MMLERC. Excess parking would also be available near the maintenance shop, next to the Guess House (150 yards). Refuge staff would also utilize a very narrow access road to the Beck Unit maintenance shop, which currently does not have a turn-around area.

Nature Trails and Overlooks

Currently, the Refuge would utilize and maintain a few trails around the Refuge including a deteriorating path from the MMLERC to the pavilion, a small path from the parking area to the MMLERC, one 1/4-mile trail from MMLERC to Spavinaw Creek, 1/8-mile trail from MMLERC to the old garden area at top of hill, 150-yards trail from Guess House to the MMLERC, and 1/4-mile trails near the Guess House on the Looney Unit. As is currently, there would be no established overlook areas.

Public Use Signs and Interpretive Displays

As is currently, the Refuge would continue to neither post public use signs for any Refuge units, except for outside of caves stating that they are closed to the public, nor interpretive displays at the MMLERC/Looney Unit.

Refuge Headquarters Site

The Refuge would continue to operate Refuge Headquarters at the MMLERC, which provides only one office and is primarily used for EE and interpretation programs. Therefore, Refuge staff would continue to work out of non-centralized office spaces including the Oklahoma Ecological Services (ES) Field Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR.

Boundaries

As is currently, there are over 36 miles of unit boundaries with a total of over 4 miles of fencing and 11 gates that would be maintained and repaired by Refuge staff. Only two of the Refuge units have been completely surveyed and marked. The following table (Table A-4) shows an assessment of current Refuge boundary needs and infrastructure to maintain.

Table A-4. 2012 Refuge Boundary Assessment

| Refuge Unit | Boundary | Surveyed? | Marked? | Fencing? | Gates? |
|----------------------|-----------------|------------------|----------------|-----------------|---------------|
| Looney | >1.37 mi. | X | X | X | 2 |
| Liver | 3.14 mi. | X | X | - | 1 |
| Potter | unknown | (partial) | (partial) | - | 1 |
| Sally Bull Hollow | 15.42 mi. | - | - | - | 4 |
| Gittin Down Mountain | 3.87 mi. | - | - | - | - |
| Varmint | 1.24 mi. | - | - | - | - |
| Boy Scout | 1.93 mi. | - | - | - | 1 |
| Beck | 2.99 mi. | - | - | X | 3 |
| Eucha | 2.51 mi. | - | - | - | - |

Maintenance Shops and Service Buildings

The Refuge would utilize and maintain two maintenance shops and one storage building: Beck Unit Shop: 50' x 30' metal building on concrete pad for cave gate construction and storage; Looney Unit: 50 x 30 metal building on concrete pad for all other maintenance, containing a WNS decontamination site; and Guess House metal storage building: 30' x 20'.

Refuge Housing

The Refuge would continue to provide Refuge housing for Refuge staff at the Guess House, located on the Looney Unit and one bedroom for volunteers, researchers, interns, educators, Refuge staff, and other guests at the MMLERC cabin. In addition, the Refuge would currently maintain an agreement with Leslie Krause, in which, after he resides and maintains Krause House on the Beck Unit, the house reverts to the Refuge (via donation) at termination of agreement.

2.3.7 Current Refuge Administration

Funding and Staffing

The Refuge would continue to receive funding and staffing for operations, infrastructure and maintenance, through the Department of the Interior budget approved by Congress, and allocated to the Refuge by the Southwest Regional Office of the U.S. Fish & Wildlife Service. Refuge staff would continue to seek additional funding elsewhere such as applying for grants and

working with NGOs in order to implement all current and future management activities and educational programs.

Volunteers/Friends Program

The Refuge does not have an official Friends group established. However, the Refuge would continue provide volunteer opportunities for:

- informal Friends support from NSS local chapters (cavers)
- 2 part-time, resident volunteers at Guess House (Looney Unit) for management activities such as: mowing, building/property maintenance, security, visitor coordination at MMLERC (20 hours per week by agreement).
- 1 part-time, resident volunteer at Krause House (Beck Unit) for management activities such as: mowing, maintaining fences, assisting with cave gate construction, cleaning up trash/litter, ice damage recovery and cleanup, and maintaining security at Beck Unit (approximately 10-20 hours per week on a volunteer basis).
- Approximately 25 individuals as part-time, non-resident volunteers and approximately 10 to 15 organizations that maintain a habitual relationship with the Refuge to offer volunteer services and labor from a number of individuals (several hundred) for management activities such as: cave mapping, cave gate construction/repair/maintenance, EE, invasive plant removal, trail maintenance, litter and trash cleanup, cabin renovation and maintenance, chimney repair, 2010 Ozark Summit administration and support, research and citizen science, and wildlife inventorying and monitoring (approximately 5,000 to 10,000 person hours total per year).

Coordinate Beyond Service Regional Boundaries to More Effectively Manage Federally Listed Cave Species on a Landscape Level

Ozark Plateau NWR would continue to be managed by dedicated staff for the purpose(s) listed below:

- Assure the continuing existence, and aid in recovery of federally listed endangered and threatened Ozark cave species
- Reduce the need for future listing of species of concern in the Ozarks
- Protect large continuous stands of Ozark forest essential to migratory interior forest birds
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

Meanwhile, other nearby cave resource satellite refuges including Logan Cave NWR, Cave Fish NWR, and Pilot Knob NWR would continue to be managed by staff from refuges that primarily manage habitats other than caves. Ozark Plateau NWR staff, with its experience and expertise in karst management, would continue to cooperate with Hollow Bend NWR staff to assist in

developing management plans and activities for Logan Cave NWR. The Ozark Plateau NWR Refuge staff would also continue working closely with Cave Fish and Pilot Knob NWRs (managed out of Mingo NWR) in Missouri. However, there would be no current management agreement to ensure that this continues.

2.4 Alternative B – Proposed Action (Proposed Future Management)

2.4.1 Proposed Landscape-level Management

Ozark Habitat Loss & Fragmentation

Land and Conservation Easements Acquisition from Willing Sellers and Conservation Agreements

The Refuge would continue those actions identified in Alternative A, plus the Refuge would partner with Service Regions 2, 3, 4 and 6 to establish an expanded acquisition boundary in the Ozark ecoregion.

Partnerships

The Refuge would continue actions described in Alternative A, plus the Refuge would increase collaboration and partnerships at a landscape-level on public and private lands, crossing state and regional boundaries, with private landowners, conservation organizations, universities, state agencies, Tribal Nations, and other federal agencies.

Restoration

Same as Alternative A, plus the Refuge would maintain, conserve, and/or restore up to 15,000 acres of acquired lands to natural forest habitat (see 2.4.2 Proposed Habitat Management).

Climate Change

Monitoring

The Refuge would continue the same management in Alternative A, plus it would implement long-term monitoring of habitat and wildlife to better understand the impacts of climate change. Monitors would consist of fixed, solar-powered acoustic monitoring stations (Anabat) at cave locations. The Refuge would partner with universities to determine the best locations for monitoring. The Refuge would also expand its data loggers program to collect air temperature, humidity, light, cave rock temperature, groundwater elevation, and cave stream temperature data at cave, surface and groundwater locations on each unit every hour everyday year-round.

In addition, the Refuge would identify bat, bird, and other wildlife species migration routes/corridors utilizing various methods (i.e., conduct acoustic route monitoring, banding, tagging, and using radio transmitters, radar technology, and other technology). Then it would use GIS to delineate high risk areas based on identification of migration corridors to understand how climate change is affecting migratory routes on a landscape-level.

The Refuge would install permanent weather stations at the Looney, Boy Scout, and Sally Bull Hollow Units, and any appropriate new areas acquired to establish baseline climate information and measure trends over time. The weather stations would be approximately 4 feet by 4 feet on a concrete pad with a five feet tall box to house the instruments and gauges.

Green Infrastructure

Same as Alternative A, plus the Refuge would install solar panels on the MMLERC, Guess House, or near previously disturbed, infrastructure areas on the Looney Unit and potentially on any newly acquired or developed buildings, if amount of sun and location is appropriate, to offset carbon and rely mostly on alternative energy sources.

In the case that the Refuge establishes a new Refuge Headquarters/Visitor Center site (see 2.4.6 Proposed Facilities & Infrastructure Management: *Refuge Headquarters*) it would also install solar panels on the roof of the new building or where amount of sun is appropriate. The Refuge would install solar panels on some new buildings developed or acquired as a part of new Refuge units, if appropriate.

The Refuge would install and/or maintain energy efficient heating and cooling systems and appliances on Refuge buildings such as geothermal heating and cooling system, proper insulation in the walls, ceilings, and subfloors, double-pane windows, energy-efficient stove, refrigerator, dishwasher, on-demand hot water, and washer and dryer in all (utilized) Refuge buildings, including the new Headquarters site. The Refuge would also refit buildings with rain collection equipment to capture rainwater for irrigation purposes. A water filtration system would also be installed and maintained at the MMLERC and all other Refuge buildings to utilize local water resources and reduce carbon emissions and waste associated with bottled water.

Carbon Sequestration

The Refuge would continue protecting and managing up to 15,000 acres of mostly forested lands, enhancing carbon sequestration. The Refuge would either acquire lands that already have large, continuous stands of native oak-hickory forests and preserve them or it could restore native oak-hickory forests on lands that were previously used for agricultural purposes or deforested.

Restoration would involve prescribed fire, mowing, tilling, and thinning with chainsaws and tractors if necessary, to initially remove non-native vegetation followed by planting native oak and hickory trees (moderately stocked with an herbaceous understory) to provide continuous stands of oak-hickory forest for the benefit of migratory birds and foraging habitat for bats (see also 2.4.2 Proposed Habitat Management). This would include restoration of 50 acres of improved pasture lands on the Beck Unit back to native forest habitat by mowing existing Bermuda grass and fescue in the spring for three consecutive years, and replanting area with

moderately stocked native oak-hickory trees and grasses after successful eradication of non-native invasive species.

Surface and Groundwater Quality & Quantity

Land and Conservation Easements Acquisition from Willing Sellers

Same as Alternative A.

Groundwater Mapping

Same as Alternative A, plus work with Service Water Resources Division to create groundwater level contour maps to map water wells on or surrounding the Refuge.

Monitoring

The Refuge would continue management actions in Alternative A, plus the Refuge staff would work with USGS and local universities to implement a permanent water quality and quantity monitoring program, instead of the current opportunistic water sampling.

To implement a permanent water quality monitoring program, the Refuge would install small water quality measurement devices (semi-permeable water sampling devices and other automated water quantity and quality sampling devices), submerge them in cave and surface streams, leave them for one month, send monitoring results to a laboratory for analysis, record data, and schedule this procedure to re-occur every 5 years in wells, streams, such as Spavinaw Creek, and caves, including January-Stansberry, Duncan Field, Crystal, Boy Scout Cave, and any other new caves acquired, to measure contaminant levels and how they affect cavefish. In addition, the Refuge would implement the same permanent water quality program off-refuge at the Twin, McGee, Long's, Jailhouse caves and other appropriate cave discoveries.

The Refuge would also implement a long-term water quantity monitoring program, consisting of installing water quantity devices permanently, to record data constantly, reviewing results every two years to establish baseline data on water levels and identify trends in water levels in wells on or surrounding the Refuge, as well as January-Stansberry, Duncan Field, Crystal, Twin, other new caves acquired, and any other important caves within the landscape-level.

Partnerships

Same as Alternative A, plus pursue partnerships with commercial firms and businesses within the ecoregion.

White-nose Syndrome (WNS)

WNS National Plan

As in Alternative A, the Refuge would continue to implement actions from the WNS National Plan, as it is updated.

Monitoring

Same as Alternative A plus the Refuge would coordinate and partner with universities to implement a permanent monitoring program in forests and caves to determine which bat species are being affected by WNS. The Refuge would also partner with laboratories in Oklahoma and Arkansas, NSS, and with ES, to track movement and occurrence data of WNS for each bat species, search for bat mortality in caves, collect data on soil and cave substrate samples, and search for physical signs of WNS-affected bats. The Refuge would deposit data in a central WNS research warehouse. The Refuge would continue cave access monitoring and construction of cave gates to control access to caves and prevent the potential spread of the fungus, *Geomyces destructans*, by unauthorized people. The Refuge would coordinate more closely with Tribal Nations, State agencies, and caving organizations to search on- and off-Refuge caves for affected or deceased bats and to collect data on soil and air samples. In addition, the Refuge would continue conducting genetic sampling to identify which populations are genetically isolated, by comparing nuclear and mitochondrial DNA among bats from essential maternity caves.

The Refuge would also collaborate with multiple landscape-level partners to identify migration corridors of bat, bird or other wildlife species by utilizing various methods (i.e., conduct acoustic route monitoring, banding, tagging, and using radio transmitters, radar technology, and other technology) and use GIS to delineate high risk areas based on identification of migration corridors to help track movement of WNS on a landscape-level.

Public Outreach

Same as Alternative A.

Cave Access Control

Same as Alternative A, but the Refuge would increase law enforcement (LE) presence and monitoring of caves by Refuge staff and a LE Officer based out of Sequoyah NWR, who would dedicate part of his/her time to working for Ozark Plateau NWR to include routine visits once every month or variable by season based on bats' use of the caves.

Additionally, the Refuge would investigate the feasibility and necessity of installing motion- and light-activated alarms inside all essential maternity and hibernacula caves, and do so when and where deemed feasible. The alarms would notify Refuge staff and LE of any intruders and would record occurrences.

*Wind Energy Farms**Monitoring and Research*

The Refuge would continue actions in Alternative A, plus would conduct research projects with local universities, energy companies, USGS, and other partners to identify corridors and routes for bat migration by utilizing various methods (i.e., conduct acoustic route monitoring, banding,

tagging, and using radio transmitters, radar technology, and other technology). It would also use GIS to delineate high risk areas based on identification of migration corridors. It would also quantify impacts and investigate potential mitigation measures. The Refuge would work with ES to develop a resource map to demonstrate range of bat habitat, focusing on sensitive areas, migration routes, and population densities.

2.4.2 Proposed Habitat Management

Degradation of Cave, Stream, and Forest Habitat

Cave Protection

The Refuge would continue actions described in Alternative A, but the LE officer based at Sequoyah NWR would increase LE presence and monitoring of caves with routine visits once every month or variable by season based on bats' use of the cave. Additionally, the LE officer would monitor to prevent illegal timber harvesting on all Refuge units. Similar to those actions described for WNS, the Refuge would install and develop alarm systems and/or infrared video cameras at essential maternity and hibernacula caves (approximately 14 caves), on- and off-Refuge to deter and detect cave vandalism.

In addition, the Refuge would increase cave protection efforts by searching for new caves to protect. This would be accomplished first by partnering with local cavers, NSS, universities, Tribal Nations, USGS, Service I&M, and other organizations or agencies to map full subterranean extent of known caves to identify all surface cave entrances (which may lead to other unidentified caves), and then "ridge walking" areas that are conducive to cave formation on- and off-Refuge to identify unknown cave sites. This includes walking along faults, contacts, depressions, springs, sinking streams and/or other appropriate geological areas which may lead to potential cave locations. Utilizing technology such as satellite and aerial imagery (to look for features indicative of having a cave opening), thermal imagery (to locate potential hot or cold zones), radio telemetry (track bats to unknown roost sites), and others would also help the Refuge to locate and protect important cave habitats.

Fire Management

See *Fire Management* category below.

Boundaries

Same as Alternative A.

Partnerships

The Refuge would increase participation with Partners for Fish and Wildlife Program to assist adjoining and nearby landowners with wildlife and cave and forest management on private lands with more on-the-ground time discussions with landowners and educating them on the importance of caves and surrounding resources. The Refuge would also work with ODWC and

ES to increase Section 6 of Endangered Species Act funding for cave gating projects, controlled burns, fencing, wetlands restorations, invasive species removal and planting of native species on tribal, state-owned, and private lands. The Refuge would also increase partnerships by going to meetings, working on joint projects, and contracting through cost-share or joint funding to assist them with their projects.

Lack of Detailed, Scientific Cave Habitat Data

Research and Monitoring

The Refuge would continue actions described in Alternative A, plus it would work with universities and other partners to develop a habitat suitability index model for cave species which would determine optimum cave habitat requirements for species such as Ozark big-eared bats, gray bats, Ozark cavefish, Oklahoma cave crayfish, Delaware County cave crayfish and other federally listed species and species of concern as needed. The Refuge would employ the best adaptive management practices according to the requirements discerned out of the model(s). In addition, the Refuge would research effects of prescribed fire/thinning on cave habitats and impacts to Ozark big-eared and gray bats. The Refuge would also implement a monitoring program for non-listed cave species to establish baseline information, including the use of acoustic equipment/monitors, surveys conducted by Refuge staff and partners, and macro-invertebrate and other cave fauna sampling.

Also see 2.4.1 Proposed Landscape-level Management: *Climate Change: Monitoring*.

Invasive Flora

Monitoring

The Refuge would work with partners such as landowners, NGOs, universities, state agencies, Tribal Nations, and federal agencies to identify, document, and monitor all plant species (native and non-native) occurring on the all units of the Refuge. The Refuge would continue to reassess changes in vegetation throughout the lifetime of this CCP in order to identify which non-native flora species are causing the greatest (negative) impact to T&E species, species of concern, and/or representative species. If deemed necessary, the Refuge would develop an Integrated Pest Management Plan to further address the issue.

Fire Management

See *Fire Management* category below.

Herbicide Treatment

The Refuge would rather refrain from using chemicals in management activities, however, in the event that invasive non-native species become uncontrollable and hazardous to the health of the habitat's ecosystem, the Refuge would use herbicides to spot-treat invasive flora species including: Japanese honeysuckle; sericea lespedeza; Chinese privet; shrubby lespedeza; tall

fescue; yellow sweetclover; puncturevine; stinkgrass; shepherd's-purse; watercress; fivestamen tamarisk; barnyardgrass; curly dock; field bindweed; Johnson grass; mimosa; tall fescue; Russian-olive; ground ivy; red clover; hairy vetch and others that become a threat to important native plant and/or fauna species. The Refuge would apply one to three applications per year of Garlon 3A, (made of LI-700, Methylated seed oil, MSO, Fighter-F 10, Ethanol, Triethylamine, and EDTA), on problematic areas of newly acquired lands or existing Refuge Units between the months of March through November. Applications to a cut stump would be done by hand or backpack using 50% solution and applications for ground spot treatment would only be 2% solution. The Refuge would employ best management practices during planning and application of all herbicide use including: application at wind speeds less than 10 mph (but not inversion conditions) - must follow label; calibrate application equipment; field scouting/monitoring before pesticide application; pesticide application buffers around sensitive areas; use lowest effective application rate; and vegetative buffers. The Refuge would not apply chemical herbicides in sensitive groundwater recharge areas or above karst topography that is conducive to filtrating into fragile cave habitat.

Mechanical Treatment

The Refuge would continue actions described in Alternative A, plus the Refuge would increase mechanical removal of problematic non-native invasives to include all Refuge Units on approximately 50 acres per year for the first 5 years, then decreasing each year as non-native invasives are controlled to approximately 10 acres per year in a continuous maintenance regimen.

Partnerships

The Refuge would continue actions described in Alternative A, plus would increase the number of agreements with surrounding private landowners for prescribed fire to include burning up to approximately 1/3 of the total Refuge adjoining lands (see *Fire Management* below).

Fire Management

Wildfire Management

The Refuge would continue actions described in Alternative A, plus the Refuge would address wildfire policy and management in a Refuge-wide FMP. Additionally, the Refuge would increase funding available to support the Wildland-Urban Interface Program.

Prescribed Fire

The Refuge would continue actions described in Alternative A for the Looney and Sally Bull Hollow Units, plus the Refuge would develop a FMP for all Refuge Units, including burn plans and a training program for Refuge staff, to increase the use of prescribed fire to 1/3 of the Refuge's total acreage per year including future acquired lands (approximately 1,300 acres in 2012), in 3 to 5 year rotations.

The Refuge would increase communication and build relationships with surrounding private landowners to increase the number of agreements for prescribed fire to include burning up to 1/3 of the total Refuge adjoining lands on a 3 to 5 year rotation. The Refuge would partner with private contractors, local fire departments, OSU, the Oklahoma State Forestry Division, tribal entities, NPS, Forest Service, etc. to assist in prescribed burns efforts.

Monitoring

The Refuge would research the effects of prescribed fire and midstory thinning on forest and cave habitats and how they impact T&E and representative species such as Ozark big-eared and gray bats. The Refuge would employ the best adaptive management practices according to results of these studies.

2.4.3 Proposed Wildlife Management

Threatened and Endangered (T&E) Species and Species of Concern

Monitoring and Research

The Refuge would continue actions described in Alternative A, plus the Refuge would establish permanent, stationary acoustic monitors, both inside and outside of caves, on all units determined necessary to record bat calls and identify which bat species use which caves and at what season/time(s) of the year.

The Refuge would establish a permanent acoustic survey program on designated routes, instead of the current temporary (2-year) program, in order to learn more about foraging ecology and roost sites outside of caves. This program would include utilizing radio tracking, a permanent mobile and stationary acoustic survey program, transects, insect surveys, guano dissection, vegetation surveys, and other methods on and around the Refuge to determine listed and non-listed foraging bat species presence and distribution, roost tree sites, foraging habitat preferences, habitat conditions that affect foraging ecology, and monitor these trends overtime. The Refuge would also work closely with Service I&M to create a database documenting these results and would use data to guide adaptive management to best maintain and/or restore forest habitat and other bat foraging habitats.

As mentioned in 2.4.2 Proposed Habitat Management: *Lack of Detailed Scientific Cave Habitat Data*, the Refuge would work with partners to develop a habitat suitability index model to determine optimum forest and cave habitat requirements for Ozark big-eared bats, gray bats, Ozark cavefish, Oklahoma cave crayfish, Delaware County cave crayfish and other federally listed species and species of concern as needed, and employ the best adaptive management practices to meet these requirements.

The Refuge would continue partnering with OSU and other scientific organizations to perform genetic research on- and off- Refuge of bat, crayfish, cavefish, and other cave species in order to

identify undetermined cave species, determine population dynamics, identify genetic diversity, etc., by comparing nuclear and mitochondrial DNA samples.

The Refuge would install permanent cameras in the January-Stansberry Cave and/or other appropriate caves to monitor bat activity to provide additional scientific information (i.e., seasonal use of the caves by the bats, observe bat behavior, etc.) and monitor human disturbance. In addition, these cameras could provide online web-streaming during the maternity season for interpretation purposes twenty-four hours per day.

Fire Management

See *Fire Management* above in 2.4.2 Proposed Habitat Management.

Migratory and Resident Bird Species

The Refuge would continue actions described in Alternative A, plus the Refuge would work with landowners, bird conservation organizations, state agencies, Tribal Nations, and federal agencies to identify migratory bird species occurring near or on the Refuge during the spring and fall (compile a species list). The Refuge would also conduct seasonal nesting studies and MAPS banding of birds once a month for six months each year on the Refuge in cooperation with partners, such as the Audubon Society and universities, to gather additional data on migration corridors, paths, origins and destinations, as well as population data trends. The Refuge would implement recommendations from the Partners in Flight Plan and coordinate with them on migratory bird conservation management including research such as identify the quantity, quality and spatial configuration of available habitat, link habitat condition and population response, and anticipate future habitat conditions, in order to set and achieve population objectives for priority landbirds of the Central Hardwood Bird Conservation Region.

Also, the Refuge would increase the use of prescribed fire, as described in 2.4.2 Proposed Habitat Management: *Fire Management*, from 400 acres per year to 1/3 of the Refuge's total acreage per year (approximately 1,300 acres total in 2012) to improve Refuge habitats to support bird species.

Also see 2.4.1 Landscape-level Management: *Ozark Habitat Loss & Fragmentation* and 2.4.2 Habitat Management: *Degradation of Cave, Stream and Forest Habitat*.

Resident Non-T&E Species

Monitoring

The Refuge would continue actions described in Alternative A, plus the Refuge would establish permanent, stationary acoustic monitors, both inside and outside of caves, on all units determined necessary to record bat calls and identify which bat species use which caves and at what time(s) of the year. The Refuge would also establish a permanent mobile acoustic survey program on

designated routes, instead of the current temporary, 2-year program, in order to learn more about foraging ecology and roost sites outside of caves. This program would include utilizing radio tracking, a permanent mobile and stationary acoustic survey program, transects, insect surveys, guano dissection, vegetation surveys, and other methods on and around the Refuge to determine listed and non-listed foraging bat species presence and distribution, roost tree sites, foraging habitat preferences, habitat conditions that affect foraging ecology, and monitor these trends overtime. The Refuge would also work closely with Service I&M to create a database documenting these results and would use data to guide adaptive management to best maintain and/or restore forest habitat and other bat foraging habitats.

The Refuge would perform annual monitoring count surveys of all non-T&E cavefish and mark recapture of cave crayfish to understand population trends.

In addition, the Refuge would work with cooperative landowners, NGOs, universities, state agencies, Tribal Nations, USGS, Service I&M and other federal agencies to continue monitoring and conducting surveys of invertebrates, herpetofauna, fish, birds, and mammals to identify and document all wildlife species occurring on all units of the Refuge, potential acquisition areas, and with cooperating adjacent and nearby landowners (compile a species list). The Refuge would continue partnering with OSU, other universities, and other scientific organizations to perform genetic research on- and off- Refuge of bat, crayfish, cavefish, and other cave species to identify undetermined cave species, determine population dynamics, identify genetic diversity and isolation, etc.

Bioinventories

The Refuge would continue actions described in Alternative A, plus the Refuge would establish a scheduled monitoring program in which specific caves (approximately 5 caves per year) would be inventoried on a five-year rotation by the Refuge to monitor cave resources.

Invasive Fauna Species and Pest Management

Monitoring

The Refuge would work with partners such as landowners, NGOs, universities, state agencies, Tribal Nations, and federal agencies to identify, document, and monitor all species (native and non-native) occurring on the all units of the Refuge. The Refuge would perform studies in cooperation with partners to identify which non-native wildlife species are causing the greatest (negative) impact to native flora, wildlife T&E species, species of concern, and/or representative species. If deemed necessary, the Refuge would develop an Integrated Pest Management Plan (step-down plan) to further address specific management for invasive species (flora and fauna).

Feral Hogs

The Refuge would conduct a feral hog population study and, if deemed necessary, Refuge staff would consider partnering with adjoining landowners to sterilize and/or shoot and/or trap feral hogs found on and around the Refuge in an Integrated Pest Management Plan.

Feral Cats

The Refuge would conduct a feral cat population survey and, if deemed necessary, Refuge staff would consider partnering with adjoining landowners to sterilize and/or shoot and/or trap feral cats found on and around the Refuge in an Integrated Pest Management Plan.

Hothouse Millipede

The Refuge would conduct research with partners to determine Hothouse millipede population occurrence, impacts on cave resources, and if necessary, potential eradication strategies in an Integrated Pest Management Plan.

2.4.4 Proposed Public Use Management*Hunting*

In this alternative, the Refuge would develop a Hunt Plan, in accordance with 605 FW 2.9, to allow walk-in only, open access hunting according to State regulations, on the Sally Bull Hollow Unit of the Refuge, adjacent to the State wildlife management area (WMA), called Ozark Plateau WMA, managed by ODWC. Hunting regulations would be coordinated with ODWC and would ideally be identical to those of Ozark Plateau WMA. The Refuge would inventory and monitor federally listed endangered cave species on the Sally Bull Hollow Unit to identify whether this public use causes any adverse effects, and would coordinate with the ODWC to modify hunting regulations, if necessary. The Refuge would also evaluate the feasibility of allowing hunting on other areas of the Refuge as lands are acquired (such as in the case of acquiring migratory waterfowl habitat, etc.).

Environmental Education (EE)

The Refuge would continue to conduct EE programs on the Looney Unit, by permit only, in cooperation with multiple local partners, plus the Refuge would provide more EE opportunities and programs. It would increase EE visitation to 50-100 people per week, with 3-4 visits per week in spring, fall, and summer, and approx. 10-20 per week with 1-2 visits per week in winter. The Refuge would continue to seek funding, write grants, oversee contracting, and do all that is necessary to provide funding to its partnering NGOs in order to provide all current and future EE programming and staffing needs. If needed, the Refuge would also develop a Visitor Services Plan (step-down plan) to further develop facilitation and management of visitor services opportunities, including EE.

When staffing and funding are available, the Refuge would engage in the planning, development, leadership, and evaluation of EE programs in order to determine effectiveness of current programs and better design future EE programs regarding Ozark Plateau NWR resources. This would also include developing curriculum and workbook documents in conjunction with EE partners for current and future EE programs.

The Refuge would also expand its EE programs for after- and home-school student programs and create a Teacher Continuing Education and General Education Credits program. It would also collaborate with master gardeners and master naturalists to lead EE hands-on gardening programs on growing traditional foods and herbs (seeds provided by Cherokee Nation) in raised garden beds and landscape design using native plants (aesthetically-pleasing landscape, while also benefitting native wildlife such as birds and pollinators). MMLERC would be utilized as a quarterly training and meeting site for the local master gardeners.

In addition, Refuge staff would develop curricula and conduct training for Service and other partner agencies staffs on effective EE methods based on “coyote mentoring” techniques (Young, et. al., 2010) to effectively accomplish national goals associated with Connecting People with Nature (CPWN) and Youth in the Great Outdoors (YGO), using the Ozark resources as a vehicle and example. Coordinate curricula with Region 2 Regional Office Division of Visitor Services and NCTC. Training would be Refuge-based due to the proximity of four states, four Service regions, the Ozark ecoregion common to all four states/regions, and other unique landscapes and facilities.

The Refuge would improve the MMLERC cabin and Looney Unit access roads and trails associated with EE (see 2.4.6 Proposed Facilities & Infrastructure Management).

Interpretation

The Refuge would continue actions in Alternative A, plus the Refuge would create new interpretive programs to include permaculture gardening in collaboration with the Tribal Nations and master gardeners, and it would also showcase Refuge use of sustainable/green technologies. The Refuge would engage in the planning, development, leadership, and evaluation of interpretive programs in order to determine effectiveness of current programs and better design future programs regarding Ozark Plateau NWR resources, when funding and staffing are available. If needed, the Refuge would also develop a Visitor Services Plan (step-down plan) to further develop facilitation and management of visitor services opportunities, including interpretation.

In accordance with the contemporary WNS National Response Plans in effect at the time, the Refuge would resume limited interpretive programs within caves, by permit and/or under escort by Refuge staff. The Refuge would update its website(s) and create a flier/brochure advertising visitor services opportunities, including EE and interpretation programs at MMLERC/Looney

Unit, with contact information. Lastly, the Refuge would stream a live video of bat activity within caves on the web as an opportunity to engage in off-site interpretation.

The Refuge would improve the MMLERC cabin and Looney Unit access roads and trails associated with interpretation programs (see 2.4.6 Proposed Facilities & Infrastructure Management).

Wildlife Observation & Photography

The Refuge would continue actions in Alternative A, however, once Sally Bull Hollow Unit is surveyed and marked, the Refuge would also allow wildlife observation at Sally Bull Hollow Unit with walk-in access only at all times of the year aside from hunting season. Sally Bull Hollow Unit is adjacent to the State-managed Ozark Plateau WMA, which allows wildlife observation with walk-in access as well. The Refuge would also explore additional opportunities for wildlife observation and photography as lands are acquired. The Refuge would continue to prohibit wildlife observation and photography from within caves, in accordance with the current WNS National Plan.

The Refuge would install photography blinds and three primitive overlook areas in appropriate areas that would cause minimal to no disturbance to vegetation and/or wildlife adjacent to Looney Unit primitive trails and potentially on other acquired lands, if appropriate, as stopping points for wildlife observation and photography and/or for EE and interpretation programs. (Also see 2.4.6 Proposed Facilities & Infrastructure Management: *Nature Trails and Overlooks* and *Public Signs and Interpretive Displays*).

Wood Harvesting

Wood harvesting would only be permitted if Refuge forest and wildlife management needs dictate, such as after ice or wind storms, selective thinning by the Refuge, and for fuel reduction. In the event that the Refuge would need additional assistance in removal of downed-trees or fallen wood for wildlife and forest management needs, the Refuge would contact interested landowners, NGO partners, NRCS, ODWC, and other state and federal agencies, as well as Tribal Nations, to notify the public of wood harvesting opportunities. For interested individuals, a special use permit would be issued. The public would not be permitted to cut down any live or dead-standing trees, however, they would be permitted to cut and harvest using chain saws, axes, or other handtools, to remove downed-trees and haul away with trucks, trailers and 4WD vehicles on designated Refuge roads only. If necessary, the Refuge would contract for the removal and use of excess wood.

Public Outreach

The Refuge would create a flier/brochure to advertise visitor services opportunities and update Refuge websites (<http://www.Service.gov/southwest/refuges/oklahoma/Ozark/> and

<http://www.Service.gov/refuges/profiles/recEdMore.cfm?ID=21645>) to inform the public of current programs and recreational opportunities, including contact information (while cave locations continue to remain confidential). The Refuge would also work with dedicated volunteers to establish an official Friends group, which would increase public outreach efforts.

2.4.5 Proposed Cultural Resource Management

Historical Sites

The Refuge would continue actions in Alternative A, plus it would increase LE (from Sequoyah NWR) to provide better security to known sites.

Archeological and Paleontological Sites

The Refuge would continue actions in Alternative A, plus it would increase LE (from Sequoyah NWR) to provide better security to known sites.

2.4.6 Proposed Facilities & Infrastructure Management

Mary & Murray Looney Education & Resource Center (MMLERC)

The Refuge would remodel and renovate the MMLERC to make the building safe, more energy-efficient, conserve water, make ADA-accessible, more secure, as well as to ensure adequacy of plumbing and electrical systems. Actions under this alternative would include: Renovate the roof; Insulate the basement and attic; Renovate the cabin exterior (replace logs and grout, seal the exterior, paint exterior trim, and repair the retaining wall behind the cabin); Renovate flooring of porch and ensure porch railing meets safety standards; Renovate flooring of porch and ensure porch railing meets safety standards; Renovate front door to be ADA-accessible; Renovate one bathroom in the EE center to include an accessible entrance and shower; Install monitored alarm system in cabin; Replace plumbing system, if necessary; Replace electrical system, if necessary; Replace propane gas lines, if necessary; Install energy-efficient exterior storm windows; Maintain water filter for drinking water to reduce energy and waste associated with bottled water; Install rainwater collection system for irrigation purposes; Collaborate with master gardeners and master naturalists to build raised garden beds and to re-landscape with native plants around the MMLERC, using permaculture methods; Install solar panels on area with the most sunlight on the Looney Unit, to offset carbon and rely mostly on alternative energy sources; Use energy-efficient heating and cooling system and appliances (geothermal heating and cooling system, insulation, double pane windows, stove, refrigerator, dishwasher, on-demand hot water, washer and dryer) on all Refuge buildings; Maintain energy-efficient heating and cooling air duct systems and appliances; Install audio/visual technology (i.e. ceiling-mounted projector, etc.) for modern methods of teaching EE programs (i.e., power points, etc.); and remove small cabin building (but retain existing fireplace) adjacent to MMLERC and replace with a 800 sq. ft. outdoor pavilion studio space (partially open, partially covered), that would also bridge the stream in a previously-disturbed site.

Access Roads

The Refuge would continue to maintain current access roads and parking areas, plus it would work with Refuge personnel to improve its roads and parking areas including: Widen the MMLERC access drive by 2 feet and improve with gravel, including parking area; Improve road with gravel from county road to maintenance shop (next to Guess House) on the Looney Unit; Improve parking area surfaces with gravel at both the overflow parking, near maintenance shop, and parking on top of MMLERC road; Improve 0.3 miles of gravel road on the Beck Unit for Refuge management access; and improve and/or maintain roads on newly acquired lands, where necessary.

Nature Trails and Overlooks

The Refuge would establish a 0.25-mile mostly primitive trail to connect the MMLERC pavilion/Spavinaw Creek trail to the maintenance shop trail (move old concrete, some boulders). The Refuge would build a new 2-mile primitive trail (no clearing or removing of trees or large shrubs, however some boulders may need to be removed and some small creek-crossing bridges may need to be built) around the perimeter of the Mary & Murray Looney Unit to connect to the MMLERC-Pavilion-Spavinaw Creek trail, the maintenance shop trail, and the parking area trail. The Refuge would repave the 0.1-mile concrete path from the MMLERC cabin to the pavilion. The Refuge would improve the 0.25-mile trail with gravel from the Looney maintenance shop to the MMLERC. Also the Refuge would improve the 0.1 mile primitive trail with gravel from the parking/camping area on top of the hill down to the MMLERC to ensure safety. (See Figures A-2 and A-3).

The Refuge would install photography blinds and three primitive overlook areas in appropriate areas that would cause minimal to no disturbance to vegetation or wildlife adjacent to Looney Unit primitive trails and potentially on other acquired lands, if appropriate, as stopping points for wildlife observation and photography and/or for EE and interpretation programs.

Figure A-2. Current and proposed infrastructure and trails on Looney Unit.

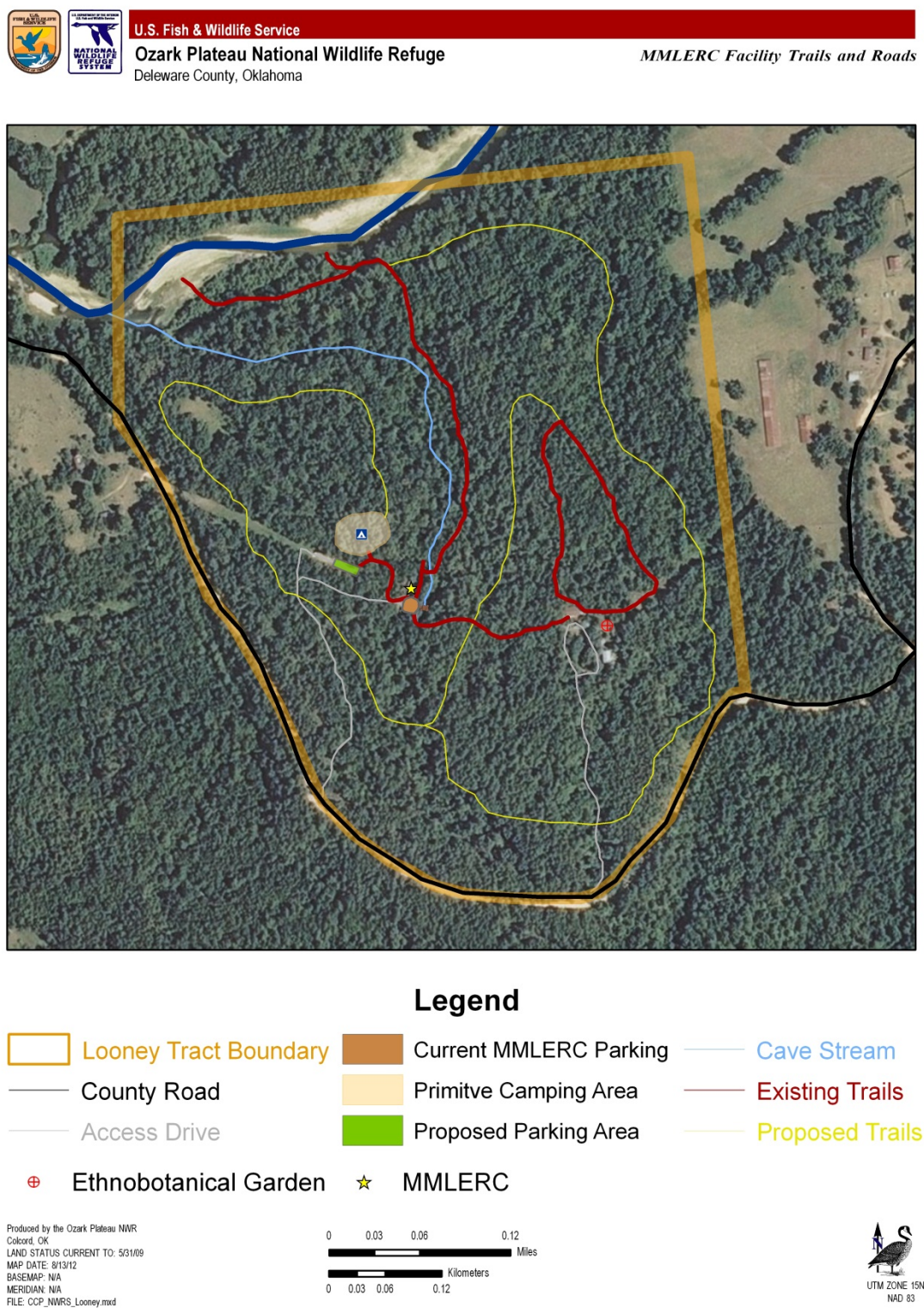
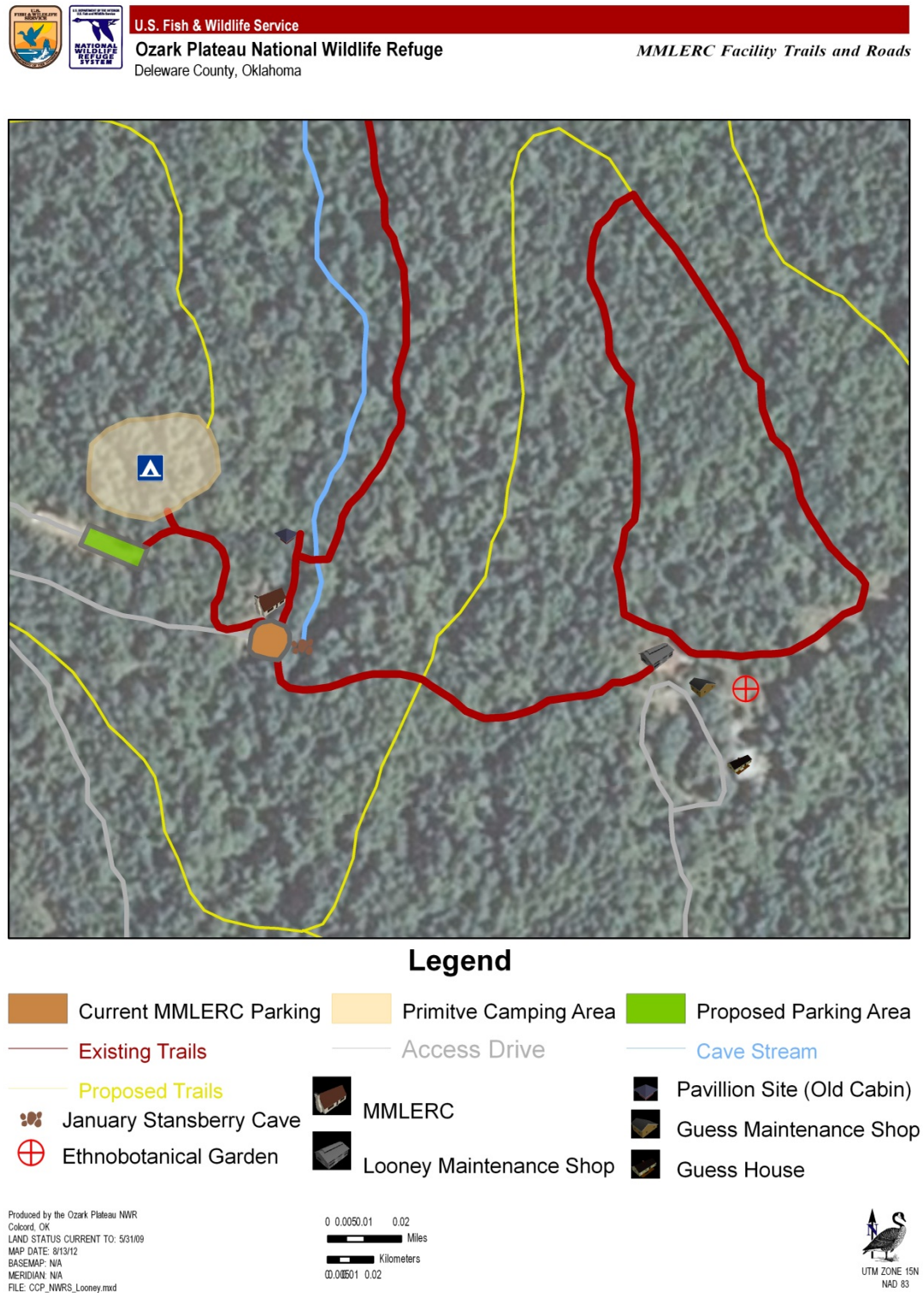


Figure A-3. Zoomed-in view of MMLERC and surrounding current and proposed infrastructure.



Public Use Signs and Interpretive Displays

The Refuge would construct and post a sign at the MMLERC to say “Mary & Murray Looney Education & Research Center”. The Refuge would construct a directional MMLERC sign at the county road entrance, only once MMLERC is sufficiently secure. The Refuge would establish a Refuge Headquarters sign, once the new Refuge Headquarters is built/established. The Refuge would continue to maintain resources confidentiality by not posting public use signs at all other Unit entrances and/or on public access roadways. The Refuge would install signs at all cave entrances to prohibit public entry and also to inform them about WNS. Lastly, the Refuge would install limited interpretive signage on the nature trail at the Looney Unit.

Refuge Headquarters/Visitor Center Site

The Refuge would acquire up to 15,000 acres of land and conservation easements from willing sellers within the approved acquisition boundary and utilize an acquired building(s), if appropriate, that could be retrofitted for a new, centralized, Headquarters site/Visitor Center. This building would be remodeled/retrofitted with adequate office and administrative space for anticipated staffing in a centralized location. This building would also be retrofitted to be as “green” as possible, using energy efficient upgrades and water conservation technologies.

In the case that the Refuge does not acquire any appropriate buildings for a Refuge Headquarters/Visitor Center site, the Refuge would build a new Headquarters/Visitor Center site on appropriate areas of newly acquired lands near the Looney Unit. In this event, the Refuge would design a sustainable Headquarters building (energy-efficient and using sustainable materials) and construct it only in previously disturbed habitat, not to exceed 5,000 square-feet to provide adequate office and administrative space for anticipated staffing within the lifetime of this CCP.

Boundaries

The Refuge would continue to contract surveyors to survey all unsurveyed unit boundaries on the Refuge (see Table A-2 in section 1.8.6). The Refuge would install permanent boundary markers (standard metal post and sign) on all unit boundaries that are marked. The Refuge would maintain and repair existing gates, fencing and markers. In addition, the Refuge would construct a new road gate on the access road at the Beck Unit for access to the Krause House and on the MMLERC access road.

Maintenance Shops and Service Buildings

The Refuge would continue maintaining maintenance facilities and supplies, as specified in Alternative A, plus it would build an additional maintenance shop (50'x100' metal building/concrete pad) at new Headquarters site. The Refuge would construct an additional decontamination and storage facility/structure at the new Headquarters location to decontaminate caving equipment in accordance with the Service's WNS decontamination guidance

(<http://www.Service.gov/WhiteNoseSyndrome/index.html>). The Refuge would construct a separate ventilated building located next to maintenance shop at new Headquarters site for hazardous materials storage. The Refuge would outfit these facilities with appropriate maintenance equipment, heat, insulation, electricity, appropriate plumbing, lighting, etc. The Refuge would construct a new fueling station for Refuge vehicles and equipment at new Headquarters location. Lastly, the Refuge would reconstruct existing pole barn on the Beck Unit, near the Krause House.

Refuge Housing

The Refuge would continue to maintain all Refuge housing as described in Alternative A, plus once the new Headquarters is established, it would convert existing Refuge office to a second guest room at the MMLERC for volunteers, researchers, interns, educators, and/or Refuge staff. The Refuge would also construct and/or purchase two new residences (one staff, one volunteer/student) adjacent to the new Headquarters building location. In addition, the Refuge would construct two RV pads for volunteers at the new Headquarters site, to include utilities as well as an additional RV pad for a volunteer on the Looney Unit, adjacent to the maintenance shop next to the Guess house, to include utilities. The Refuge would include facilities for volunteers (lounge, kitchen, showers, etc.) in the site plan for the new Headquarters facility. Once the residence agreement with Leslie Krause is terminated (via donation), the Refuge would renovate Krause residence to use for staff/volunteer/student housing.

2.4.7 Proposed Refuge Administration

Funding and Staffing

Same as Alternative A.

Volunteers/Friends Program

The Refuge would maintain partnerships and volunteers as described in Alternative A, plus the Refuge would coordinate with unofficial Friends group and/or dedicated volunteer members, current partners, and other members in the community to encourage the formation of an organized and official Friends Group. The Refuge would also perform outreach to local landowners, organizations, schools, universities, and Tribal Nations to increase part-time, non-resident volunteers to approximately 10,000 to 20,000 person hours per year. The Refuge would educate Friends and other volunteers on current issues and solutions regarding karst and cave management and other Refuge resources. The Refuge would also train Friends and other volunteers to perform their job/role in a safe, quality, and efficient manner to include citizen science, EE, interpretation, outreach, cave management and cave rescue and perform other actions as needed.

Coordinate Beyond Service Regional Boundaries to More Effectively Manage Federally Listed Cave Species on a Landscape Level

The Refuge would coordinate with the State of Arkansas and Service Region 4 to manage Logan Cave NWR as a unit of Ozark Plateau NWR or in cooperation with Ozark Plateau NWR. The Refuge would coordinate with the State of Missouri and Service Region 3 to manage Cavefish NWR and Pilot Knob NWR as units of Ozark Plateau NWR or in cooperation with Ozark Plateau NWR. The Refuge would coordinate with the State of Kansas and Service Region 6 for Ozark Plateau NWR to cooperatively manage federally listed Ozark cave species. In addition, the Refuge would establish new acquisition areas within the landscape-level of Oklahoma, Arkansas, Missouri, and Kansas and Service Regions, 2, 3, 4, and 6 to include a larger range of all federally listed Ozark cave species (such as the Ozark big-eared bat, etc.) as addressed by the recovery tasks presented in their recovery plans.

2.5 Comparison of Alternatives

Table A-5. Summary of Management Alternatives.

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|--|---|--|
| Landscape-level Management How will the Refuge contribute to addressing landscape-level conservation-related issues in the Ozarks? | | |
| Ozark Habitat Loss & Fragmentation | Acquire land from willing sellers or enter into agreements for conservation easements; maintain strong landscape-level partnerships; maintain 4,000 acres of forested habitat; restore 70 acres of agricultural land to forested habitat at Beck Unit; refrain from developing new roads or infrastructure. | Alternative (Alt) A + partner with the FWS southwestern, midwestern, southeastern and mountain-prairie regions to expand acquisition boundaries in the Ozark ecoregion; maintain, conserve, and restore up to 15,000 acres of acquired lands to native forest habitat. |
| Climate Change | Monitor baseline data on cave microclimate changes; use energy-efficient heating/cooling system and water filtration system on Looney facility. | Alt A + implement long-term Anabat monitoring stations to monitor climate change impacts to bat species; expand data loggers for climate info; install weather stations; install solar panels on Refuge facilities; sequester carbon by restoring up to 15,000 acres of acquired lands to native forest habitat. |
| Surface and Groundwater Quality & Quantity | Survey groundwater recharge areas; acquire land and conservation easements from willing sellers to restore forest and control run-off; partner with adjacent and nearby landowners; sample water quality. | Alt A + partner with U. S. Geological Services (USGS) and local universities to implement a permanent water quality and quantity monitoring program. |
| White-nose Syndrome (WNS) | Implement actions in WNS National Plan; close caves to the public; partner to monitor for WNS on and off Refuge; take preventative measures in decontamination of staff caving gear; public outreach; gain Law Enforcement (LE) support from Sequoyah NWR. | Alt A + coordinate/partner to implement permanent monitoring program to monitor species at risk, track movement and occurrence of WNS, and search for physical signs in Ozark ecoregion; develop a Refuge-specific WNS contingency plan; identify migration corridors; increase LE support; investigate feasibility of installing alarms inside caves. |
| Wind Energy Farms | Monitor baseline data of bird/bat populations affected by wind turbines and determine locations to minimize impacts. | Alt A + identify bat migration corridors; use GIS to delineate high-risk areas; quantify impacts; investigate mitigation measures. |

Appendix A: Environmental Assessment

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|--|---|--|
| <p style="text-align: center;">Habitat Management</p> <p style="text-align: center;">How will the Refuge manage habitats to ensure the protection of trust resources?</p> | | |
| Degradation of Cave, Stream, and Forest Habitat | Build and repair cave gates on- and off- Refuge; post signs prohibiting entry of caves; maintain confidentiality of cave locations; gain LE support "on call" from Sequoyah NWR; partner with landowners; survey and mark boundaries; implement fire management plans for Looney and Sally Bull Hollow Units. | Alt A + increase LE presence; install alarm systems and infrared cameras at caves; search for unknown caves with partners; outreach to landowners. |
| Lack of Detailed, Scientific Cave Habitat Data | Perform cave bio-inventories; survey bat hibernacula and maternity sites; survey cavefish and cave crayfish; map subterranean extent of caves. | Alt A + partner to develop habitat suitability indexes for cave species; research effects of prescribed burning/thinning on cave habitats and wildlife; implement acoustic monitor program for non-listed species; survey macroinvertebrates and other cave fauna. |
| Invasive Flora | Remove with handtools, chainsaws, and mow on 10 acres; partner for burns and invasive control; inventory vegetation with Oklahoma State University; (see <i>Fire Management</i> , below). | Alt A + work with partners to identify, document, and monitor all plant species occurring on the Refuge; assess changes in vegetation overtime; use mechanical treatments and if necessary, use herbicide spot-treatment a maximum of one to three applications per year, March – November (see <i>Fire Management</i> , below). |
| Fire Management | Coordinate response to all wildfires based on ecological, social, and legal consequences of fire; implement Fire Management Plans for Looney and Sally Bull Hollow Units, including prescribed burns of 400 acres/year every 3-5 years. | Alt A + develop a Refuge-wide Fire Management Plan to increase use of prescribed fire to 1/3 of Refuge's total acreage/year every 3-5 years; establish agreements with landowners to increase use of prescribed fire surrounding the Refuge; monitor effects of prescribed fire and midstory thinning on habitats and species. |

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|--|--|--|
| Wildlife Management How will the Refuge manage wildlife to ensure the protection of trust resources? | | |
| Threatened and Endangered (T&E) Species and Species of Concern | Continue annual bio-inventorying research of cave fauna; monitor surveys of bat populations, activity, guano measurements, and cavefish/crayfish counts; monitor emergence/foraging/migration of bat species using radio telemetry, infrared video, and thermal imaging; partner with universities for genetic research. | Alt A + establish permanent, stationary acoustic monitors in and around caves on all Units; establish permanent acoustic survey program on designated routes; develop a habitat suitability index model for T&E cave species; increase genetic research; install permanent cameras in caves; increase prescribed fires to all Units (see <i>Fire Management</i>). |
| Migratory and Resident Bird Species | Conduct bird counts during migration seasons; use prescribed fire on Looney and Sally Bull Hollow Units; enforce limited public use. | Alt A + identify all migratory bird species occurring on or near the Refuge (spring and fall); conduct seasonal nesting studies and MAPS banding of birds monthly for 6 months each year; increase prescribed fires to all Units (see <i>Fire Management</i>). |
| Resident Non-T&E Species | Conduct mobile acoustic monitoring once or twice a month from spring through fall from roadways and cave entrances; perform bio-inventories in 2-3 caves every 5 years. | Alt A + establish permanent, stationary acoustic monitors in and around caves on all Units; establish permanent acoustic survey program on designated routes; perform annual count surveys of non-listed cavefish and mark recapture of cave crayfish; survey all wildlife species occurring on Refuge; increase genetic research of cave species; install permanent cameras in caves; increase prescribed fires to all Units (see <i>Fire Management</i>). |
| Invasive Fauna Species and Pest Management | No management for invasive fauna species and/or pests. | Partner to identify, document, and monitor all species occurring on the Refuge; conduct a feral hog, feral cat, and hothouse millipede survey; research eradication strategies; if necessary, develop an Integrated Pest Management Plan. |
| Public Use Management How will the Refuge manage wildlife-dependent public use opportunities and public use access to ensure the protection of fish, wildlife, and their habitats? | | |
| Hunting | No hunting permitted. | Develop a Hunt Plan to allow walk-in only, open access hunting on the Sally Bull Hollow Unit, adjacent to the State-managed Ozark Plateau Wildlife Management Area. |

Appendix A: Environmental Assessment

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|---|---|--|
| Environmental Education (EE) | Partner to offer place-based EE programs on the Looney Unit and at the Mary & Murray Looney Education & Research Center (MMLERC), by permit only, limited to 10-20 people, 2-3 times per month in spring and fall, 1-2 times per month in summer and 1 per month in winter. | Alt A + increase visitation to 50-100 people per week, 3-4 times per week in spring, summer, and fall and 10-20 people per week, 1-2 times per week in winter; expand programs to include after- and home- school, teacher continuing education, gardening program, tribal-lead; train other FWS and partner agencies effective EE methods; if necessary, develop a Visitor Services Plan. |
| Interpretation | Partner to conduct interpretation programs on the Looney Unit and MMLERC, by permit only, for approximately 25 people per month on-site and to 5 to 100s of people per month off-site. | Alt A + offer interpretive programs to include permaculture gardening, showcase Refuge use of sustainable/green technologies; if necessary, develop a Visitor Services Plan. |
| Wildlife Observation & Photography | Provide opportunities by permit only on the Looney Unit, in conjunction with interpretive and/or EE programs. | Alt A + allow walk-in access of wildlife observation and photography on Sally Bull Hollow Unit, aside from hunting season; explore additional opportunities on acquired lands; prohibit use in caves; install photography blinds and 3 primitive overlook areas on Looney Unit trails and potentially newly acquired lands. |
| Wood Harvesting | Prohibit wood harvesting by the public. | Permit wood harvesting by the public of downed-trees as Refuge forest and wildlife management needs dictate. |
| Public Outreach | Maintain confidentiality to protect Refuge resources (no pamphlets/fliers available). | Create a flier/brochure to advertise Visitor Services opportunities and update Refuge websites to include contact info; work with volunteers to establish an official Friends group to assist with public outreach. |
| Cultural & Historical Resources Management How will the Refuge manage cultural and historical resources to ensure the preservation of ancient and recent history and culture? | | |
| Historical Sites | Keep sites confidential; partner with SHPO to preserve sites. | Alt A + increase LE from Sequoyah NWR to secure known sites; partner to preserve and perform studies on known sites and newly discovered sites. |
| Archeological and Paleontological Sites | Keep sites confidential; partner with SHPO, Sam Noble Museum archeologists and paleontologists to preserve sites. | Alt A + increase LE from Sequoyah NWR to secure known sites; partner to preserve and survey known sites and newly discovered sites. |

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|---|---|--|
| <p align="center">Facilities & Infrastructure Management</p> <p align="center">How will the Refuge provide infrastructure and related developments while ensuring the protection of trust resources?</p> | | |
| Mary & Murray Looney Education & Research Center (MMLERC) | Operate and maintain MMLERC (1200 sq. ft.) facility; maintain ADA accessibility. | Alt A + renovate roof; insulate basement and attic; renovate cabin exterior; renovate porch; renovate front door to be ADA-accessible; renovate one bathroom to be ADA-accessible; install monitored alarm system; replace plumbing system; replace electrical system; replace propane gas lines; install energy-efficient windows; maintain water filter; install rainwater collection system; build raised garden beds and re-landscape with native plants; install solar panels; use energy-efficient heating and cooling system and appliances; install A/V technology; remove small cabin adjacent to MMLERC and replace with a 800 sq. ft. outdoor pavilion studio space and bridge. |
| Access Roads | Maintain a 0.25-mile, unpaved and unimproved access road to the MMLERC, with a gate; maintain an unpaved parking area for approximately 10 vehicles; excess parking near the maintenance shop. | Alt A + improve roads and parking areas including: widen MMLERC access drive/parking area by 2 feet and improve with gravel; improve road with gravel from county road to maintenance shop; improve parking area surfaces with gravel; improve 0.3 miles of gravel road on Beck Unit; improve and/or maintain roads on newly acquired lands, if necessary. |
| Nature Trails and Overlooks | Utilize and maintain trails around the Refuge including: deteriorating path from the MMLERC to the pavilion, small path from the parking area to the MMLERC, 1/4-mile trail from MMLERC to Spavinaw Creek, 1/8-mile trail from MMLERC to the old garden area at top of hill, 150-yards trail from Guess house to the MMLERC, and 1/4-mile trails near the Guess house; no established overlook areas. | Alt A + Establish a 0.25-mile primitive trail to connect the MMLERC trail to maintenance shop trail; build a 2-mile primitive trail around the perimeter of the Looney Unit; repave the 0.1-mile concrete path from the MMLERC cabin to the pavilion; improve the 0.25-mile trail with gravel from the Looney maintenance shop to the MMLERC; improve the 0.1 mile primitive trail with gravel from the parking/camping area on top of the hill down to the MMLERC. |

Appendix A: Environmental Assessment

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|---|--|---|
| Public Use Signs and Interpretive Displays | No public use signs or interpretive signs posted on any Refuge units, except for outside of caves stating that they are closed to the public. | Construct and post a sign for the MMLERC and new HQ site; install directional MMLERC sign at the county road entrance; install signs at all cave entrances to prohibit public entry and also to inform them about White-nose Syndrome (WNS); install limited interpretive signage on Looney Unit. |
| Refuge Headquarters (HQ) Site | No centralized HQ site – each staff member works out of the Oklahoma ES Office in Tulsa, the MMLERC (Refuge), and/or Sequoyah NWR. | Acquire up to 15,000 acres of land and conservation easements from willing sellers within the approved acquisition boundary and utilize an acquired building(s), if appropriate, for new centralized HQ site; or build a new HQ site on centralized acquired site. |
| Boundaries | Maintain and repair 60 miles of Unit boundaries with a total of over 4 miles of fencing and 11 gates. | Alt A + Contract surveyors to survey and mark all un-surveyed/un-marked Unit boundaries on the Refuge; maintain new markers. |
| Maintenance Shops and Service Buildings | Utilize and maintain three maintenance shops: Beck Unit Shop: 50' x 30' metal building on concrete pad, Looney Unit: 50' x 30' metal building on concrete pad, and Guess House Shop. | Alt A + build an additional 50'x100' metal building on concrete pad maintenance shop at new HQ site; construct additional decontamination and storage facility at new HQ, with ventilation building; outfit facilities; construct a fueling station for Refuge vehicles and equipment at new HQ; reconstruct existing pole barn on the Beck Unit. |
| Refuge Housing | Provide Refuge housing for Refuge staff at the Guess House and one bedroom for staff, volunteers, guests, etc. at the MMLERC cabin (Looney Unit); maintain agreement with Leslie Krause. | Alt A + once HQ is established, convert existing Refuge office to a second guest room at the MMLERC; new HQ plan would include kitchen/bath facilities; construct two RV pads at the new HQ site; construct RV pad on the Looney Unit; when agreement with Leslie Krause is terminated (donation), renovate Krause residence for Refuge housing. |

| Issue | Alternative A: Current Management | Alternative B: Proposed Future Management |
|--|--|---|
| Administration Management How will the Refuge administer its management to ensure the protection of trust resources? | | |
| Funding and Staffing | Receive funding and staffing for operations, infrastructure and maintenance, determined by Congress and allocated to refuges by the Southwest Regional Office of the U.S. Fish & Wildlife Service; seek additional funding such as applying for grants and working with NGOs in order to leverage funds to implement management activities and educational programs. | Same as Alt A. |
| Volunteers/Friends Program | No official Friends group established (support from National Speleological Society local chapters); approximately 5,000 to 10,000 volunteer hours total per year. | Alt A + coordinate with unofficial Friends group and/or dedicated volunteer members to encourage formation of official Friends Group; perform outreach to increase part-time, non-resident volunteers to approximately 10,000 to 20,000 volunteer hours per year; educate and train volunteers. |
| Coordinate Beyond FWS Regional Boundaries to More Effectively Manage Federally Listed Cave Species on a Landscape Level | No management agreement in place to coordinate across FWS regional boundaries to manage cave habitat and species. | Coordinate with the state of Arkansas and FWS Region 4 to manage or co-manage Logan Cave NWR as a Unit of Ozark Plateau NWR; coordinate with the state of Missouri and FWS Region 3 to manage or co-manage Cavefish NWR and Pilot Knob NWR as Units of Ozark Plateau NWR; coordinate with the state of Kansas and FWS Region 6 for Ozark Plateau NWR to cooperate management of federally listed Ozark cave species; expand and establish new acquisition areas within the Ozark landscape across multiple state and regional boundaries. |

Chapter 3: Affected Environment of EA

Please reference Chapter 3 of the CCP for a description of Refuge resources.

Chapter 4: Environmental Consequences and Benefits of EA

This chapter describes the environmental consequences we predict from implementing the management alternatives presented in Chapter 3. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as “impacts” or “effects”. In the absence of detailed information, we make comparisons based on our professional judgment and experience. We specifically predict the effects of implementing the management actions and strategies for each of the alternatives.

Our discussion focuses on the impacts associated with the goals and issues identified in Chapter 1 – Purpose of and Need for Action. Direct, indirect, short-term, beneficial and adverse effects likely to occur over the 15-year life span of the CCP are discussed. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. At the end of this chapter, Table A-7 summarizes the effects predicted for each alternative and allows for a side-by-side comparison. This chapter identifies the irreversible and irretrievable commitment of resources from our proposed actions. The relationship between short-term uses of the environment and long-term productivity of proposed actions, their cumulative effects, and the relationship to environmental justice are also described.

As required by Council on Environmental Quality and Service regulations implementing the NEPA, we assessed the importance of the effects of the CCP alternatives based on their context and intensity. The context of the impacts ranges from local and site-specific to regional and broad-scale. For example, direct impacts to soils at a parking lot construction location would be highly localized or impacts on gray bat species would directly affect their populations in the Ozarks and indirectly affect their populations in the larger context of their limited range and distribution. Although Refuge lands comprise a small percentage of these larger ecosystem or regional contexts, each alternative was developed to contribute towards conservation goals in these large geographic landscapes.

We evaluated the intensity of impacts based on the anticipated degree of resource change from current conditions, the frequency and duration of the effect, the sensitivity of the resource to such an effect or the natural resiliency of the resource to recover from such an effect, and the potential for implementing effective preventative or mitigation measures to reduce the effect. Duration of effects vary from those that would occur only once for a brief period of time during the 15-year planning horizon, for example, the effects of construction to install solar panels, to those that

would occur every day during a given season of the year, such as the effects of a group of 20 people visiting the Looney Unit for an environmental education program.

There are certain types of actions identified in Chapter 3 that do not require additional NEPA analysis because they are “categorically excluded” (516 DM 2.3(A)) from further analysis or review. Categorical exclusions are classes of actions which do not individually or cumulatively have a significant effect on the human environment. These categorically excluded actions include, but are not limited to, the following actions, as listed in 516 DM 8.5A:

- Environmental education and interpretative programs (unless major construction is involved, or a significant increase in visitation is expected)
- Research, resource inventories, and other resource information collection activities
- Operations and maintenance of existing infrastructure and facilities, including renovation (unless major renovation is involved)
- Routine, recurring management activities and improvements
- Small construction projects (e.g. fences, cave gates, small stream projects, trail maintenance, development of access for routine management purposes)
- Minor vegetation plantings
- Reintroducing native plants and animals within their historic or established range
- Minor changes in amounts or types of public use
- Issuance of new or revised management plans when only minor changes are planned
- Law enforcement activities

However, these categorically excluded actions will be briefly mentioned in the effects analysis to justify why they are negligible for further discussion. All other actions (current and proposed) described in the two alternatives of this CCP’s EA will be analyzed in detail below.

Actions that are not categorically excluded and that will require additional NEPA analysis beyond this Final CCP/EA are:

- Use of prescribed fire on 1/3 of total Refuge lands (in a step-down, Refuge-wide FMP)
- Permit hunting on the Sally Bull Hollow Unit (in a step-down Hunt Plan)
- Construct or build a new Refuge Headquarters/Visitor Center facility that is outside of the parameters and mitigation measures described in effects analysis below

This chapter is organized by major resource heading. Under each heading we discuss the resource context and describe how the management actions may affect the environment either beneficially or adversely. An analysis of the effects of management actions on the physical environment has been conducted for air quality, water quality/quantity, and soils. Analysis of the effects of management actions on the biological environment was conducted for vegetation/habitat, cave wildlife, including species of special concern (e.g., threatened and endangered species) and other wildlife occurring on the Refuge. Although all plant, animal, and

fish species on the Refuge are important, many species are not expected to experience any adverse impacts – as a result of implementing the alternatives. For that reason, not all Refuge species are discussed in this chapter. An analysis of the effects of management actions on the socio-economic environment was also conducted for cultural resources, local populations and economy, public use opportunities, aesthetic/visual resources, public use opportunities and access.

4.1 Definition of Terms

Effects

- *Direct effects* are the impacts that would be caused by the alternative at the same time and place as the action.
- *Indirect effects* are impacts that occur later in time or distance from the triggering action.
- *Cumulative effects* (definition provided in section 4.6)

Impact Type

- *Adverse impacts* are those resulting from management actions that degrade the quality and/or quantity of identified refuge resources or recreational opportunities.
- *Beneficial impacts* are those resulting from management actions that maintain or enhance the quality and/or quality of identified refuge resources or recreational opportunities.

Duration of Impacts

- *Short-term impacts* affect identified refuge resources or recreational opportunities; they occur during implementation of the management action but last no longer.
- *Medium-term impacts* affect identified refuge resources or recreational opportunities that occur during implementation of the management action; they are expected to persist for some time into the future though not throughout the life of the CCP.
- *Long-term impacts* affect identified refuge resources or recreation opportunities; they occur during implementation of the management action and are expected to persist throughout the life of the CCP and possible longer.

Intensity of Impact

- *Negligible impacts* result from management actions that cannot be reasonably expected to affect identified refuge resources or recreational opportunities at the identified scale.
- *Minor impacts* result from a specified management action that can be reasonably expected to have detectable though limited effect on identified refuge resources or recreation opportunities at the identified scale.
- *Moderate impacts* result from a specified management action that can be reasonably expected to have apparent and detectable effects on identified refuge resources or recreation opportunities at the identified scale.

- *Major impacts* result from a specified management action that can be reasonably expected to have readily apparent and substantial effects on identified refuge resources and recreation opportunities at the identified scale.

Scale of Impact

- *Site-specific effects* are those impacts that occur solely within the project area.
- *Local effects* are those impacts that can be reasonably expected to have detectable effects within and immediately surrounding the project area.
- *Refuge-wide effects* are those impacts that can be reasonably expected to have noticeable effects across the entire Refuge landscape.

4.2 Analysis of Impacts to Resource(s)

4.2.1 Impacts to Physical Environment

4.2.1.1 Climate Change

Alternative A - Current Management (No Action Alternative):

Over the long term, such as the next 50 years, climate change is likely to have drastic effects on the Refuge's flora, fauna, and public use. Over the 15-year planning horizon of this CCP, these effects may be more subtle and incremental. Data provided by Climate Wizard (www.climatewizard.org, accessed June 2010) indicates that within the area of the Refuge the temperature is expected to warm by about 5 degrees F, while moisture is anticipated to decrease between now and 2050. Changes in climate in and around caves may affect their suitability for different bat species (Newson et al., 2009). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for bats (Newson et al., 2009). It has been observed on the Refuge that there are temporal variations on migration and birthing of Ozark big-eared bats and gray bats, however, more literature is needed to document this. Warmer and drier conditions may affect surface and groundwater availability, fire regimes, and shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area.

Adverse Impacts (Alternative A)

In this alternative, the Refuge contributes to climate change by emitting approximately 19.28 metric tons of CO₂ in the atmosphere per year from driving up to four government vehicles to individual offices and to access its nine land management units (see Table A-6 below). Since the Refuge Headquarters is currently at the MMLERC, which provides one office space, Refuge staff must drive from either Tulsa (approx. 80 miles) or Sequoyah NWR (approx. 100 miles) to frequently meet at the Looney Unit.

Table A-6. CO₂ Emissions from work-travel in FY2011.

| | Miles/gallon | Miles driven/year | Metric tons of CO ₂ |
|----------------------------------|--------------|-------------------|--------------------------------|
| 2008 Chevy Trailblazer | 17.6 | 7,300 | 5.18 |
| 2010 Ford Explorer | 17.6 | 9,700 | 4.83 |
| 2009 Chevy Silverado 2500 | 14.8 | 12,171 | 7.21 |
| 2005 Trailblazer | 23 | 5,400 | 2.06 |

Total CO₂ emissions/year = 19.28

Wildfires of approximately 500 acres per year on all Refuge units and on average 100 acres per year of prescribed fire on the Sally Bull Hollow Unit and Looney Units, would contribute to some CO₂ emissions in the atmosphere, therefore contributing to climate change in the short-term. However, there are long-term beneficial impacts to climate change regarding fire management (see below).

The Refuge would continue restoring up to 50 acres of non-native grasses from an old pasture on the Beck Unit to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Mowing and/or weed wacking of non-native grasses with handheld mechanical equipment may be done first to allow for an area feasible for planting native seeds. These mechanical devices may emit CO₂ in the atmosphere. However, this is a temporary action that lasts a few days out of the year and would not continue once some native hardwood trees become established.

Groups of 10-20 people come to the Refuge for EE programs approximately 2-3 times per month in the spring and fall, 1 or 2 times per month in summer and one per month in the winter driving primarily from Tulsa, Joplin, Fayetteville, and Tahlequah (45 – 80 mile range to Looney Unit), which also contributes (via CO₂ car emissions) to climate change. There are also a few participants that come from TN, TX, MO, KS, OK, MS and AR. However, the Refuge mitigates the amount of individual car emissions by encouraging groups to carpool and arranges for vans or buses to transport larger groups in from local schools and organizations.

Beneficial Impacts (Alternative A)

Monitoring cave species and other wildlife species on some Refuge units as well as baseline cave microclimates with temperature and humidity loggers in two Refuge caves would assist with understanding more about climate change and how it is affecting Refuge habitats and wildlife. The Refuge also works together with other federal, state, tribal and local governments, LCCs, and private landowner partners, to develop landscape-level strategies for understanding and responding to climate change impacts.

Fire management research indicates that fire can be used in hardwood stands to re-establish and release oak-hickory regeneration (<http://www.forestencyclopedia.net/p/p157>). Overall, the prescribed fires on the Sally Bull Hollow and Looney Units would contribute to an overall increase in carbon sequestration due to healthier, regenerating forests, reducing the amount of CO₂ in the atmosphere in the long-term despite the emissions created from the short duration of the burn(s) itself.

According to the U.S. Forest Service, large-diameter, long-lived, leafy hardwood species are twice as effective at sequestering carbon as conifers (Manley, 2009). In addition, the annual carbon sequestration of an old mature oak can be matched only by several newly planted oaks (Manley, 2009). Since the Refuge currently manages 3,977 acres (of 4,093 total Refuge acres) of mostly mature oak-hickory forest, the amount of carbon these forests sequester is very important for mitigating climate change.

EE and interpretation programs would help to increase several hundred people's appreciation of nature and understanding of the importance of their local resources. This may influence them to make better environmental decisions, which would help mitigate climate change.

In addition, the Refuge maintains energy-efficient appliances including a stove, refrigerator, dishwasher, hot water heater, and washer and dryer, and uses a water filtration system to tap into the local water resources to mitigate the need to purchase bottled water. In the U.S. alone 1.5 million barrels of oil are consumed in making bottles solely for bottled water (sierraclub.org). In addition, it also requires the use of fossil fuels in its transport and packaging producing tremendous waste (Arnold, 2006). Therefore, the Refuge is helping to mitigate climate change through utilization and maintenance of green infrastructure/appliances.

Alternative B-- Proposed Future Management (Proposed Action):

As described in Alternative A, climate change is likely to have drastic effects on the Refuge's flora, fauna, and public use over the next 50 years. Over the 15-year planning horizon of this CCP, these effects may be more subtle and incremental. Data provided by Climate Wizard (www.climatewizard.org, accessed June 2010) indicates that within the area of the Refuge the temperature is expected to warm by about 5 degrees F, while moisture is anticipated to decrease between now and 2050. Changes in climate in and around caves may affect their suitability for different bat species (Newson et al., 2009). Changes in temperature and rainfall patterns may affect both the timing and the availability of insect prey for bats (Newson et al., 2009). It has been observed on the Refuge that there are temporal variations on migration and birthing of Ozark big-eared bats and gray bats, however, more literature is needed to document this. Warmer and drier conditions may affect surface and groundwater availability, fire regimes, and shift hardwood forests north and produce more woodland savannah conditions within the Refuge acquisition area.

Adverse Impacts (Alternative B)

The effects of Alternative B are expected to be the same as Alternative A, however, until the Refuge establishes a centralized Headquarters/Visitor Center site and Refuge housing, the Refuge is expected to contribute more gas emissions due to an increase in staff and staff vehicles, although this figure is unknown since it would depend on where staff would live in proximity to the Refuge and where their office(s) would be located. The Refuge would mitigate this increase in gas emissions by carpooling whenever possible to perform management activities at the various units.

Wildfires of approximately 500 acres per year on all Refuge Units and an increase of prescribed burns to approximately 1/3 of the Refuge's lands (existing and as they are acquired) on 3-5 year rotations is expected to increase CO₂ emissions in the atmosphere, therefore contributing a short-term impact to climate change. However, there are long-term beneficial impacts to climate change regarding the outcome of this fire management tool (see below).

The Refuge would continue restoring habitats on newly acquired lands of non-native vegetation to native oak-hickory forest by planting moderately-stocked native hardwood species to offer benefits to wildlife, such as oaks. Mowing and/or weed whacking of non-native grasses with handheld mechanical equipment may be done first to allow for an area feasible for planting native seeds. These mechanical devices may emit CO₂ in the atmosphere. However, this is a temporary action and once native trees become established, they would offset the machinery's emission output in the long-term.

An increase in visitation for EE and interpretation programs (by 40-80 people per week in spring, summer, and fall and by 10-20 per week in the winter) driving primarily from Tulsa, Joplin, Fayetteville, Tahlequah (45– 80 mile range to Looney Unit), will also contribute to short-term impacts (via CO₂ car emissions) to climate change. There may be a few participants that come from TN, TX, MO, KS, OK, MS and AR. However, the Refuge would continue to mitigate the amount of individual car emissions by encouraging groups to carpool and arrange for vans or buses to transport larger groups in from local schools and organizations.

Beneficial Impacts (Alternative B)

In this Alternative, the Refuge plans to staff employees at a centralized (new) Headquarters site near the Looney Unit, as opposed to the current commute of 80-100 miles. In addition, the Refuge proposes to provide more Refuge housing for employees, volunteers, educators, etc., which would deter staff from having to commute from cities that are 45-80 miles away. In the long-term, this may actually reduce the amount of gas emissions that Refuge staff currently contributes in Alternative A.

In addition to working with landscape-level partners to address climate change, in this Alternative, the Refuge would implement a more permanent long-term monitoring program of habitat and wildlife to better understand the impacts of climate change. This program, comparing wildlife identification, location, and seasonality with climate information including air temperature, humidity, light, cave rock temperature, groundwater elevation, and cave stream temperature data, would contribute to greater scientific knowledge regarding how climate change is affecting Ozark habitats and wildlife and would also give management better insight as to how to adapt management according to these changes.

As described in Alternative A, fire management research indicates that fire can be used in hardwood stands to re-establish and release oak-hickory regeneration (<http://www.forestencyclopedia.net/p/p157>). Overall, the prescribed fires that the Refuge proposes in this Alternative would contribute to an overall increase in carbon sequestration due to restoration and promotion of up to 15,000 acres of healthy, regenerating forests, which scientists from the Association for Fire Ecology argue is the key to reducing net carbon emissions and preparing forests for the effects of climate change (Straub, 2012). In the long-term, prescribed burns to enhance old-growth oak-hickory forest would sequester more carbon in the atmosphere than it would produce from the prescribed burns.

According to the U.S. Forest Service, large-diameter, long-lived, leafy hardwood species are twice as effective at sequestering carbon as conifers (Manley, 2009). In addition, the annual carbon sequestration of an old mature oak can be matched only by several newly planted oaks (Manley, 2009). In Alternative B, the Refuge would attempt to acquire up to 15,000 acres of lands with cave and karst resources and made up of mostly mature oak-hickory forest. This would be a substantial additional amount of mature oak trees that would play an important role at sequestering carbon in terms of climate change.

In this Alternative, increasing EE and interpretation opportunities may also increase several hundred to thousands of people's appreciation of nature and understanding of the importance of their local resources. In addition, the Refuge proposes to discuss climate change as a talking point for both EE and interpretation programs. This may influence people to make better environmental decisions, which would help mitigate climate change.

Lastly, the Refuge would install solar panels on the MMLERC, Guess House, or near previously disturbed, infrastructure areas on the Looney Unit and potentially on any newly acquired or developed buildings, if amount of sun and location is appropriate, to offset carbon and rely mostly on alternative energy sources. The Refuge would also continue to install proper insulation and energy-efficient appliances such as a stove, refrigerator, dishwasher, hot water heater, and washer and dryer, in all Refuge buildings and at the new Headquarters site. It would also conserve and reuse water by installing a rain collection system to the outside of the building

for irrigation purposes. In addition, it would continue installing a water filtration system to tap into the local water resources at each Refuge building, including the new Refuge Headquarters site to mitigate the need to purchase bottled water. In the U.S. alone 1.5 million barrels of oil are consumed in making bottles solely for bottled water (sierraclub.org). In addition, it also requires the use of fossil fuels in its transport and packaging producing tremendous waste (Arnold, 2006). Therefore, the Refuge is helping to mitigate climate change through these simple green infrastructural upgrades and maintenance.

4.2.1.2 Impacts on Air Quality

Alternative A—Current Management (No Action Alternative):

Under Alternative A, Refuge activities affecting air quality would continue to include prescribed fire, construction and maintenance of roads, and emissions from vehicle exhaust. The Refuge would continue to coordinate with the Service's Denver Air Quality Branch to ensure appropriate and consistent air quality monitoring.

Adverse Impacts (Alternative A)

Prescribed fire would have minor adverse impacts that are short-term in duration at the local scale due to smoke from burning vegetation. Prescribed fires could produce smoke that could drift into residential communities and cause breathing and eye irritation and inconvenience during times of unpredicted inversions. There are also short-term adverse impacts on visibility, which is in conflict with the Class 1 Airshed designation.

Dust and emissions produced by equipment and vehicle operation associated with mowing non-native vegetation, maintenance, and construction would be minor. Performing work during times of low to no wind would abate blowing dust. Furthermore, most construction occurs as maintenance to already existing facilities or infrastructure that is small scale and localized.

Fugitive dust can cause impacts including visibility impairment, respiratory problems, or eye irritation. Construction and maintenance occurs Refuge-wide and could cause fugitive dust. Refuge dirt roads would continue to be maintained up to twice per year. Trail maintenance would occur on the Looney and Beck Units periodically. Under Alternative A, new facility construction is limited and would not create more than a negligible adverse impact on air quality. Fugitive dust would typically be negligible.

Cave gate construction creates short-term minor impacts that last 5-6 days total. Welding the frame is done from the outside on the surface using a long lead wire, creating some smoke. Cave gate construction activities may also create dust due to drilling and create temporary residential fumes from the rust-free primer paint.

Beneficial Impacts (Alternative A)

The Refuge currently manages 3,977 acres (of 4,093 total Refuge acres) of mature oak-hickory forest, which benefit air quality because the trees:

- Help to settle out, trap and hold particle pollutants (dust, ash, pollen and smoke) that can damage human lungs.
- Absorb CO₂ and other dangerous gasses and, in turn, replenish the atmosphere with oxygen.
- Produce enough oxygen on each acre for 18 people every day.
- Absorb enough CO₂ on each acre, over a year's time, to equal the amount you produce when you drive your car 26,000 miles. Trees remove gaseous pollutants by absorbing them through the pores in the leaf surface. Particulates are trapped and filtered by leaves, stems and twigs, and washed to the ground by rainfall.

(www.dnr.state.md.us)

Alternative B-- Proposed Future Management (Proposed Action):

Adverse Impacts (Alternative B)

Prescribed fire would have the same minor adverse impacts as described in Alternative A, that are short-term in duration at the local scale due to smoke from burning vegetation.

In addition, due to the short-term construction associated with renovations of an acquired buildings for a new Headquarters site or developing a new Headquarters site on previously disturbed acquired land, MMLERC renovations, MMLERC access drive improvements (add gravel and widen by 2 feet), parking area surface improvements with gravel, and 0.3 miles of gravel improvements on Beck Unit road as well as any necessary improvements to access roads on acquired lands, it would cause minor to moderate short-term impacts to air quality from dust and emissions produced by equipment and vehicle operation. These construction and maintenance activities would also cause minor incidents of fugitive dust. Fugitive dust could cause impacts including visibility impairment, respiratory problems, or eye irritation.

Dust and emissions produced by equipment and vehicle operation associated with mowing non-native vegetation, maintenance, and construction would be minor. Performing work during times of low to no wind would abate blowing dust. Furthermore, most construction occurs as maintenance to already existing facilities or infrastructure that is small scale and localized.

As described in Alternative A, cave gate construction would continue in this Alternative and creates short-term minor impacts that last 5-6 days total. Welding the frame is done from the outside on the surface using a long lead wire, creating some smoke. Cave gate construction activities may also create dust due to drilling and create temporary residential fumes from the rust-free primer paint.

Beneficial Impacts (Alternative B)

The Refuge proposes to acquire up to 15,000 acres of, at minimum, 80% mature oak-hickory forest which would benefit air quality because the trees would:

- Help to settle out, trap and hold particle pollutants (dust, ash, pollen and smoke) that can damage human lungs.
- Absorb CO₂ and other dangerous gasses and, in turn, replenish the atmosphere with oxygen.
- Produce enough oxygen for people and wildlife to breathe.
- Absorb enough CO₂ on each acre, over a year's time, to equal the amount one produces driving a standard car over 20,000 miles. Trees remove gaseous pollutants by absorbing them through the pores in the leaf surface. Particulates are trapped and filtered by leaves, stems and twigs, and washed to the ground by rainfall.

(www.dnr.state.md.us)

4.2.1.3 Impacts on Water Quality and QuantityAlternative A—Current Management (No Action Alternative):*Adverse Impacts (Alternative A)*

In Alternative A, the Refuge causes minimal adverse impacts to water quality and quantity.

All wildland fires, both prescribed fires (approximately 100 acres/year) and wildfires (approximately 500 acres/year), can adversely affect water quality by burning protective vegetative cover, thereby exposing soils to wind and water erosion. Especially on slopes, these soils can then be transported with runoff to waterbodies, including streams, marshes, ponds, and lakes, where they at first occur as suspended sediments, causing turbidity (muddy or cloudy water). High levels of turbidity are not only aesthetically unattractive, but may reduce the amount of light penetrating to lower depths, which inhibits the growth of submerged aquatic plants. In turn, this may affect aquatic organisms which are dependent on aquatic plants, such as fish and shellfish. High turbidity levels may also reduce the ability of fish gills to absorb dissolved oxygen. Later, when suspended sediments settle on the bottom of the waterbody in a process called sedimentation; these deposited sediments may cover and smother benthic (bottom-dwelling) organisms, both plants and animals. However, the Refuge's proposed short-term prescribed burns would have only minor impacts to water resources.

To a limited extent, use of trails may result in soil compaction, erosion, trampling of vegetation, and production of litter or human waste. Areas surrounding public use facilities can also contribute to the problems of erosion, suspended sediments, turbidity, and sedimentation. This may cause minor impacts to water quality. In addition, annual monitoring of cave fauna would cause turbidity in the water of wet caves, which may disrupt wildlife temporarily.

Maintenance to facilities or the use of roads and trails could cause soil disturbance, or materials from these sites (such as leaked equipment fluids) could get washed away during a storm event. However, the amount of work to facilities under this Alternative would be small and activity would be temporary making any associated adverse effects negligible to minor, short-term, and localized to widespread, depending on whether the runoff traveled to land or moving water.

During cave gate construction, the Refuge works within 50-100 feet within the cave recession, disrupting soil from human foot traffic, which temporarily causes turbidity. Finally, the Refuge paints the gates with a rust-proof primer, which may cause discharge of small quantities of liquids containing waxy distillate, soap, water, particles, and mineral oil into cave water, however, the small amount of this should have a minor to negligible impact to water quality.

Beneficial Impacts (Alternative A)

Direct and indirect impacts of Alternative A would primarily benefit water quality and quantity.

The Refuge has acquired a total of 4,093 acres of lands in which they manage to protect cave, karst, forest, groundwater, as well as surfacewater resources. Maintaining and restoring 3,977 of these acres of large stands of healthy forest provides natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter water bodies from surface run-off. In addition, the Refuge partners with adjacent and nearby landowners to implement conservation agreements to maintain or restore forest and aquatic habitats and encourage sustainable grazing methods, which overall benefit water quality and quantity.

In this Alternative, the Refuge surveys groundwater recharge areas in order to gain more information regarding point-source pollution and identify sensitive areas to protect. The Refuge also samples ground- and surface-water quality and shares information with local municipalities and water authorities regarding how water quality affects the Refuge.

Alternative B—Proposed Future Management (Proposed Action):

Adverse Impacts (Alternative B)

As well as in Alternative A, actions in Alternative B would cause minimal adverse impacts to water quality and quantity.

As described in Alternative A, all wildland fires, including the proposed amount of 1/3 of Refuge lands and adjacent lands with cooperating landowners of prescribed fires and wildfires (approximately 500 acres/year), can adversely affect water quality by burning protective vegetative cover, thereby exposing soils to wind and water erosion. Especially on slopes, these soils can then be transported with runoff to waterbodies, including streams, marshes, ponds, and lakes, where they at first occur as suspended sediments, causing turbidity (muddy or cloudy water). High levels of turbidity are not only aesthetically unattractive, but may reduce the

amount of light penetrating to lower depths, which inhibits the growth of submerged aquatic plants. In turn, this may affect aquatic organisms which are dependent on aquatic plants, such as fish and shellfish. High turbidity levels may also reduce the ability of fish gills to absorb dissolved oxygen. Later, when suspended sediments settle on the bottom of the waterbody in a process called sedimentation; these deposited sediments may cover and smother benthic (bottom-dwelling) organisms, both plants and animals. However, fire management within this proposed alternative would only have short-term, minor impacts to water resources. The benefits to fire management would outweigh these adverse effects (see *Beneficial Impacts* below).

To a limited extent, use of trails may result in soil compaction, erosion, trampling of vegetation, and production of litter or human waste. Areas surrounding public use facilities can also contribute to the problems of erosion, suspended sediments, turbidity, and sedimentation. This may cause minor impacts to water quality. In addition, annual monitoring of cave fauna would cause turbidity in the water of wet caves, which may disrupt wildlife temporarily.

Under this Alternative, the Refuge would re-construct a water crossing for single-file pedestrians to cross the stream by the MMLERC from the newly renovated outdoor pavilion studio space to the primitive trail on the other side. Construction itself would likely consist of a small crew working on either side of the stream (stream is less than 5 feet wide). Concrete anchor points (2x4') or wood posts would be placed on either side, however this should not disrupt aquatic habitat because it will be placed in a previously disturbed area.

Construction of new facilities such as a new Headquarters/Visitor Center site, three Refuge housing RV pads, additional maintenance shops and decontamination facilities, as well as maintenance to existing facilities or the use of roads and trails will cause minor to moderate soil disturbance, and materials from these sites (such as leaked equipment fluids) may get washed away during a storm event. However, construction would be short-term and localized to the site, making any associated adverse effects negligible to minor, short-term, and localized to widespread, depending on whether the runoff traveled to land or moving water.

As described in Alternative A, during cave gate construction, the Refuge works within 50-100 feet within the cave recession, disrupting soils due to human foot traffic, which temporarily causes turbidity in cave streams. Finally, the Refuge paints the gates with a rust-proof primer, which may cause discharge of small quantities of liquids containing waxy distillate, soap, water, particles, and mineral oil into cave water, however, the small amount of this should not have a minor impact to water quality.

Beneficial Impacts (Alternative B)

Direct and indirect impacts of Alternative A would primarily benefit water quality and quantity.

The Refuge would acquire up to 15,000 acres of lands in which they manage to protect cave, karst, forest, groundwater, as well as surfacewater resources. Maintaining and restoring 50-100% of total acquired lands as large stands of healthy forest will provide natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter water bodies from surface run-off. In addition, the Refuge would continue implementing Strategic Habitat Conservation regarding water protection by continuing its groundwater mapping efforts in order to identify sensitive areas that would be of high-priority potential land acquisition areas for the benefit of cave and aquatic species.

The Refuge would continue to partner with adjacent and nearby landowners to implement conservation agreements to maintain or restore forest and aquatic habitats and encourage sustainable grazing methods, which overall benefit water quality and quantity.

In this Alternative, the Refuge would increase monitoring of water quantity and quality by implementing a permanent water quality and quantity monitoring program, instead of the current opportunistic water sampling. This would ensure current and accurate information that could help the Refuge better understand and analyze water quantity and quality trends in relation to cavefish and cave crayfish population levels.

Under this Alternative, reconstruction of an old water-crossing that would cross the stream by the MMLERC from the newly renovated outdoor pavilion studio space to the primitive trail on the other side would mitigate disturbance to stream water and habitat in the long-term.

4.2.1.4 Impacts on Soils

Alternative A—Current Management (No Action Alternative):

Adverse Impacts (Alternative A)

The Refuge would continue to apply fire according to a naturally-occurring fire regime. The primary objective is to return fire at a historic fire frequency. Research has found that this historic fire return interval was at least every five years (Stambaugh et al. 2009). As noted above, both prescribed and wildland fires, affect soils in several ways. A number of factors influence just how prescribed fire affects soils, including fire intensity, ambient temperature, vegetation type, and soil moisture (Wells et al., 1979). Low-intensity prescribed fires have few, if any, adverse effects on soil properties; in some cases such fires may improve soil properties. Repeated burning over a long period may affect levels of available phosphorus, exchangeable calcium, and organic matter content of mineral soil. While fire volatilizes nitrogen, causing losses of this nutrient, these losses are often offset by increased activity of nitrogen-fixing soil microorganisms after fires. Calcium and phosphorus may be lost from the upper soil layer but tend to be partially retained in lower mineral soil horizons. Moderate-intensity prescribed burns have little, if any, adverse effect on soil erosion even on relatively steep slopes (Brender and Cooper, 1968; Cushwa et al., 1971; Goebel et al., 1967). Alternatively, prescribed burns

conducted when soils and fuel loads are too dry can cause severe damage to soils. The Refuge would mitigate this by burning during state season of burn, and by considering weather variables in planning burns and fire safety. High-intensity prescribed fires have a short-term negative impact on nutrient status from volatilization of nitrogen and sulfur, plus some cation loss from ash convection. Such effects tend to be short-term after moderate-intensity fires, but recovery is not as rapid after severe fires (Stanturf, no date). Virtually all prescribed fires on the Refuge would be moderate-intensity.

In addition, the Refuge would continue restoring up to 50 acres of non-native grasses from an old pasture on the Beck Unit to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Planting new hardwoods would be done by seedling primarily in the fall. A hole large enough to plant seed and bury it at least a few inches below the soil's surface (to keep out predation by birds, rodents, and insects) would be made (by hand or mechanically), disrupting soil layers within the planting area (Wittwer et al, OSU). Overall, re-establishment of these native species will improve the soil quality overtime, since it will mitigate the need for heavy equipment to continue mowing the area (as was done before the land was donated to the Refuge to maintain pasture), which would compact the soil, reducing the ability of soil to absorb and hold water and the ability of roots to penetrate through the soil (see more in *Beneficial Impacts*). However, this is a temporary action that lasts one to two weeks out of the year and may not continue once some native hardwood trees become established.

Maintenance activities would have localized, negligible to minor adverse impacts on soils by exposing them through removing vegetation, and by erosion. These effects would range from short-term. Short-term effects would occur during and immediately after maintenance activities. The amount of work to facilities under this Alternative would be small and activity would be temporary making any associated adverse effects negligible to minor, short-term, and localized to widespread depending on the potential for storms and erosion.

Service staff, expert cavers, and scientists that enter caves throughout the year (primarily winter during bat hibernaculum) perform cave fauna monitoring that may have short-term minor impacts to the soil within caves, including compaction, disturbance and may also cause turbidity in the water of wet caves, which may disrupt or scare wildlife temporarily.

EE and interpretation programs that include hiking around the Looney Unit on designated primitive trails and off-trail would result in some disturbance to soils. However, trail maintenance would occur periodically to reduce potential for erosion. In addition, a few of these programs include overnight camping in a designated primitive camping area (approximately one weekend per month). These impacts have little potential of leading to extensive soil erosion or degradation. Visitor access typically occurs by individuals or groups that participate in recreational activities for short durations. The Refuge would continue to allow public access by

appointment only on the Looney Unit and MMLERC, where the facility exists specifically to accommodate the use while reducing resource impacts. The use of trails may result in soil compaction, erosion, and minor trampling of vegetation. These impacts have little potential of leading to extensive soil erosion or degradation.

Cave gate construction creates short-term minor to moderate impacts to the soils that last 5-6 days total. Construction happens in phases, beginning with initial measuring. This mostly creates disturbance to soils by foot trampling at the mouth of the cave. Then, a gate frame is installed, which may include minor adjustments such as knocking out small pieces of rock with a sledgehammer in order to place steel frame. Cave gate construction activities may create dust or displace soil and/or rock in cave mouth area, which may pollute cave water sources temporarily.

Beneficial Impacts (Alternative A)

The Refuge has acquired 4,081 acres of lands in which it manages to protect cave, karst, forest, groundwater, as well as surfacewater resources. Maintaining and restoring 3,977 acres of native, large stands of healthy forest and their root systems in addition to multiple watershed areas without farming, grazing, or using chemical pesticides, increases soil health and quality, including its organic matter, water holding capacity, soil organisms, soil structure, infiltration capacity, and nutrients (NRCS; USDA Soils, 2012). In addition, the Refuge partners with adjacent and nearby landowners to implement conservation agreements to maintain or restore forest and aquatic habitats and encourage sustainable grazing methods, which overall benefit soil quality.

Restoring 50 acres on the Beck Unit of non-native pasturelands to native trees and native vegetation will increase the soil quality, once established. These native plants and wildflowers are adapted to local soil pH, nutrient levels, soil moisture and weather conditions so they do not require chemical inputs, irrigation, or other inputs that may deplete soil quality in order to thrive (NRCS; USDA Soil Health Fact Sheet 5, 2011). These plants evolved with native soil fungi, bacteria and invertebrates and help maintain a healthy soil ecosystem (NRCS; USDA Soil Health Fact Sheet 5, 2011). Furthermore, the Refuge would not need to apply excess water or nutrients, which may degrade local surface and subsurface water quality in order to maintain these native plant populations.

Alternative B--Proposed Action:

Adverse Impacts (Alternative B)

The Refuge would continue to apply fire according to a naturally-occurring fire regime of burning approximately 1/3 of Refuge lands, including newly acquired lands and on adjacent lands with cooperating landowners in a 3-5 year rotation. The primary objective is to return fire at a historic fire frequency. Research has found that this historic fire return interval was at least every five years (Stambaugh et al. 2009). As noted above, low-intensity prescribed fires have

few, if any, adverse effects on soil properties. Alternatively, prescribed burns conducted when soils and fuel loads are too dry can cause severe damage to soils. The Refuge would mitigate this by burning during state season of burn, and by considering weather variables in planning burns and fire safety. High-intensity prescribed fires have a short-term negative impact on nutrient status from volatilization of nitrogen and sulfur, plus some cation loss from ash convection. Such effects tend to be short-term after moderate-intensity fires, but recovery is not as rapid after severe fires (Stanturf, no date). Virtually all prescribed fires on the Refuge would be moderate-intensity. At Ozark Plateau NWR, the fire program is such that prescribed fires would be conducted at such a frequency as to avoid the accumulation of fuels that might result in hot fires and severe damage to soils.

As described above, the Refuge would continue restoring lands of non-native grasses from old pasture lands (50 acres on the Beck Unit) and any other acquired lands with these conditions to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Planting new hardwoods may involve using machinery such as a Bobcat Auger with 36" tapered tree bit to drill holes for planting. Drilling would disrupt soil layers and root systems and may damage soil organisms within the 20-40" holes. However, overall re-establishment of these native species will improve the soil quality overtime, since it will mitigate the need for heavy equipment to continue mowing the area (which would compact the soil, reducing the ability of soil to absorb and hold water and the ability of roots to penetrate through the soil) (see more in *Beneficial Impacts*). However, this is a temporary action that lasts one to two weeks out of the year until native hardwood forest has become established.

Construction of new facilities such as a new Headquarters/Visitor Center site, three Refuge housing RV pads, additional maintenance shops and decontamination facilities, as well as maintenance to existing facilities or the use of roads and trails will cause minor to moderate soil disturbance, or materials from these sites (such as leaked equipment fluids) could get washed away during a storm event. However, construction would be short-term and localized to the site, making any associated adverse effects negligible to minor, short-term, and localized to widespread, depending on whether the runoff traveled to land or moving water.

An increase in visitation for EE and interpretation programs (by 40-80 people per week in spring, summer, and fall and by 10-20 per week in the winter) using designated primitive trails and/or wandering off-trail would result in an increase to disturbance to soils. However, the Refuge proposes to construct additional primitive trails in order to mitigate soil disruption to areas where visitors would walk without an established trail. Building and/or improving 2.52 miles of trails would also disrupt top soil and foot traffic using these trails would create soil compaction, minor erosion and trampling of vegetation. The Refuge would perform trail maintenance every spring and fall to reduce the potential for erosion. In addition, a few of these programs include overnight camping in a designated primitive camping area (up to three weekends per month).

These impacts have a low potential of leading to extensive soil erosion or degradation. Visitor access typically occurs by individuals or groups that participate in recreational activities for short durations. The Refuge would continue to allow public access by appointment only on the Looney Unit and MMLERC/outdoor pavilion, where the facilities would exist specifically to accommodate the use while reducing resource impacts.

Beneficial Impacts (Alternative B)

In this Alternative, the Refuge proposes to acquire up to 15,000 acres of lands in which it would manage to protect cave, karst, forest, groundwater, as well as surfacewater resources.

Maintaining and restoring up to 15,000 acres of native, large stands of healthy forest (protection and prescribed burns) and their root systems in addition to multiple watersheds without farming, grazing, or using chemical pesticides to treat invasive species, will increase soil health and quality, including its organic matter, water holding capacity, soil organisms, soil structure, infiltration capacity, and nutrients (NRCS Soils, 2012). In addition, the Refuge would increase partnerships with adjacent and nearby landowners to implement conservation agreements to maintain or restore forest and aquatic habitats and encourage sustainable grazing methods, which overall benefit soil quality.

In addition, the Refuge would continue restoring up to 50 acres of non-native grasses from an old pasture on the Beck Unit to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Planting new hardwoods may involve using machinery such as a Bobcat Auger with 36" tapered tree bit to drill holes for planting. Drilling would disrupt soil layers and root systems and may damage soil organisms within the 20-40" holes. However, overall re-establishment of these native species will improve the soil quality overtime, since it will mitigate the need for heavy equipment to continue mowing the area (which would compact the soil, reducing the ability of soil to absorb and hold water and the ability of roots to penetrate through the soil) (see more in *Beneficial Impacts*). This is a temporary action that lasts one to two weeks out of the year until native hardwood forest has become established.

4.2.2 Impacts to Biological Environment

4.2.2.1 Impacts on Subterranean Cave Habitat

Alternative A—Current Management (No Action Alternative):

Adverse Impacts (Alternative A)

Current monitoring is done by Service staff, cave experts, and scientists, enter caves (where appropriate) throughout the Refuge and on adjacent and nearby neighboring lands (only by agreement with landowner) to perform annual bat hibernacula counts, cavefish and cave crayfish counts, and bio-inventorying of cave fauna. These visits contribute short-term minor impacts to cave habitats including additional noise in the caves, light pollution, soil compaction, soil disturbance and cause turbidity in the water of wet caves, which may disrupt or scare wildlife

temporarily. However, the Refuge only permits a necessary and minimal amount of experts to enter caves for essential cave monitoring and management activities. In addition, staff or partners that extract limited bat guano samples for scientific monitoring purposes may slightly reduce nutritional sources for all other cave-dwelling organisms; however, this amount is so small relative to the total amount of guano within the caves, that the overall impact is negligible.

Because caves are in remote locations, maintaining a LE presence and/or security is difficult. Therefore, illegal entry by the public may take place. In these incidents, cave species are disturbed and trash, graffiti, and vandalism may take place, which affects the quality of cave habitat for its respective species. The Refuge takes measures to avoid this by posting interpretive signs prohibiting entry, constructing cave gates to control access, and patrolling the areas as often as possible.

Cave gate construction creates short-term moderate impacts that last 5-6 days total. The Refuge schedules cave gate construction outside of maternity and hibernacula season when bats are not present or will be least impacted. Construction happens in phases, beginning with initial measuring. This mostly creates disturbance to soils by foot trampling at the mouth of the cave. Then a gate frame is installed, which may include minor adjustments such as knocking out small pieces of rock with a sledgehammer in order to place steel frame. This will re-adjust cave rock formation and create minor noise. Next, the Refuge and staff take large pieces of steel (to fit the length and/or width of the cave) and drill them with a large hand drill into cave wall, which directly impacts that particular section of cave rock and contributes to minor noise due to drilling. Welding the frame is done with the welder outside on the surface using a long lead wire, creating some smoke. The Refuge then attaches final steel bars. This semi-final phase creates moderate to severe noise from hammering, banging, and welding (humans need earplugs). Lastly, the Refuge paints the gates with a rust-proof primer, which may create fumes and cause discharge of small quantities of liquids containing waxy distillate, soap, water, particles, and mineral oil, however, the amount of this should not have a minor to negligible impact to water quality. Cave gate construction activities may create dust or displace soil in cave mouth area, which may pollute cave water sources temporarily.

According to a study for the 1999 *National Cave and Karst Management Symposium*, cave gates, if not designed properly, may restrict the natural airflow in and out of the caves (Roebuck et. al., 1999). There is less than 1% pressure loss for low velocity airflow for typical cave gate materials at solidity ratios of 60% or less (Roebuck et. al., 1999). Research on cave gates on Refuge caves and other nearby caves has shown that biological implications on endemic cave fauna are minimal (Martin et. al., 2006). The Refuge chooses its location carefully for installing cave gates so as to minimize impacts on air flow and continues to seek materials and designs that allow for natural air flow. In addition, the Refuge only designs and constructs “bat-friendly” gates with horizontal bars, enough distance apart, to allow for all bat species and even small

mammals to pass between bars with ease (White & Seginak, 1987). The majority of bat gates are built approximately 50-100 feet recessed into the caves so that bats are more tempted to utilize the cave. Again, the benefits to having cave gates to ensure protection for fragile cave habitats and wildlife outweigh these adverse impacts.

Beneficial Impacts (Alternative A)

Monitoring of groundwater quality in caves for traces of pesticides nitrates, phosphates, pharmaceuticals, and heavy metals helps the Refuge assess the quality of habitat for cave dwellers such as Oklahoma cave crayfish, and Delaware County cave crayfish. Groundwater mapping also allows the Refuge to identify any point-source pollution area that is affecting specific Refuge cave locations, which helps the Refuge prioritize communication with landowners as well as land acquisition areas with important recharge zones.

The Refuge prohibits public entry of the caves, so as not to disturb the fragile habitat and wildlife within and also to avoid the potential of humans to spread of WNS. The Refuge takes precautions before entering caves to make sure that all their caving equipment and gear is decontaminated prior to entry, as per the WNS National Plan guidelines (<http://www.Service.gov/WhiteNoseSyndrome/pdf/WNSnationalplanMay2011.pdf>). This ensures that staff and partners also avoid spreading WNS from cave to cave. In addition and as stated above, the Refuge builds, maintains, and repairs “bat-friendly” cave gates on- and off- Refuge which mitigate illegal entry and disturbance to the environment immensely. The Refuge also partners with landowners to identify cave entry violations. An LE officer is “on-call” from Sequoyah NWR. Furthermore, all EE and interpretation programs discuss the importance of cave ecosystems as well as the importance of preventing disturbance to cave habitats and wildlife. This may influence people to think twice about entering caves on and/or off the Refuge in order to protect endangered species.

Alternative B--Proposed Future Management (Proposed Action):

Adverse Impacts (Alternative B)

The Refuge would have the same adverse impacts as described in Alternative A. However, in this Alternative, installing climate data loggers and fixed, solar-powered acoustic monitoring stations (Anabat) at cave locations would have little to no adverse effects on cave habitats or Refuge wildlife.

Installing cameras and alarms inside maternity/hibernacula caves may have short-term adverse impacts such as drilling in cave rock for attachment of equipment, and would also create temporary noise from the drill and light pollution from headlamps. In addition, installation of permanent acoustic monitors (of approximately the size of a human hand) in and around caves would have minor aesthetic and spatial impacts to cave habitat. Installation of these devices

would occur only during the appropriate season that would cause the least amount of disturbance possible to wildlife, especially bat species.

Beneficial Impacts (Alternative B)

The Refuge proposes to acquire up to 15,000 acres of land and will implement Strategic Habitat Conservation efforts to locate and acquire additional caves, springs, aquifers, groundwater recharge areas, and forested foraging areas that host an array of biodiversity of cave and surface fauna, including cave T&E species or species of concern on a landscape-level.

In addition, the Refuge proposes to coordinate beyond its own acquisition and Service regional boundaries to more effectively manage and protect subterranean and surface habitats for federally listed cave species on the landscape-level, such coordinating management efforts with Logan Cave NWR (Region 4), Cavefish NWR and Pilot Knob NWR (Region 3), and Region 6.

Monitoring activities proposed in this alternative will provide many benefits by increasing knowledge for Refuge staff and the academic and scientific community such as identifying cave habitat suitability requirements for Ozark big-eared bats, gray bats, Ozark cavefish, and cave crayfish, and other T&E and/or species of concern.

The Refuge will continue to control public entry of the caves, so as not to disturb wildlife that use the cave and other cave resources and also to avoid the potential of humans to spread of WNS. The Refuge takes precautions before entering caves to make sure that all their caving equipment and gear is decontaminated prior to entry, as per the WNS National Plan guidelines (<http://www.Service.gov/WhiteNoseSyndrome/pdf/WNSnationalplanMay2011.pdf>). This ensures that staff and partners also avoid spreading WNS from cave to cave. In addition the Refuge would continue to build, repair, and maintain cave gates, where and when appropriate, increase law enforcement presence around caves to monitor cave entry (once every month or especially during high bat activity seasons), and install alarm systems and infrared cameras at maternity and hibernacula caves, which would help reduce and prevent illegal entry. An increase in EE and interpretation programs would also increase the amount of people learning and discussing the importance of cave ecosystems as well as the importance of preventing disturbance to cave habitats and wildlife. This may influence people to think twice about entering caves on and/or off the Refuge.

4.2.2.2 Impacts on Forest and Riparian Habitats

Alternative A—Current Management (No Action Alternative):

Under Alternative A, management activities for bottomland and upland hardwood forests would continue. Current management includes maintaining and protecting approximately 3,977 acres of forest on all Refuge Units and restoring 50 acres of native prairie on the Beck Unit back to historical forest conditions. Pre-settlement conditions are described as moderately stocked, open

woodlands and mature Oak-hickory forest, with an abundant understory of grasses, wildflowers, and herbaceous plants (Heikens, 1999).

Adverse Impacts (Alternative A)

The Refuge uses prescribed fire (approximately 300-500 acres every 3-5 years) on the Looney and Sally Bull Hollow Units and allows naturally-occurring wildfires to burn (as long as they do not pose a threat to infrastructure) to restore these forest areas to the desired conditions described above. Low-intensity prescribed fires have few adverse effects on Ozark forest habitat because it mainly plays a healthy role for the bottom- and up-land forest ecosystems. While the fires may cause short-term disturbance and/or changes to soil, water, and/or air quality (as described in those resource categories above), overall it has negligible adverse effects on the forest habitat, except that the prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be few grasses or understory forbs remaining and most of the brush will be scorched. Trees may be scorched and scarred thereafter. Some of the less fire resistant trees will show signs of wilting and may succumb. After one season of regrowth, most signs of prescribed burning will be difficult to detect without close examination, except tree scarring. The Refuge uses firebreaks including existing roads, trails and/or water bodies such as streams. Road and trail firebreaks would be maintained, when necessary, for use in containing wildland fires and future prescribed burns. Because of wet ground conditions or patchy fuels, there are often areas within the burn unit that are untouched by fire, resulting in a patchy, mosaic burn. Some visitors find recently burned areas of the forest to be aesthetically unpleasing. On the other hand, prescribed fire can actually enhance the appearance of the area even within a few days. For example, after a spring burn, the enriched soil will promote rapid growth of green sprouts, native grasses and forbs will begin within a few days to a couple of weeks (see more in *beneficial impacts* below). The threat to biodiversity from lack of fire in many forest types outweighs the potential advantages of fire suppression (Noss, 2001).

In addition, the Refuge would continue restoring up to 50 acres of non-native grasses from an old pasture on the Beck Unit to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Mowing and/or weed wacking of non-native grasses with handheld mechanical equipment may be done first to allow for an area feasible for planting native seeds. These mechanical devices cause temporary moderate to high levels of noise, create short-term dust and pollen spores, and may emit CO₂ in the atmosphere. However, this is a temporary action that lasts a few days out of the year and would not continue once some native hardwood trees become established. The noise would disturb wildlife within the habitat; however, it would not be a long-enough period to deter wildlife from living or utilizing the area. Planting new hardwoods would be done by seedling primarily in the fall. A hole large enough to plant the seed and bury it at least a few inches below the soil's surface (to keep out predation by birds, rodents, and insects) would be made (by hand or mechanically), disrupting soil layers

within the planting area (Wittwer et al, OSU). In addition, seedlings would need to be watered until they have been established to at least one- to two-feet high. However, re-establishment of these native species will improve the soil quality and should not affect water tables since their root systems should be adapted to the area's groundwater levels and to the natural amount of rainfall that northeast Oklahoma precipitates annually.

In addition, trail maintenance is performed on less than one-mile total of trails supporting limited public use (by appointment only) through bottomland hardwood forests, which result in minor, site-specific impacts since these trails are primarily "primitive", meaning there has been no major construction or removal of well-established or important native vegetation or boulders to create them.

The MMLERC and its adjoining dirt parking lot and primitive trails occupy land surface area of this forest. However, Refuge infrastructure represents a very small fraction of the total area of bottomland forest and the impacts to habitat quality are minor to negligible.

Beneficial Impacts (Alternative A)

Currently, approximately 97% of Refuge lands are upland and bottomland hardwood forest habitat, which is very important to conserve, protect, and manage within the Ozarks landscape since the habitat is disappearing due to extensive urban, suburban, industrial, and agricultural development. In addition, this forest is very important foraging habitat for the endangered Ozark big-eared bat (*Corynorhinus townsendii ingens*) and the associated streams and riparian habitat within it are also important foraging habitat for endangered species, gray bat (*Myotis grisescens*).

Historically, oak-hickory forests had an understory fire regime (Van Lear and Waldrop 1989). Native Americans burned these forests frequently to promote grasses and attract game, among other reasons. Oaks and hickories were favored by these frequent fire regimes, because they both have adaptations that make them resistant to fire, such as thick bark (<http://www.forestencyclopedia.net/p/p157>). U.S. Forest Service describes that after many years of fire exclusion, an ecosystem needs periodic fire or it becomes unhealthy. Trees become stressed by overcrowding; fire-dependent species disappear; and flammable fuels build up and become hazardous. The Refuge plans to carefully plan its prescribed burns to mimic these natural fire regimes of fires occurring every three to five years under the appropriate conditions to benefit its forest habitat by giving it sufficient recovery time for existing plant communities and time for new plants to establish. These burns only occur on a small portion of Refuge lands, however the benefit to the forest ecosystem is great including reducing hazardous fuels, preventing woody encroachment, protecting human communities from extreme fires; minimizing the spread of pest insects and disease; removing non-native invasive species that threaten species native to an ecosystem; opening up understory for ideal foraging habitat for Ozark big-eared bats; recycling nutrients back to the soil; and promoting the growth of native trees, wildflowers,

and other plants, which can also be aesthetically pleasing (<http://www.fs.fed.us/fire/management/rx.html>) (Bidwell et al, 2003).

Restoring approximately 70 acres on the Beck Unit of non-native pasturelands to native trees and native vegetation will increase the soil quality, and provide better habitat for native wildlife species, once established. These native plants and wildflowers are adapted to local soil pH, nutrient levels, soil moisture, and weather conditions. Therefore, once established, in order to maintain these native plant populations, the Refuge will not need to apply excess water or chemical nutrients, which would degrade local surface and subsurface water quality.

Alternative B—Proposed Future Management (Proposed Action Alternative):

The Refuge would continue to implement actions as stated in Alternative A, plus it would acquire at least 80% of forested-lands, or up to 10,907 acres, ideally, of mature oak-hickory and pine forest habitat. The Refuge proposes to protect, maintain and/or restore acquired habitats to pre-settlement conditions - described as moderately stocked, open woodlands and mature oak-hickory forest, with an abundant understory of grasses, wildflowers, and herbaceous plants (Heikens, 1999).

Adverse Impacts (Alternative B)

The Refuge proposes to increase the use of prescribed fire (approximately 1/3 of Refuge lands every 3-5 years) to all Refuge Units to restore these forest areas to the desired conditions described above. Low-intensity prescribed fires have few adverse effects on Ozark forest habitat because they mainly play a healthy role for the bottomland forest ecosystem. While prescribed fire may cause short-term disturbance and/or changes to soil, water, and/or air quality (as described in those resource categories above), overall it has negligible adverse effects on the forest habitat, except that the prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be few grasses or understory forbs remaining and most of the brush will be scorched. Trees may be scorched and scarred thereafter. Some of the less fire resistant trees will show signs of wilting and may succumb. After one season of regrowth, most signs of prescribed burning will be difficult to detect without close examination, except tree scarring. The Refuge uses firebreaks including existing roads, trails and/or water bodies such as streams. Road and trail firebreaks would be maintained, when necessary, for use in containing wildland fires and future prescribed burns. Because of wet ground conditions or patchy fuels, there are often areas within the burn unit that are untouched by fire, resulting in a patchy, mosaic burn. Some visitors find recently burned areas of the forest to be aesthetically unpleasing. On the other hand, prescribed fire can actually enhance the appearance of the area even within a few days. For example, after a spring burn, the enriched soil will promote rapid growth of green sprouts, native grasses and forbs will begin within a few days to a couple of weeks (see more in *beneficial impacts* below). The threat

to biodiversity from lack of fire in many forest types outweighs the potential advantages of fire suppression (Noss, 2001).

In the event that a portion of these acquired lands are old pasture-lands, farm fields, or other lands that require intense restoration from invasive plant species, the Refuge would first attempt using mechanical treatments, such as mowing (see Alternative A) and if necessary, would also apply spot-herbicide treatment, to initiate the restoration process. Herbicides can efficiently and effectively suppress or kill unwanted plants and the Service uses them in such a manner as to minimize adverse effects on non-target resources. An herbicide suppresses or kills plants by decreasing their growth, seed production, and competitiveness (USFWS, 2009b). The Refuge must weigh the benefits of herbicides in controlling invasive plants against the potential for exposure and impacts to human health, non-target organisms, and the environment. The federal and state governments regulate herbicides to ensure that they do not pose unreasonable risks. The EPA requires extensive test data from herbicide producers to show that their products are safe to use. EPA scientists and analysts carefully review these data to determine whether to register (license) an herbicide and whether certain restrictions on use are needed (USFWS, 2009b). EPA evaluates both exposure and toxicity to determine the risk associated with use of a given herbicide. Applications and subsequent movement may expose people, non-target flora and fauna, water, and soil directly or indirectly to herbicides; the Refuge can minimize or avoid this exposure by following proper instructions and labels. For wildlife and humans, herbicides may enter the body through the skin, by swallowing, and by breathing. Once the Refuge applies herbicides, the many biotic (living) and abiotic (non-living) processes that affect the fate of herbicides in the environment further influence the potential for exposure. Herbicide use on national wildlife refuges must comply with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and other federal laws and authorities. The use of herbicides and other pesticides on refuges is governed by the U.S. Department of Interior Integrated Pest Management Policy (517 DM 1), the Service Pest Management Policy and Responsibilities (30 AM 12), and the Service Refuge Manual (7 RM 14). Refuge staff must complete a Pesticide Use Proposal (PUP) whenever we use a pesticide or herbicide on a refuge, including applications by staff, volunteers, contractors, or in association with a right-of-way easement or Special Use Permit. Individuals with duties related to plant management and knowledge and experience with herbicides typically complete and submit the PUP. An online PUPS database enables staff to complete and submit PUPS electronically at <https://systems.Service.gov/PUPS/>. Depending on the pesticide and other conditions listed in the PUP, the PUP may need Regional Office review and approval, and under some circumstances, the Regional Office may need to submit the PUP for Washington Office (WO) review and approval. PUPS that are part of an approved integrated pest management plan may receive five-year approvals. The Director periodically issues specific guidance that includes details about PUP approval authority and which herbicides and application scenarios require review beyond the field station.

Refuge managers or the project leader ensures that:

- Pest management decisions are consistent with all applicable policies, laws, and regulations.
- Anyone applying pesticides, releasing biological control agents, and conducting other Integrated Pest Management (IPM) activities has the appropriate training and equipment necessary to protect their safety and health.
- We apply pesticides only after the appropriate reviewer approves the PUP.
- We establish threshold levels of damage or pest populations according to Service or field station goals and objectives and applicable laws.
- Staff store, handle, and dispose of pesticides and pesticide containers in accordance with the label and in a manner that safeguards human, fish, and wildlife health and prevents soil and water contamination.
- Submit annual reports documenting pesticide use and efficacy into the online PUPS database (USFWS, 2009b).

The Refuge would rather refrain from using chemicals in management activities because of the potential of contaminating groundwater aquifers used by the federally listed threatened Ozark cavefish, species of concern cave crayfish, other subterranean aquatic species, and forage species fed upon by federally listed endangered Ozark big-eared bats and gray bats. However, in the event that invasive non-native species become uncontrollable and threaten the health of the ecosystem, the Refuge would use limited herbicides to spot-treat invasive flora species including: Japanese honeysuckle; sericea lespedeza; Chinese privet; shrubby lespedeza; tall fescue; yellow sweetclover; puncturevine; stinkgrass; shepherd's-purse; watercress; fivestamen tamarisk; barnyardgrass; curly dock; field bindweed; Johnson grass; mimosa; tall fescue; Russian-olive; ground ivy; red clover; hairy vetch and others that become a threat to important native plant and/or fauna species within the habitat. Once the PUP is approved, the Refuge proposes to apply one to three applications per year of Garlon 3A (made of LI-700, Methylated seed oil, MSO, Fighter-F 10, Ethanol, Triethylamine, and EDTA), between the months of March through November. Applications to a cut stump would be done by hand or backpack using 50% solution and applications for ground spot treatment would only be 2% solution. The Refuge would employ best management practices during planning and application of all herbicide use including: application at wind speeds less than 10 mph (but not inversion conditions) - must follow label; calibrate application equipment; field scouting/monitoring before pesticide application; pesticide application buffers around sensitive areas; use lowest effective application rate; and vegetative buffers. The Refuge would not apply chemical herbicides in sensitive groundwater recharge areas or above karst topography that is conducive to filtrating into fragile cave habitat.

Trail-building of 2.25 miles of primitive trails and maintenance of less than one-mile of primitive trails would support limited public use (by appointment only) through Ozark forests, and would

result in minor, site-specific impacts. Since these trails are primarily “primitive”, there would be no major construction or removal of well-established native vegetation or large boulders in order to create and/or maintain them. This would be done primarily using hand tools and occasionally using mechanical tools.

Weather stations, each consisting of a 4 feet tall by 4 feet wide concrete pad with a five feet tall box to house instruments and gauges, would be installed as permanent structures at the Looney, Boy Scout, and Sally Bull Hollow Units as well as any appropriate acquired land areas. The Refuge would choose the location for this structure carefully, so that no important native vegetation or large rocks would need to be removed for the installation. In addition, these would be placed near Refuge access roads to avoid vehicle disturbance within any protected habitat area. In addition, weather stations would adversely affect the aesthetics of this habitat, since it will appear as man-made structure amidst predominately wild forest habitat. However, the Refuge will mitigate this by choosing locations carefully so as to somewhat “camouflage” the stations from human and/or wildlife visibility.

In this Alternative, Ozark Plateau NWR proposes hunting on the Sally Bull Hollow Unit, by walk-in access only, and to be limited to state seasons and regulations. Hunting activities on the Refuge will be 1) consistent with resource objectives of the Refuge and 2) supported by yearly State harvest estimates indicating that target species support a harvestable surplus. Allowing this public use on the Refuge will increase foot traffic (hunting would only be accessed by foot), which may cause minor long-term impacts to the habitat, such as trampling of vegetation.

Photography blinds and three primitive overlook areas on the Looney Unit trails and potentially newly acquired lands would be established, primarily within upland forest habitats. In order to protect the habitat, these would be placed carefully so as not to remove any native vegetation, trees, or large rocks. In addition, these would not require heavy construction equipment and would be constructed by hand in areas with great views or nature-viewing opportunities for visitors. The impacts would mostly be negligible to the forest habitat, however, it would increase groups stopping around it and may cause some additional trampling of vegetation or soil.

In this alternative, the Refuge proposes to allow wood harvesting by the public, only in the events that there are wind or ice storms or to reduce fuel accumulation in the forests. During these events, there would be an increase in public use of these areas, which may trample vegetation and temporarily compact soils. In addition, loud noise occurring from the use of chainsaws and other mechanical equipment may disturb wildlife.

Construction due to the building and/or restoring of a new Headquarters site and building of could disturb animals in the short-medium term that it persists. The Refuge would not construct

a new building on any site that would damage critical habitat for any native wildlife species; instead, Refuge staff would identify a building site that had been previously disturbed (i.e. old pasturelands, etc.). The construction of two RV pads, adjacent to existing or future acquired buildings on the other hand, may have minor impacts to habitat by removing vegetation and/or boulders.

Beneficial Impacts (Alternative B)

The Refuge proposes to acquire up to 15,000 acres of lands throughout the lifetime of this CCP. The Refuge ideally would acquire at least 80% of those as mature oak-hickory forest habitat (including cave habitats). Restoring habitat on and surrounding the Refuge to conditions that promote a more open, and regenerating, mature forest condition (e.g., basal area of 50-60 sq. ft.) is expected to provide an enhanced foraging environment and abundant food source for the endangered species, Ozark big-eared bat (*Corynorhinus townsendii ingens*), and protect important flight corridors for gray bats (*Myotis grisescens*). Another purpose of Ozark Plateau NWR is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that must nest some distance from an edge. The forest also plays an important role in preventing degradation of water quality in caves used by the Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish. Large stands of healthy forest also provide natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter water bodies from surface run-off.

As described in Alternative A, historically, oak-hickory forests had an understory fire regime (Van Lear and Waldrop 1989). Native Americans burned these forests frequently to promote grasses and attract game, among other reasons. Oaks and hickories were favored by these frequent fire regimes, because they both have adaptations that make them resistant to fire, such as thick bark (<http://www.forestencyclopedia.net/p/p157>). U.S. Forest Service describes that after many years of fire exclusion, an ecosystem needs periodic fire or it becomes unhealthy. Trees become stressed by overcrowding; fire-dependent species disappear; and flammable fuels build up and become hazardous. The Refuge would carefully plan its prescribed burns to mimic these natural fire regimes of fires occurring every three to five years under the appropriate conditions to benefit its forest habitat by giving it sufficient recovery time for existing plant communities and time for new plants to establish. Increasing the amount of prescribed burns to up to 1/3 of total Refuge lands, will greatly reduce hazardous fuels; prevent woody encroachment; protect human communities from extreme fires; minimize the spread of pest insects and disease; remove non-native invasive species that threaten species native to an ecosystem; open up understory for ideal foraging habitat for T&E species, Ozark big-eared bat; provide ideal nesting and breeding conditions for resident and migratory birds; recycle nutrients back to the soil; and promote the growth of native trees, wildflowers, and other plants, which can

also be aesthetically pleasing to the human eye (<http://www.fs.fed.us/fire/management/rx.html>) (Bidwell et al, 2003).

Aside from using fire as a management tool, wood harvesting would aid in a reduction of fuel loads, which is important in order to mitigate hot-burning wildfires (which could destroy old-growth trees). Wood harvesting of downed trees and excessive fuel loads would also assist the Refuge at attaining the forest conditions necessary for restoration such as moderately stocked mature oak-hickory-pine with an open understory in order to provide suitable habitat for its bat, resident, and migratory wildlife species.

Restoring future acquired lands from non-native invasive flora species to native trees and native vegetation will increase the soil quality, and provide better habitat for native wildlife species, once established. These native plants and wildflowers are adapted to local soil pH, nutrient levels, soil moisture, and weather conditions. Therefore, once established, in order to maintain these native plant populations, the Refuge will not need to apply excess water or chemical nutrients, which would degrade local surface and subsurface water quality.

4.2.2.3 Impacts on Wildlife: Cave Species (T&E, Species of Concern, and Non-T&E)

Alternative A—Current Management (No Action):

Adverse Impacts (Alternative A)

Using florescent dye-tracing methods to map groundwater recharge areas within the acquisition may affect the pH levels of the water quality, which may also influence a short-term impact to Ozark cavefish and cave crayfish and other aquatic cave organisms. However, a 2011 study by researchers, Rowinski and Chrzanowski, revealed that if used properly, Rhodamine B and Rhodamine WT (commonly used fluorescent dyes for hydrological research), are low enough concentrations that exert almost no toxic impact on small aquatic organisms.

Because caves are in remote locations, maintaining a LE presence and/or security is difficult. Because of this, illegal entry by the public may take place. In these incidents, cave species are disturbed and trash, graffiti, and vandalism may take place, which affects the quality of cave habitat for its respective species. The Refuge takes measures to avoid this by posting signs prohibiting entry, constructing cave gates to control access, and patrolling the areas as often as possible.

Monitoring efforts performed within caves may temporarily disturb cave wildlife. Refuge staff and other cave experts enter wet caves with decontaminated waders and gear, disrupting bottom-soil and water flow, while causing turbidity, which may pollute the quality of the water (affecting cavefish or cave crayfish's quality of breathing) or scare wildlife temporarily. In addition, cavers must go in using headlamps and light can bother cave wildlife, which is accustomed to complete darkness. However, monitoring activities in each cave only last a few

days out of the year and have minor to negligible long-term impacts on cave fauna. In addition, Refuge staff employs best management practices so as to least disturb the species, such as whispering in the caves while the bats are hibernating.

Beneficial Impacts (Alternative A)

Monitoring cave species and other wildlife species on some Refuge Units as well as baseline cave microclimates with temperature and humidity loggers in two Refuge caves would provide more understanding about climate change and how it is affecting Refuge habitats and wildlife. Other monitoring activities in this Alternative benefit the scientific community by providing baseline information to begin studying trends. This information can help guide management to meet cave fauna needs.

The Refuge controls public entry of the caves, so as not to disturb the fragile habitat and wildlife within and also to avoid the potential of humans to spread WNS. The Refuge takes precautions before entering caves to make sure that all their caving equipment and gear is decontaminated prior to entry, as per the WNS National Plan guidelines (<http://www.Service.gov/WhiteNoseSyndrome/pdf/WNSnationalplanMay2011.pdf>). This ensures that staff and partners also avoid spreading WNS from cave to cave. In addition and as stated above, the Refuge builds, maintains, and repairs “bat-friendly” cave gates on- and off- Refuge which mitigate illegal entry and disturbance to cave species immensely.

All EE and interpretation programs highlight the important role of bat species in supporting cave ecosystems. These discussions may influence people to appreciate rather than fear bats as well as understand the need to protect fragile cave habitat.

Alternative B—Proposed Future Management (Proposed Action):

Adverse Impacts (Alternative B)

Impacts to monitoring cave fauna would be the same as described in Alternative A.

The Refuge also proposes to use herbicide spot-treatment of Garlon 3A (described in detail in 4.2.2.2 Impacts on Forest and Riparian Habitats), only if necessary, on future acquired lands that may require intensive restoration of non-native invasive flora. Non-target species sensitive to herbicide application of Garlon 3A include: amphibians, crustaceans, fish, fish-eating birds, honeybees, mammals, native lepidopterans, native pollinating insects, passerines, reptiles, and waterfowl. If the Refuge deems that it is necessary to use minimal herbicide spot treatments on non-native invasive flora of future acquired lands for habitat restoration, the Refuge will take all precautions necessary such as follow label guidelines and implement best management practices to eliminate drift, exposure, or any harm to non-target species and T&E species.

When cave wildlife species are handled for genetic sampling (DNA samples), levels of stress hormones may increase, which can temporarily lead to a depression of immune functions. However, when possible, the Refuge will use “non-invasive sampling” as the primary method used to gather genetic material such as: hair, feces, saliva, feathers, urine, etc. so as to reduce or mitigate any disturbance to wildlife, especially T&E species (Waits & Paetkau, 2005).

Beneficial Impacts (Alternative B)

The Refuge proposes to acquire up to 15,000 acres of lands throughout the lifetime of this CCP, focusing acquisition priorities on providing and protecting cave habitat for T&E cave species and species of concern.

In addition, acquiring and protecting/restoring up to 15,000 acres of forested habitat (removal of non-native species, prescribed burns, planting native trees, and wood harvesting downed trees to reduce fuel loads) on and surrounding the Refuge to conditions that promote a more open, and regenerating, mature forest condition (*e.g.*, basal area of 50-60 sq. ft.) is expected to provide an enhanced foraging environment and abundant food source for the endangered species, Ozark big-eared bat (*Corynorhinus townsendii ingens*), and protect important flight corridors for gray bats (*Myotis grisescens*). The forest also plays an important role in preventing degradation of water quality in ground water aquifers used by the Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish.

In addition, the Refuge proposes to coordinate beyond its own acquisition and Service regional boundaries to more effectively manage and protect cave habitats for federally listed cave species on the landscape-level, such as coordinate management efforts with Logan Cave NWR (Region 4), Cavefish NWR and Pilot Knob NWR (Region 3), as well as coordinate management efforts with Region 6. This would promote stronger support for these species to assure continuing existence and recovery from being threatened, endangered, or a species of concern.

In this alternative, an increase in LE support by Refuge staff and a LE Officer based out of Sequoyah NWR to monitor cave entry once every month or by high bat activity seasons could prevent cave vandalism, which would ensure cave species protection from disturbance to their cave habitat and/or physical disturbance/harm.

Monitoring activities proposed in this alternative will provide many benefits by increasing knowledge for Refuge staff and the scientific community such as identifying cave habitat suitability requirements for Ozark big-eared bats, gray bats, Ozark cavefish, and cave crayfish, and other T&E and/or species of concern. Monitoring cave species and other wildlife species on and around Refuge Units as well as baseline cave microclimates with temperature and humidity loggers in two Refuge caves would assist with understanding more about climate change and how it is affecting Refuge habitats and wildlife. Identifying bat migration corridors will help to

identify high risk areas to mitigate wind energy farm projects and it will also give useful insight of how WNS is anticipated to spread. Genetic sampling of bat, crayfish, cavefish, and other cave species would help to identify which cave species populations are genetically isolated, identify undetermined cave species, and determine population dynamics by comparing nuclear and mitochondrial DNA, and which could also contribute to WNS research. Other monitoring activities in this Proposed Action Alternative benefit Refuge staff and the scientific community by addressing gaps in scientific information that could provide more insight for improvements in cave, karst, forest, and water resource management.

4.2.2.4 Impacts on Wildlife: Resident or Migratory Species

Alternative A--No Action Alternative:

Adverse Impacts (Alternative A)

The Refuge would continue restoring up to 50 acres of non-native grasses from an old pasture on the Beck Unit to native oak-hickory forest by planting native hardwood species to offer benefits to wildlife, such as oaks. Mowing and/or weed whacking of non-native grasses with handheld mechanical equipment may be done first to allow for an area feasible for planting native seeds. This is a temporary action that lasts a few days out of the year and would not continue once some native hardwood trees become established. During this short period, these mechanical devices cause moderate to high levels of noise, which may disturb and/or deter wildlife within 50 feet of use, such as deer, birds, and/or other small mammals temporarily, however, it is not anticipated to have any long-term adverse impacts.

Prescribed burns on the Looney and Sally Bull Hollow Units (approximately 400 acres every 3-5 years) would have minor adverse impacts to wildlife (see *Beneficial Impacts* below). During spring burns, some birds may lose their nests, but if the prescribed burn is early enough in the breeding season, the majority of these animals will re-nest. These prescribed burns could result in the mortality of some individuals, although this is unlikely. However, overall this will benefit the native species population levels by creating and maintaining highly productive native habitat.

Beneficial Impacts (Alternative A)

One of the purposes of Ozark Plateau NWR's establishment is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that require nesting some distance from an edge. The Refuge is currently managing 3,977 acres of this type of habitat and plans to continue acquiring more habitat critical for these birds.

The majority of the prescribed fires will take place in early spring prior to the hatching and birthing periods for most species (i.e. deer fawns, song bird broods, etc.) and in late fall when the young animals have matured enough to avoid the fire. Prior to European settlement and wildfire suppression, fires played a major role in shaping the historic landscapes of the region and the

Refuge's native plant and animal communities. Animals and plants associated with these fire dependent habitat types have evolved with fire and, through time, developed adaptations to endure fire's effects. The immediate impact of fire on animals is generally less severe, as both vertebrates and invertebrates have shown to be fairly successful at avoiding fire. Many small mammal species, amphibians, reptiles, and invertebrates will survive burns by retreating into underground burrows or by going under water until the burn passes through. Healthy large mammals and birds have the ability to escape. Also, prescribed fires tend to burn in a mosaic fashion leaving some areas unburned and providing refugia for wildlife species. Changes in the plant community following a fire have benefits on the animal communities that inhabit these ecosystems. The long-term survival of wildlife species depends on the health of the plant community, which is enhanced by intermittent prescribed burns in a fire-dependent ecosystem. Fire programs also create a diverse mosaic of habitat conditions that support a biodiversity of native wildlife species.

Monitoring cave species and other wildlife species and surrounding Refuge Units as well as baseline cave microclimates with temperature and humidity loggers in Refuge caves would assist with understanding more about climate change and how it is affecting Refuge habitats and wildlife.

Other monitoring activities in this Alternative benefit Refuge staff and the scientific community by providing baseline information to begin studying trends. This information can help guide management to meet resident and migratory species' needs.

The Refuge controls public entry of the caves, so as not to disturb the fragile habitat and wildlife within and also to avoid the potential of humans to spread of WNS. The Refuge takes precautions before entering caves to make sure that all their caving equipment and gear is decontaminated prior to entry, as per the WNS National Plan guidelines (<http://www.Service.gov/WhiteNoseSyndrome/pdf/WNSnationalplanMay2011.pdf>). This ensures that staff and partners also avoid spreading WNS from cave to cave. In addition and as stated above, the Refuge builds, maintains, and repairs "bat-friendly" cave gates on- and off- Refuge which mitigate illegal entry and disturbance to cave species immensely.

All EE and interpretation programs highlight the important role of bat species in supporting cave ecosystems. These discussions may influence people to appreciate rather than fear bats as well as understand the need to protect fragile cave ecosystems.

Alternative B--Proposed Action:

Adverse Impacts (Alternative B)

In the event that a portion of these acquired lands are old pasture-lands, farm fields, or other lands that require intense restoration from invasive plant species, the Refuge would first attempt

using mechanical treatments, such as mowing (see impacts in Alternative A) and if necessary, would also apply spot-herbicide treatment, to initiate the restoration process. In these cases, the Refuge proposes to use herbicide spot-treatment of Garlon 3A (described in detail in 4.2.2.2 Impacts on Forest and Riparian Habitats), once to three times per year March – November. Non-target species sensitive to herbicide application of Garlon 3A include: amphibians, crustaceans, fish, fish-eating birds, honeybees, mammals, native lepidopterans, native pollinating insects, passerines, reptiles, and waterfowl. If the Refuge deems that it is required to use herbicide spot treatments on non-native invasive flora of future acquired lands for habitat restoration, the Refuge will take all precautions necessary such as follow label guidelines and implement best management practices to eliminate drift, exposure, or any harm to non-target species and T&E species.

In this alternative, the Refuge proposes to allow wood harvesting by the public, only in the events that there are wind or ice storms or to reduce fuel accumulation in the forests. Loud noise occurring from the use of chainsaws and other mechanical equipment may disturb wildlife, such as birds and small mammals, but only temporarily.

In this Alternative, Ozark Plateau NWR proposes to develop a Hunt Plan to allow hunting on the Sally Bull Hollow Unit. Hunting activities on the Refuge will be 1) consistent with resource objectives of the Refuge and 2) supported by yearly state harvest estimates indicating that target species support a harvestable surplus. According to ODWC monitoring and regulations, there would be no negative impacts on game abundance and distribution if the Refuge implements a Hunt Plan, under Alternatives B. However, allowing this public use on the Refuge will increase human foot traffic (hunting would only be accessed by foot). In addition, gun shots may temporarily startle wildlife, such as birds for the short duration of the shot.

Increasing EE opportunities at the Looney Unit for approximately 50-100 people per week, with 3-4 visits per week in spring, fall, and summer, and approximately 10-20 people per week with 1-2 visits per week in winter will increase the number of humans within the boundary of the Looney Unit. A greater number of groups per week may disturb wildlife species even if only when passing through/by. However, most species within the area are accustomed to humans and will not be affected by their presence. Large groups of school children may cause medium to loud levels of noise that can disturb birds and mammals. The Refuge will encourage large groups of children to listen carefully to the sounds of the forest around them to mitigate the noise level.

Construction due to the building and/or restoring of a new Headquarters site, MMLERC renovations, installation of solar panels, construction of raised garden beds, construction of RV pads, and/or renovations to other Refuge housing could disturb animals in the short to medium term that the renovation persists. Most disturbance would be due to noise from drilling,

hammering, banging, and mechanical equipment involved. During construction, wildlife such as birds, may choose a location that is within a safe distance from the noise and work. However, these species would be expected to return once construction is complete. The Refuge would not construct a new building on any site that would damage critical habitat for any native wildlife species; Refuge staff would identify building sites that had been previously disturbed (i.e. old pasturelands, etc.).

Banding of bird species once a month for six months each year on the Refuge may temporarily stress the species being handled. In addition, it may disturb the bird's flight balance or perching accuracy for a very short-term, until the band is adapted to by the bird. The Refuge will make sure to employ best management practices when banding birds such as those recommended by USGS, including handle each bird carefully, gently, quietly, with respect, and in minimum time; capture and process only as many birds as you can safely handle; close traps or nets when predators are in the area; do not band in inclement weather; frequently assess the condition of traps and nets and repair them quickly; properly train and supervise students; check nets as frequently as conditions dictate; check traps as often as recommended for each trap type; properly close all traps and nets at the end of banding; do not leave traps or nets set and untended; and use the correct band size and banding pliers for each bird; treat any bird injuries humanely (<http://www.pwrc.usgs.gov/bbl/resources/ethics.cfm>).

In this Alternative, the Refuge proposes to conduct studies to identify, document, and monitor all non-native wildlife species occurring on the Refuge, such as feral hog, feral cat, and hothouse millipede. The Refuge will evaluate the impacts of these species on cave, stream, riparian, forest, bottomland, and upland forest communities and if necessary, investigate methods for control and/or eradication. Hunting, trapping, or sterilizing any invasive fauna species would have a negative impact on its own population, by reducing breeding potential. However, these actions would greatly benefit native habitat and give native resident or migratory species a better chance to compete.

Beneficial Impacts (Alternative B)

The Refuge would continue the policies of limited public use activities to minimize disturbance to resident and migratory birds and other wildlife on Refuge lands. This ensures that wildlife have an authentic "refuge"- a sanctuary from human noise, distraction, and disturbance.

One of the purposes of Ozark Plateau NWR's establishment is to protect large continuous stands of mature Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that require nesting some distance from an edge. The Refuge is proposing to acquire a minimum of 80% forest habitat of its remaining 10,907 acreage, which would provide critical habitat for these birds, especially in anticipation of increased development within the area.

Monitoring activities proposed in this alternative will provide many benefits by increasing knowledge of Refuge staff and the scientific community such as identifying migration corridors of bat, bird, and other wildlife species; conducting species surveys of invertebrates, herpatofauna, fish, birds, and mammals to identify and document all wildlife species occurring on all units of the Refuge, potential acquisition areas, and with cooperating adjacent and nearby landowners, including surveys regarding non-native fauna species and their impacts to native species; conduct seasonal nesting studies as well as MAPS banding of birds once a month for six months each year on the Refuge to gather additional data on migration corridors, paths, origins and destinations, as well as population data trends; identify the quantity, quality and spatial configuration of available habitat, link habitat condition and population response, and anticipate future habitat conditions, in order to set and achieve population objectives for priority landbirds of the Central Hardwood Bird Conservation Region.

Collaborating with master gardeners and master naturalists to create raised vegetable/herb gardens and plant a native flower, plant, and herb permaculture-design garden around the MMLERC will benefit wildlife, especially for important pollinators including bees, butterflies, and hummingbirds.

4.2.3 Impacts to the Human Environment

4.2.3.1 Impacts to Cultural Resources

Alternative A—Current Management (No Action Alternative):

Under this alternative, there are no anticipated direct or indirect adverse impacts to cultural resources, as current conditions would be maintained, and no ground disturbance would occur.

Beneficial Impacts (Alternative A)

Cultural, historical, and/or archeological known sites would be kept confidential from the public to ensure preservation and protection.

Alternative B—Proposed Future Management (Proposed Action):

Adverse Impacts (Alternative B)

Under the Proposed Action Alternative, if there are any adverse impacts to cultural resources, it would only be accidental such as if any cultural, historical, and/or archaeological sites are found where mechanical treatment for forest restoration already occurs or when construction of a new Headquarters site and RV pads for Refuge housing takes place. However, the Refuge would survey these areas first in early planning stages to ensure that construction of infrastructure and/or disturbance to the land does not occur where valuable natural or cultural resources are present.

Beneficial Impacts (Alternative B)

Same as Alternative A, plus, if cultural, historical, and/or archaeological sites are discovered, the Refuge would coordinate with universities, Sam Noble Museum of National History archeologists and paleontologists, Tribal Nations, and SHPO to survey the area, study its historical context and significance, and preserve the site.

4.2.3.2 Impacts on Local Population and/or EconomyAlternative A--No Action Alternative:*Beneficial Impacts (Alternative A)*

The economic and social condition of the area would remain the same in this Alternative. The presence and operation of the Refuge provides economic benefits to the surrounding communities within an 80 mile radius by bringing in groups of 10-20 people for EE and interpretation programs approximately 2-3 times per month in the spring and fall, 1 or 2 times per month in summer and one per month in the winter driving primarily from Tulsa, Joplin, Fayetteville, Tahlequah (45 mile – 80 mile range to Looney Unit), which contributes to generating revenue for the local economy (i.e., stopping at local restaurants and shops). There are a few participants that come from TN, TX, MO, KS, OK, MS and AR, which also bring more revenue into the State of Oklahoma. In addition, much of the Refuge's annual budget is invested in equipment and supplies- purchased primarily from local businesses, and is also spent on contracts for local labor to accomplish Refuge projects. The Refuge provides full-time employment for 2 individuals, part-time employment for 2 individuals, as well as student employment and paid-internship opportunities for people that live in nearby communities.

Alternative B--Proposed Action:*Beneficial Impacts (Alternative B)*

The economic and social condition of the area would improve in this Alternative. The presence and operation of the Refuge would provide economic benefits to the surrounding communities within an 80 mile radius by bringing in additional groups of 50-100 people for EE and interpretation programs approximately 3-4 times per week in the spring, summer and fall, and approximately 10-20 people, 1 or 2 times per week in winter, driving primarily from Tulsa, Joplin, Fayetteville, Tahlequah (45 mile – 80 mile range to Looney Unit), which contributes to generating revenue for the local economy (e.g., stopping at local restaurants and shops). There may be a few participants that come from TN, TX, MO, KS, OK, MS and AR, which would also bring more revenue into the State of Oklahoma. In addition, much of the Refuge's annual budget is invested in equipment and supplies purchased from local businesses and is sometimes spent on contracts for local labor to accomplish Refuge projects. In this Alternative, the Refuge would provide full-time employment for over 9 individuals, in addition to many student employment and paid-internship opportunities. The Refuge would also provide housing for as many of these individuals as possible.

4.2.3.3 Impacts on Aesthetic and/or Visual Resources

Alternative A--No Action Alternative:

The visual landscape of Ozark Plateau NWR would primarily remain the same in this No Action Alternative.

Adverse Impacts (Alternative A)

Cave gates would remain on caves where federally listed species reside inside. Wildland fires (wildfire and/or prescribed fires) would blacken the land immediately after occurrence. There would be few grasses or understory forbs remaining and most of the brush would be scorched. Trees may be scorched and scarred thereafter. Some of the less fire resistant trees will show signs of wilting and may succumb. After one season of regrowth, most signs of prescribed burning will be difficult to detect without close examination, except tree scarring. Because of wet ground conditions or patchy fuels, there are often areas within the burn unit that are untouched by fire, resulting in a patchy, mosaic burn. Some visitors find recently burned areas of the forest to be aesthetically unpleasing.

Beneficial Impacts (Alternative A)

After only a few days to one year, wildland fires can enhance the appearance of the area. For example, after a spring burn, the enriched soil will promote rapid growth of lush green sprouts, native grasses, wildflowers, and forbs.

Alternative B-- Proposed Future Management (Proposed Action):

Adverse and beneficial impacts on aesthetic and/or visual resources would be the same as described in Alternative A plus:

Adverse Impacts (Alternative B)

Weather stations would adversely affect the aesthetics of this habitat, since they will appear as man-made structures amidst predominately wild forest habitat. However, the Refuge will mitigate this by choosing locations carefully so as to somewhat “camouflage” the stations from human visibility.

Beneficial Impacts (Alternative B)

Photography blinds would be constructed so as to blend in with the natural habitat (for example: made of local wood sources), and would enhance visitors’ ability to observe authentic wildlife behavior, without scaring wildlife away. Areas designated as primitive overlooks will also increase the opportunities for people to appreciate the beauty of various habitats and vista points of the Ozark Plateau NWR. Wood harvesting of accumulated fuel loads due to ice/wind storms or over-stocked areas of forest habitat will increase the aesthetics of these areas by allowing for grasses, wildflowers, and other vegetation to grow as an open understory to a moderately-stocked mature oak-hickory and pine forest of large trees. Establishment of 2.25 miles of new

primitive trails will give visitors better access to viewing and appreciating the splendor of Ozark Plateau forests, rocks and cave exteriors, and flowing streams.

4.2.3.4 Impacts on Public Use Opportunities and/or Access

Alternative A--No Action Alternative:

Adverse Impacts (Alternative A)

Ozark Plateau NWR has not promoted public use of the Refuge because of the sensitivity to human disturbance of the federally listed T&E cave species the Refuge was established to protect. Many people from the surrounding communities do not know about any public use opportunities that Ozark Plateau NWR has to offer (website is not updated frequently enough, there are no fliers/brochures, etc.). Many locals and ODWC have expressed that they would like hunting to be allowed on the Refuge, however, the Refuge currently does not allow hunting.

Beneficial Impacts (Alternative A)

The Refuge provides EE, interpretation, wildlife photography and observation opportunities to engage the public from surrounding communities to connect to nature and understand the importance of Ozark natural resources, including cave, karst, water, and forest. This benefits groups of 10-20 people, 2-3 times per month in the spring and fall, 1 or 2 times per month in summer and one per month in the winter. There are even some participants that come from TN, TX, MO, KS, OK, MS and AR. Not only are these programs engaging and satisfying (based on feedback) for visitors, they most likely will influence people to make “greener” decisions. This is concluded based on various research including one study that found that measures of environmental consciousness are closely linked to environmentally-responsible purchasing behavior (Schlegelmilch, 1996).

Alternative B--Proposed Action:

Impacts would be the same as those described in Alternative A. In addition:

Adverse Impacts (Alternative B)

An increase in visitation for EE and interpretation programs would increase the traffic along the access road. In addition, group sizes would be larger, therefore less personal. Hunting opportunities on the Sally Bull Hollow Unit may expose caves to the public, which could increase the potential for vandalism. There would be a temporary increase of vehicle traffic on Refuge roads close to wood harvest pile areas.

Beneficial Impacts (Alternative B)

In this alternative, the Refuge would provide more EE, interpretation, wildlife photography and observation opportunities and allow hunting to engage the public from surrounding communities to connect to nature and understand the importance of Ozark natural resources, including cave, karst, water, and forest. In addition, programs would improve community

support of the Refuge as well as benefit all kinds of people from elders to young children to local Native American populations. The additional gardening program should teach people the skills and knowledge they need to know on how to grow their own vegetable, herb, and native plant (pollinator) garden in their backyard.

Trail-building of 2.25 miles of primitive trails and maintenance of current and future trails would support limited public use through bottomland hardwood forests, allowing visitors to get exercise while accessing new areas of the Refuge. This may increase the visitors' appreciation for not only the work the U.S. Fish & Wildlife Service does, but also for the environment in general.

Allowing for more public use opportunities, such as hunting and wood harvesting, will improve relationships with the public/local landowners, Tribal Nations, and the State. It will also heighten awareness of what Ozark Plateau NWR's purposes are. Support from people on all levels is needed to benefit the lands and species in the long-term and to establish future conservationists.

4.3 Assessment of Cumulative Impacts

A cumulative impact is defined as an impact on the environment that results from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future action regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions, initiated by Ozark Plateau NWR and beyond the Refuge boundary by private landowners, businesses, industries, cities, universities/researchers, the State, and/or Tribal Nations. Impacts caused by all of these stakeholders can "accumulate" spatially, when different actions affect different areas of the same resource. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially cancelling out each other's effects on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource.

As stated in the Service Manual (550 FW 1 and 2), in an EA, a cumulative impact assessment should be conducted if it is determined necessary through scoping to make a determination of significance of the proposed action. When a cumulative effects analysis is included in an EA, the analysis need only be sufficient for the decision maker to reach a conclusion on the significance of the impact in order to determine if the preparation of an EIS is required.

This section addresses the potential cumulative effects for all the alternatives and is intended to consider the activities on the Refuge in the context of other actions on a larger spatial and temporal scale. The impacts of past and present actions that have taken place on Ozark Plateau NWR are reflected in the current resource conditions (Affected Environment) as described in Chapter 3 of the Final CCP. The impacts of proposed future actions (for all alternatives) are discussed in earlier parts of this EA. The Service also considered past, present and future planned actions on other State, Federal and private lands surrounding the Refuge. Based on this analysis, the Service has concluded that proposed Refuge management actions (for both alternatives) when added to other past, present or future proposed actions would not result in significant cumulative impacts, as summarized below. The benefits to habitat, wildlife, and public use opportunities that the proposed actions would achieve greatly outweigh any of the adverse impacts discussed in this document.

4.3.1 Cumulative Impacts to Physical Resources

4.3.1.1 Cumulative Impacts of and to Climate Change

In the past 1,000 years, studies have shown that climate change is occurring primarily due to worldwide human activities that increase CO₂ in the atmosphere, causing the greenhouse effect (Crowley, 2000). This is expected to impact ecosystems in a variety of ways. These impacts may include: species range shifts, species extinctions, phenological changes, and increases in primary productivity.

Growing global corporation, Wal-Mart, has its corporate headquarters located only 40 miles from the Ozark Plateau NWR in Bentonville, Arkansas. Wal-Mart accounts for much of the urbanized growth in the surrounding area due to jobs and expansion. In Wal-Mart's 2010 Global Sustainability Report, the corporation reported to emit over 20 million metric tons of CO₂ in 2008, and that their "company's absolute GHG footprint continues to rise as [they] expand". In addition, Tulsa, Oklahoma (located 80 miles from the Looney Unit) boomed to a population of 72,000 by 1920, earning the city title, "Oil Capital of the World" (Tulsa Historical Society, 2010). The period of the 1950's and 60's saw Tulsa expand its physical limits. Small towns that had once been suburbs of the city were annexed as the city limits expanded to the south and east with additional roads, vehicles, large footprint homes, etc. (Tulsa Historical Society, 2010), further contributing to global greenhouse gas emissions.

The Refuge may be a minor contributor to climate change; however, the potential to acquire up to 15,000 acres of mature forest will account as an important carbon offset on the landscape-level through carbon sequestration. In addition, the Template for Assessing Climate Change Impacts and Management Options (TACCIMO) study suggests that prescribed burning could reduce CO₂ and other emissions from fires in dry forest types by 52-68%. This equates to overall fire emission reduction in the western U.S. of 18-25%, and as much as 35% at the state level

(<http://www.forestthreats.org/>). Therefore, the Refuge benefits climate change within the context of cumulative impacts. As the Refuge begins experiencing greater effects from climate change, the need for adaptive management will increase. More scientific data on when and where these changes may occur (the Refuge will be establishing an inventorying and monitoring program specifically to begin monitoring for this) along with what they may entail is necessary before determining how to counteract or adapt to them.

4.3.1.2 Cumulative Impacts to Air Quality

Surrounding city growth, the aerial spraying of croplands and invasive plants, and hot wildfires can contribute adversely to air quality. Spraying of croplands for pests and weeds has occurred and continues to occur regularly on croplands within the seven counties of the Refuge acquisition area, however, the Refuge does not have nor propose a farming program. The Refuge does not treat invasive plants through aerial spraying, but there are many farm fields surrounding the Refuge that may use aerial application of herbicides, which can result in an immediate and temporary air quality impact.

Oil refineries and gas companies make up for the majority of the State of Oklahoma's contributions to emissions that decrease air quality (Oklahoma Department of Environmental Quality, 2010). In addition, Oklahoma coal mines produced 2.0 million tons of coal in 2006, (0.2% of the U.S. total) (sourcewatch.org). In November 2010, a report produced by the Sierra Club attributed as many as 64 days with harmful levels of smog in Oklahoma to Texas' coal-fired power plants (sourcewatch.org). Grand River Dam Authority, located within the Refuge acquisition area of Mayes County, produces approximately 65.8% from coal and 34.2% from hydroelectricity (Energy Information Administration, 2008). Northeastern Station, a coal power plant only 30 miles from the Refuge acquisition boundary of Mayes County, which encompasses more than 40 square miles, five towns, and an entire watershed in far northeastern Oklahoma, creates toxic dust from over 75 million tons of chat piles (mining waste) of abandoned lead and zinc mines, which are especially hazardous to children under six years of age, causing lifelong impaired neurological development problems (Hughes, et. al., 2012). Furthermore, the miscarriage rate in the Tri-State Superfund Site area is 24%, compared to the national average of 10% (Sheiback, et al, 1982) due to large amounts of mine waste.

Projects on the Refuge that result in effects to air quality would be about the same over time, with minimal differences based on conditions (i.e. prescribed burning regimen, etc.). Restoring up to 15,000 acres of forest could improve the air considerably for the region. Beyond the Refuge, air quality impacts would remain about the same or decrease air quality in the foreseeable future, pending extreme population growth and subsequent heightened impacts to air quality from pollution.

4.3.1.3 Cumulative Impacts to Water Quality and Quantity

Some past, present, and reasonable foreseeable future Refuge activities; construction, herbicide spraying, and 15,000 acres of forest management affect water quality. In the Proposed Action, the Refuge proposes to restore up to 15,000 acres of forest, which includes mature trees that provide natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter the groundwater from surface run-off. This would provide a beneficial cumulative impact to water resources and those that rely on these in surrounding communities. On the other hand, if the Refuge is compelled to use herbicide spot-treatment to control problematic invasive species, it may have negligible to minor cumulative impacts to water quality for lands downstream, depending on the duration and extent of the use in the future.

Water quality and quantity is also affected by adjacent and nearby landowners due to management decisions of grazing and the method and use of chemical fertilizers, insecticides, and herbicides. In a 1983 study on cattle grazing impacts to water quality, it found that bacteria densities in stream water are significantly higher when there is a high concentration and amount of cattle near the water source (Howard, 1983). Furthermore, Delaware County has some of the most severe numbers of “factory farms” in the United States, also known as “confined animal feeding operations” (CAFOs) (factoryfarmmap.org). CAFOs pollute surface and groundwater sources due to the mass amount of chicken and hog waste that is created- which seeps into local aquifers (foodandwaterwatch.org). Even though this is not taking place directly on the Refuge, it cumulatively impacts the water quality of surrounding areas, eventually making its way to Refuge water resources. This cumulatively impacts wildlife species including native fish of freshwater creeks and streams and even T&E species, such as the Ozark cavefish and Delaware County cave crayfish.

In 2010, the Environmental Integrity Project, the Sierra Club, and Earthjustice reported that Oklahoma, along with 34 states, had significant groundwater contamination from coal ash that is not currently regulated by the Environmental Protection Agency (EPA), including the Northeastern Station coal plant, only 30 miles from the Refuge acquisition boundary of Mayes County (sourcewatch.org). In addition, abandoned lead and zinc mines from the Tri-State Superfund Site have contaminated surface and groundwater resources in the northern part of the Refuge acquisition area.

Nearby fracking operations (a.k.a., hydraulic fracturing or industrial gas drilling) in northeast Oklahoma and northwestern Arkansas continue to be a threat to the water resources in the area (earthjustice.org). The *Scientific American* published an article on fracking stating, “records from disparate corners of the United States, [including Oklahoma], show that wells drilled to bury this waste deep beneath the ground have repeatedly leaked, sending dangerous chemicals and waste gurgling to the surface or, on occasion, seeping into shallow aquifers that store a

significant portion of the nation's drinking water (Lustgarten and ProPublica, 2012). “In 10 to 100 years we are going to find out that most of our groundwater is polluted”, stated Mario Salazar, an engineer who worked for 25 years as a technical expert with the EPA's underground injection program in Washington (Lustgarten and ProPublica, 2012).

Grand River Dam Authority's (GRDA) hydroelectric dams may continue to affect the water levels and flows on important maternity cave sites near the Refuge, unless the Service and Federal Energy Regulatory Commission come to a management agreement. Beaver Dam Cave is a Refuge cave monitoring site and major gray bat maternity cave (5,000 - 20,000 bats) on private land in the Grand Lake flood pool. It is an alternate site for the major gray bat maternity colony (5,000 - 30,000 bats) using Twin Cave owned by TNC, that the Refuge helps manage. Operation of Grand River Dam Authority's hydropower project at Pensacola Dam on Grand Lake in cooperation with the U.S. Army Corps of Engineers' flood control operation of Grand Lake has increased the frequency of flooding (about once every five years) of Beaver Dam Cave, which has drowned bats in the past. During renewal of GRDA's Federal Energy Regulatory Commission Hydropower License, they consulted with the Oklahoma ES Field Office through Section 7 of the Endangered Species Act and a Biological Opinion was prepared indicating the effects and resulting in GRDA being required to help with and fund management of Beaver Dam Cave, Twin Cave and Jail Cave (another cave in the basin used by gray bats in the past).

The Department of Environmental Quality of Oklahoma, the City of Tulsa, and Indian Nations Council of Governments (INCOG) produced a Watershed Restoration Action Strategy in 1999 for the Eucha/Spavinaw watershed, which lies within the acquisition boundary of the Refuge and directly impacts the Refuge's water resources and wildlife. In this document the main sources identified that contribute to water pollution include: poultry litter/production; cattle/hog livestock; poor private septic systems; municipal permitted point sources dischargers; background nutrient sources; commercial fertilizer use; and soil erosion (City of Tulsa and INCOG, 1999). This Strategy outlines a cumulatively beneficial action plan; however, it may be outdated and should be revisited/updated.

4.3.1.4 Cumulative Impacts to Soils

Maintaining continuous stands of mature oak-hickory forest on up to 15,000 acres of Refuge will benefit surrounding lands and communities because it will stabilize the soil and reduce the potential for erosion. Many adjacent lands, however, are currently used for crop production, ranching or commercial development. Development, ranching and agriculture could cause cumulative effects of soil erosion, including more soil particulates travelling in the air from wind, tillage, and removal of native vegetation. In addition, development and monocultures could cause soil to erode into water sources on and around the Refuge. Continuous use of chemical compounds on or around the Refuge would mean that residues of a number of pesticides would continue to occur in soils throughout the lifetime of the CCP. The Refuge

would only use minimal herbicide spot-treatment, if necessary, on invasive flora of newly acquired lands in order to restore the land to native forest or other native habitat, which should not negatively impact the soils cumulatively. The Refuge would also collaborate with landowners adjacent to and near the Refuge to assist in conservation efforts by promoting sustainable land management practices.

4.3.2 Cumulative Impacts to Biological Resources

4.3.2.1 Cumulative Impacts to Vegetation/Habitats

The Refuge is surrounded by private agricultural lands and nearby developing urban centers, which have cumulative impacts for the habitat(s) within the seven county acquisition area of the Refuge. Some timber harvesting in the region has involved the clearing of forested areas, converting them to cattle and other agricultural uses. This results in the loss of mature tree forests, while increasing understory growth, increasing water runoff, and decreasing groundwater recharge. Mining operations near the Refuge remove trees and reduce habitat for bat foraging and other species. Current and projected agricultural uses on the landscape result in a patchwork mosaic of open rangelands, further fragmenting the Ozark forests. The region is also experiencing increasing road and right-of-way construction and other infrastructure development.

In a northeastern Oklahoma study, Bidwell et al. (2010) showed that caves and species within the caves were exposed to contaminants including pesticides, antibiotics and other pharmaceuticals, fragrances, and other plasticizers. Potential sources of water contaminants include sewage lagoons, municipal and industrial wastewater treatment outflows, septic systems, mining operations, fracking operations, runoff from landfills, confined animal feeding operations, roads, and agriculture occurring off-Refuge (Aley, 1990; 1999).

Earthquakes can greatly affect wildlife habitat on and surrounding the Refuge, especially cave habitat, due to the fragile karst formations. The Oklahoma Geological Survey released a study in 2011 examining whether the fracking activities in Oklahoma related to several series of earthquakes in Garvin County, Oklahoma in 2011. They conclude that “the strong spatial and temporal correlations to the hydraulic fracturing in Picket Unit B Well 4-18 certainly suggest that the earthquakes observed in the Eola Field could have possibly been triggered by this activity” (Holland, 2011).

In addition, increased urbanization has the potential to dramatically reduce or inhibit Refuge habitat management activities. As more homes surround the Refuge, prescribed burning becomes more expensive and more difficult to conduct safely.

City, State, Tribal, and Federal lands and other conservation areas adjacent to the Refuge would benefit from the protection of habitat and mitigate future development on that particular area.

Cumulatively, the Refuge contributes many beneficial impacts to habitat(s) within the seven county acquisition area and landscape-level. Within the lifetime of this CCP, the Refuge proposes to acquire and protect up to 15,000 acres of cave and forest habitat within Craig, Ottawa, Mayes, Delaware, Cherokee, Adair, and Sequoyah Counties to address Ozark habitat loss and fragmentation on a landscape-scale. Although the Refuge's contribution may be relatively small in acreage in the grander scale within these county's boundaries, preservation and restoration of this rare habitat in this region is invaluable. Furthermore, in Alternative B, the Refuge proposes to coordinate beyond the Service southwest (Region 2) regional boundary to more effectively manage federally listed Ozark cave species on a landscape-level by cooperating with Services Region 3 and 4 in managing Logan Cave, Cavefish, and Pilot Knob NWRs, as well as expanding cave habitat acquisition areas within four surrounding regions (Region 2, 3, 4, and 6 in Oklahoma, Arkansas, Missouri, and Kansas), which could extremely benefit federally listed species in a cumulative context.

Lastly, preserving and studying the uniqueness of subterranean habitats and life forms they host provides an important source of information for the advancement of scientific knowledge because caves and aquifers are unique evolutionary "laboratories" for the study of natural selection and adaptation (Graening, et. al, 2011). Caves also have unique ecosystems for ecological studies since habitat variables are stable, photosynthetic inputs are absent, amount of species is low, gene pool is restricted, and natural replication is plentiful (Culver, 1982). Refuge habitat management and inventorying and monitoring activities contribute beneficially, cumulatively, to the advancement of science.

4.3.2.2 Cumulative Impacts to Wildlife

Regionally, the Refuge anticipates increased habitat loss and fragmentation to occur in the coming 15 years from the general, long-term increase in population and development within and surrounding the seven county acquisition area. In general, such habitat loss and fragmentation would be detrimental to populations of many species of resident, native wildlife. Specifically, there is a potential for future development of wind energy farms on nearby migration corridors, which cause mortality in migratory bird and bat species due to direct strikes and barotrauma from turbine blades (Johnson et al, 2002). The Refuge would take an active role in participating in various wildlife migration corridor identification research projects on- and off- Refuge, which could be useful insight for planners to mitigate, for example, wind energy projects in wildlife migration high-risk areas.

Furthermore, the Refuge will mitigate habitat loss by acquiring up to 15,000 acres of beneficial habitat to native resident species, including cave species within these seven counties. Also, in

cooperation with private landowners, state, Tribal Nations, and other federal agencies, the Refuge can help to influence a conservation need within the Ozarks via education and partnerships, especially in order to protect and recover T&E cave species. A cooperative conservation movement would benefit T&E, species of concern, and non-T&E species alike, if all partners work to provide quality native habitat(s) for wildlife foraging, resting, breeding, nesting, roosting, hunting, etc. Additionally, in Alternative B, the Refuge proposes to coordinate beyond the Service Southwest (Region 2) regional boundary to more effectively manage federally listed Ozark cave species on a landscape level by cooperating with Regions 3 and 4 in or co-managing Logan Cave, Cavefish, and Pilot Knob NWRs, which lie outside of Ozark Plateau NWR's Region 2, as well as expanding cave habitat acquisition areas within the four surrounding Service regions: 2, 3, 4, and 6.

The disease, WNS, caused by the fungus *Geomyces destructans*, is responsible for unprecedented mortality in cave-hibernating bats in the northeastern and central U.S and eastern Canada (Lorch et al, 2011). This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to cave-hibernating bats throughout North America. More than 5 million hibernating bats have died since 2007 (Froschauer, 2012). Even though the Refuge has not had any WNS occurrences to date, it anticipates that the disease will spread to the Ozark Plateau area. If in fact, WNS does occur on or surrounding the Refuge, it could be catastrophic for bat populations. Not only does WNS threaten to decrease bat populations, but it also would affect insect populations that bats prey on, as well as cave species, including Ozark cavefish and Delaware County, which depend on bats to bring in sources of energy (via guano deposits) from the exterior of caves. Refuge staff, in addition to biologists with state and federal agencies and organizations across the country, are still trying to figure out how to minimize the spread and impacts of the disease and recover impacted populations. To date, seven bat species are known to be affected by the disease: gray bat (*Myotis grisecens*), the little brown bat (*M. lucifugus*), eastern small-footed bat (*M. leibii*), Indiana bat (*M. sodalist*), northern long-eared bat (*M. septentrionalis*), big brown bat (*Eptesicus fuscus*), and the tri-colored bat (*Perimyotis subflavus*). Four of these species, (gray, the northern long-eared, big brown, and tri-colored bats) occur on the Refuge. It is likely that WNS will affect bat populations on and around the Refuge within the lifetime of the CCP. It is difficult to predict which populations will be affected and the scale of impact to these populations and dependent cave species. The Refuge contributes to WNS research in both alternatives, and follows emerging news and research in order to be informed and prepared for occurrence adaptive management strategies. The Refuge will pull all resources it can to prevent WNS from occurring and/or mitigate the spread of WNS to all bat species, especially to T&E bat species and bat species of concern. Hopefully, Refuge mitigations, prevention methods, and adaptive management strategies will cumulatively benefit bat populations susceptible to the disease; however it may be extremely challenging to control.

4.3.3 Cumulative Impacts to the Socio-Economic Environment

4.3.3.1 Cumulative Impacts to Cultural Resources

No external factors have been identified that would contribute adversely to cumulative effects on the Refuge's cultural resources. At the close of the planning period, it is anticipated that the condition of the Refuge's cultural resources would remain intact and protected and society's knowledge and appreciation of them would be somewhat better than at present.

4.3.3.2 Cumulative Impacts to Local Population/Economy

The Refuge will have minor cumulative impacts on the local economy, because it provides very few public use opportunities in order to best conserve and protect cave and karst habitat for T&E cave species. Nonetheless, the public opportunities it does provide, especially those proposed in Alternative B, provide some cumulative economic benefits to the surrounding communities within approximately an 80 mile radius by generating revenue for the local economy (e.g., visitors stopping at local restaurants and shops). Some participants may come from TN, TX, MO, KS, OK, MS and AR, which also bring more revenue into the State of Oklahoma. In addition, much of the Refuge's annual budget is invested in equipment and supplies purchased primarily from local businesses, and are often spent on contracts for local labor to accomplish Refuge projects. The Refuge would also provide full-time employment for up to 9 people within the next 15 years, in addition to providing multiple local student research opportunities and paid-internships. Furthermore, a 2012 peer-reviewed national study by the U.S. Fish & Wildlife Service showed that homeowners owning a home near a national wildlife refuge increases the home value and supports the surrounding community's tax base.

4.3.3.3 Cumulative Impacts to Aesthetic/Visual Resources

The Refuge's management would enhance the scenic resources on a landscape-level, by protecting up to 15,000 acres of at least 80% mature oak-hickory-pine forest and cave habitat within Craig, Ottawa, Delaware, Mayes, Cherokee, Adair, and Sequoyah Counties of Oklahoma, adding to cumulative beneficial impacts on visual landscape. However, pushing in the opposite direction are growth trends in the area. Adding vehicles and commercial and industrial development would raise emissions of air pollutants that tend to compromise visibility and aesthetics of the landscape. Moreover, development outside the Refuge's boundaries, such as the recent construction of a wind farm to the east, will gradually fill the formerly rural landscape with a number of structures that many visitors might regard as unsightly clutter. On balance, it seems more likely that these adverse factors will predominate. To conclude, the Refuge's natural landscape character would become even more important in the future.

4.3.3.4 Cumulative Impacts to Public Use Opportunities/Access

According to the U.S. Census Bureau, the total population in Oklahoma is projected to grow by about 13.4% by the year 2030 (U.S. Census Bureau, 2012). In all likelihood, the rising local and state populations, along with increased development, will drive an increase in the demand for outdoor recreation and public use opportunities, such as hiking and hunting, on undeveloped, public lands in Oklahoma, including Ozark Plateau NWR. The Refuge would benefit surrounding communities by providing a natural space for people to reconnect with nature and learn about their local environmental resources and wildlife. As proposed in Alternative B, the Refuge would increase EE programs on the Looney Unit and allow hunting on the 2,280 acre, Sally Bull Hollow Unit, which would accommodate the projected increase in population and desire for accessing natural public use areas. In addition, it would enhance EE opportunities for tribal youth by collaborating with nearby tribes to provide Native American–led and –designed programs. These should cumulatively benefit tribal communities by enhancing opportunities for cultural preservation and environmental awareness. According to renowned author and journalist, Richard Louv, providing more programs and opportunities for children to have experiences in the outdoors has a great beneficial impact on “everything from a positive effect on the attention span to stress reduction to creativity, cognitive development, and their sense of wonder and connection to the earth” (von Zastrow, 2008). Cumulatively, increasing public use opportunities on the Refuge will enhance outdoor experiences, environmental consciousness, and may improve the wellbeing of surrounding community members.

4.4 Comparison of Resource Impacts by Alternative

KEY:

(-) = *adverse impact*

(+) = *beneficial impact*

Table A-7. Summary of Impacts by Environmental and Social Resources.

| Environmental Resource | Impacts of Alternative A: No Action | Impacts of Alternative B: Proposed Action |
|---|---|---|
| <i>Impacts to Climate Change</i> | (-) moderate, long-term impacts due to CO ₂ emissions (+) moderate long-term impacts due to carbon sequestration of 4,000 acres of forest (+) minor long-term impacts due to environmental education (+) minor impacts due to maintenance of energy-efficient appliances and water filter | (-) minor to moderate impacts due to CO ₂ emissions (+) minor impacts due to climate monitoring (+) moderate impacts due to carbon sequestration of acquiring up to 15,000 acres of forest habitat (+) minor impacts due to environmental education (+) minor impacts due to use of energy-efficient retrofits, appliances, and water conservation (+) minor to moderate impacts due to use of renewable energy source (solar panels) |
| <i>Impacts to Air Quality</i> | (-) short-term minor impacts due to prescribed burns and wildfires, dust, welding, and emissions (+) long-term minor impacts of managing 4,000 acres of forest- producing oxygen and cleaning air | (-) short-term minor impacts due to prescribed burns and wildfires, dust, welding, and emissions (+) long-term moderate impacts of maintaining and restoring up to 15,000 acres of forest- producing oxygen and cleaning air |
| <i>Impacts to Water Quality and Quantity</i> | (-) minor localized impacts due to soil erosion, turbidity caused by human traffic in caves, soil compaction, and leaked fluids from maintenance (+) minor to moderate impacts due to managing and protecting approximately 4,000 acres of forest, groundwater aquifers and surfacewater resources | (-) minor localized impacts due to soil erosion, turbidity caused by human traffic in caves, soil compaction, and leaked fluids from construction/maintenance (-) minor to moderate short- to medium-term impacts on water quality due to use of herbicide spot treatment (+) moderate impacts due to protection of up to 15,000 acres of forest, groundwater aquifers and surfacewater (+) minor impacts due to increasing knowledge of water quantity/quality in permanent I&M program |

Appendix A: Environmental Assessment

| Environmental Resource | Impacts of Alternative A: No Action | Impacts of Alternative B: Proposed Action |
|-------------------------|---|--|
| <i>Impacts to Soils</i> | (-) negligible to minor short-term impacts due to prescribed burns (-) minor short-term localized impacts due to invasive species removal and native tree planting (-) minor to moderate soil disturbance due to compaction and erosion of visitor use of trails and roads and cave gate construction (+) moderate impacts of maintaining and restoring 4,000 acres of mature stands of native trees | (-) negligible to minor short-term impacts due to prescribed burns (-) minor short-term localized impacts due to invasive species removal and native tree planting (-) minor to moderate soil disturbance due to compaction and erosion of visitor use of trails and roads, cave gate construction, and facility construction (+) moderate impacts of maintaining and restoring up to 15,000 acres of mature stands of native trees |

| Environmental Resource | Impacts of Alternative A: No Action | Impacts of Alternative B: Proposed Action |
|----------------------------------|---|---|
| <i>Impacts on Habitat</i> | (-) minor, short-term, localized impacts due to human disturbance of cave habitats due to scientific monitoring and cave gate construction (-) minor to moderate localized impacts due to illegal cave entry and vandalism within caves (-) minor impacts due to cave gates restricting air flow within habitat (-) minor short-term impacts due to prescribed burns on two Refuge units (+) moderate impacts due to protection and restoration of 4,000 acres of forest, cave, and riparian habitats (+) minor to moderate impacts due to monitoring cave habitat quality, cave mapping, and groundwater delineation (+) minor impacts due to controlled cave entry (+) minor impacts on forest habitat due to prescribed burns | (-) minor, short-term, localized impacts to human disturbance of cave habitats due to scientific monitoring and cave gate construction (-) minor to moderate localized impacts due to illegal cave entry and vandalism within caves (-) minor impacts due to cave gates restricting air flow within habitat (-) minor, short-term impacts due to installation of cameras, alarms, climate data loggers and acoustic monitors (-) minor short-term impacts due to prescribed burns on 1/3 of total Refuge lands (-) minor impacts due to vegetation removal for trails (+) moderate impacts due to protection and restoration of up to 15,000 acres of forest, cave, and riparian habitats (+) moderate to highly beneficial impacts due to coordination efforts of expanding acquisition and cave management on a landscape level (+) minor to moderate impacts due to increase of law enforcement and alarm systems to prevent and reduce vandalism of cave habitats (+) minor to moderate long-term impacts due to increase in environmental education regarding cave and karst habitats (+) minor to moderate impacts on forest habitat due to increase of prescribed burns (+) minor to moderate impacts due to evaluation and control of invasive species |

Appendix A: Environmental Assessment

| Environmental Resource | Impacts of Alternative A: No Action | Impacts of Alternative B: Proposed Action |
|---|---|--|
| <i>Impacts on Wildlife (T&E and non-T&E)</i> | (-) negligible to minor short-term impacts on cavefish due to florescent dye tracing affecting pH levels (-) minor, short-term, localized impacts due to human disturbance of cave wildlife for scientific monitoring and cave gate construction (-) minor to moderate localized impacts due to illegal cave entry and vandalism within caves (+) minor to moderate impacts of increasing knowledge by I&M of Refuge wildlife species (+) minor impacts due to controlled cave entry (+) minor long-term impacts due to environmental education programs increasing awareness of importance of bat, cave, and other wildlife species | (-) negligible to minor short-term impacts on cavefish due to florescent dye tracing affecting pH levels (-) minor, short-term, localized impacts due to human disturbance of cave wildlife for scientific monitoring and cave gate construction (-) minor localized impacts due to illegal cave entry and vandalism within caves (-) minor short-term to long-term impacts on Refuge species due to use of herbicide spot treatment (+) moderate impacts due to protection and restoration of up to 15,000 acres of forest, cave, and riparian habitats for T&E/Species of Concern (+) moderate to highly beneficial impacts due to coordination efforts of expanding acquisition and cave management on a landscape level for T&E/Species of Concern (+) minor to moderate impacts due to increase of law enforcement and alarm systems to prevent and reduce vandalism of cave habitats and species (+) moderate impacts of increasing knowledge by enhancing I&M of Refuge wildlife species (+) minor impacts due to controlled cave entry (+) minor long-term impacts due to environmental education programs increasing awareness of importance of bat, cave, and other wildlife species (+) minor to moderate long-term impacts due to restoration of historic fire regime (+) minor to moderate long-term impacts due to an increase of environmental education programs raising awareness of importance of bat, cave, and other wildlife species |

| Environmental Resource | Impacts of Alternative A: No Action | Impacts of Alternative B: Proposed Action |
|---|--|---|
| <i>Impacts on Cultural Resources</i> | (-) none anticipated (+) minor to moderate impacts by keeping cultural and historical sites protected and confidential | (-) negligible to moderate localized impacts due to the potential of discovering resources on new construction area of HQ (+) minor to moderate impacts due to the protection and preservation of newly discovered cultural/historical resource sites |
| <i>Impacts on Socioeconomic Resources</i> | (+) minor economic impacts to surrounding communities via staffing, supply purchases, and visitation | (+) minor increase to economic impacts to surrounding communities, via increase in staffing, increase in supply purchases, and anticipated increase in visitation |
| <i>Impacts on Aesthetic and Visual Resources</i> | (-) minor to moderate long-term impacts due to cave gate aesthetics (-) minor to moderate short-term impacts due to fires (+) minor to moderate long-term impacts due to fire enhancement of forest habitat and vegetation | (-) minor impacts due to weather stations (-) minor to moderate long-term impacts due to cave gate aesthetics (-) minor to moderate short-term impacts due to fires (+) minor to moderate long-term impacts due to fire enhancement of forest habitat and vegetation (+) minor impacts due to photography blind and overlook opportunities (+) minor impacts due to wood harvesting to clean up fuel loads (+) minor impacts due to establishment of trails for more wildlife-viewing opportunities |
| <i>Impacts on Public Use</i> | (-) minor impacts due to limited public use opportunities because of sensitivity of federally listed cave species (-) minor to moderate impacts due to lack of hunting opportunities on Refuge (-) minor impacts due to lack of public information regarding Refuge opportunities (+) minor to moderate impacts of EE, interpretation, wildlife photography and observation opportunities | (-) minor impacts due to limited public use opportunities on most Refuge units (-) minor impacts due to minor increase in traffic (-) minor to moderate impacts due to exposure to caves on Sally Bull Hollow and Looney Units (+) minor to moderate impacts due to proposal to allow hunting on the Sally Bull Hollow Unit (+) minor to moderate impacts of increasing EE programs and increasing awareness of local resources (+) minor impacts of increasing public outreach efforts (+) minor impacts due to adding trails for public use |

4.5 Short-Term Uses versus Long-Term Productivity

The habitat protection and management actions under the proposed alternative are dedicated to maintaining the long-term productivity of Refuge habitats. The benefits of this CCP for long-term productivity far outweigh any impacts from short-term actions, such as the construction of a cave gate, installation of solar panels, or improvement of access roads and trails. While these activities would cause short-term negative impacts, the protection of habitat, increased scientific knowledge regarding cave and karst ecosystems, as well as public support gained from an enlightening outdoor experience, would produce long-term benefits on a landscape-level.

The key to protecting and ensuring the Refuge's long-term productivity is to find the threshold where public uses do not degrade or interfere with the Refuge's natural resources. The plans proposed have been carefully conceived to achieve that threshold. Therefore, implementing the proposed alternative would lead to long-term benefits for wildlife protection and land conservation that far outweigh any short-term impacts.

4.6 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of finite resources and the effects that this use could have on future generations. Irreversible effects primarily result from the use or destruction of specific resources that cannot be replaced within a reasonable time frame, such as energy or minerals. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action, such as extinction of a threatened or endangered species or the disturbance of a cultural resource.

Neither of the alternatives would result in a large commitment of nonrenewable resources. Project implementation would require the irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by vehicles and heavy equipment. However, the Refuge proposes to install and utilize solar power as a renewable energy source to provide electricity for Refuge facilities. Also, management actions in this document will require a commitment of funds that would then be unavailable for use on any other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. The Proposed Action would result in some unavoidable harm or harassment to some wildlife; however, the actions proposed are merely to protect the Refuge's finite resources, not harm them. The Service would implement best management practices to minimize potential negative impacts.

4.7 Environmental Justice

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority and Low-Income Populations; February 11, 1994) was designed to focus the attention of Federal Agencies

on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations. The order is intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low income communities with access to public information and opportunities for participation in matters related to human health and the environment.

Neither alternative described in this EA will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low income populations. Implementation of the proposed action is anticipated to benefit the environment and people in the surrounding communities.

4.8 Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States for Indian Tribes or individuals. The Secretary of the Interior, acting as the trustee, holds many assets in trust. Examples of objects that may be trust assets are lands, minerals, hunting and fishing rights, and water rights. While most ITAs are on reservations, they may also be found off-reservations. The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian Tribes or Indian individuals by treaties, statutes, and executive orders. These are sometimes further interpreted through court decisions and regulations. Tribal lands are lands that have been deeded to tribes or upon which tribes have a historical claim.

ITAs have been identified within and/or surrounding the seven county area approved acquisition boundary of Ozark Plateau NWR, including nearby tribal allotted lands and individually-owned tribal lands in trust by tribal members of Caddo, Cherokee, Eastern Shawnee, Miami, Modoc, Osage, Quapaw, Seneca-Cayuga, and Wyandotte Nations. The Refuge partners with many of these Tribal Nations to protect and conserve these lands, cultural resources, and essential cave habitat for important cave species. For example, under agreements with the Cherokee Nation, Ozark Plateau NWR monitors cave species populations on adjacent tribal land (ITA) and shares that information with the Tribe. Some archaeological and cultural resources have been found on the Refuge and are preserved in place by stabilizing the surrounding soils and restricting human use so as not to disturb these sites any further. No significant impacts are anticipated to affect ITAs from implementation of either Alternative described in the EA.

Chapter 5: EA Consultation, Coordination, and Document Preparation

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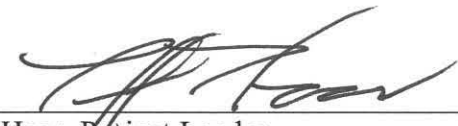
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**United States Fish and Wildlife Service
Environmental Action Statement**

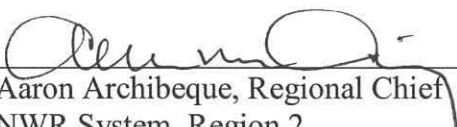
Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the action of implementing the Ozark Plateau National Wildlife Refuge Comprehensive Conservation Plan is found not to have significant environmental effects as determined by the attached *Finding of No Significant Impact* (following) and the *Comprehensive Conservation Plan and Environmental Assessment*.


for Dr. Benjamin N. Tuggle, Regional Director
U.S. Fish and Wildlife Service, Region 2

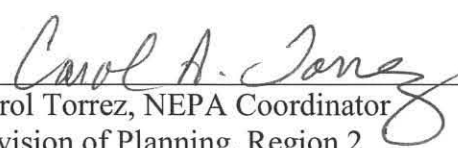
9/12/13
Date


Jeff Haas, Project Leader
Sequoiah and Ozark Plateau National Wildlife Refuges

4/24/13
Date


Aaron Archibeque, Regional Chief
NWR System, Region 2

9/11/13
Date


Carol Torrez, NEPA Coordinator
Division of Planning, Region 2

9/10/13
Date

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FINDING OF NO SIGNIFICANT IMPACT

**ENVIRONMENTAL ASSESSMENT FOR THE
OZARK PLATEAU NATIONAL WILDLIFE REFUGE
COMPREHENSIVE CONSERVATION PLAN
U.S. FISH AND WILDLIFE SERVICE**

The U.S. Fish and Wildlife Service (Service) has developed a Comprehensive Conservation Plan (CCP) and Environmental Assessment (EA) for the Ozark Plateau National Wildlife Refuge, which has an approved acquisition boundary that includes Adair, Cherokee, Craig, Delaware, Mayes, Ottawa, and Sequoyah Counties, Oklahoma. The CCP provides management direction for present and future refuge managers for the next 15 years. The Refuge took a landscape-scale approach in preparing the CCP, identifying issues and threats to the ecosystem including climate change, habitat fragmentation, degradation of cave, stream and forest habitat, wind energy farms, white-nosed syndrome, invasive species and fire management, and surface and ground water quality and quantity. The CCP describes management activities that occur on the Refuge and provides management goals, measurable objectives, and strategies designed to enhance and protect existing habitats for the benefit of wildlife. The goals and objectives shall guide management toward the Refuge's vision or the ecologically desirable outcome across the refuges. The CCP also identifies opportunities for environmental education, interpretation, public outreach, photography, wildlife observation, and other wildlife-dependent recreation opportunities; development of compatible facilities; habitat and wildlife management; and implementation of related programs.

An EA was completed to fulfill the requirements of the National Environmental Policy Act (NEPA) of 1969 and to inform the public of the possible environmental consequences of implementing the CCP for the Refuge. Two alternatives were developed and analyzed for potential impacts on the natural and human environment. Three other actions were considered but dismissed from detailed analysis, as documented in the EA. The EA was prepared to provide decision-making framework that 1) explores a reasonable range of alternatives to meet project objectives, 2) evaluates potential issues and impacts to the refuge resources and values, and 3) identifies measures to minimize the degree or extent of these impacts.

ALTERNATIVES CONSIDERED AND ANALYZED

Alternative A: Current Management (No Action Alternative)

This alternative is the baseline for comparison with the action alternatives because it does not involve change from current management programs and emphases. It represents biological management, land conservation and public use activities presently occurring and those that have occurred on the Ozark Plateau NWR since it was established. Ozark Plateau NWR would continue to: assure the continuing existence, and aid in recovery of federally listed endangered and threatened Ozark cave species; reduce the need for future listing of species of concern in the Ozarks; protect large continuous stands of Ozark forest essential to migratory interior forest nesting birds; and provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

Activities such as cave protection, fire management, forest management, threatened and endangered species and other wildlife management, research and monitoring, environmental education, interpretation, wildlife observation and photography, and public outreach would continue without any major changes. No hunting, fishing, or wood harvesting opportunities currently occur on the Refuge.

The Refuge would continue current management to address habitat loss and fragmentation by acquiring land and conservation easements from willing sellers (up to 15,000 acres) and entering into conservation agreements with private landowners, conservation organizations, state, Tribal Nations, and other federal agencies. The Refuge would not build or permit the construction of any new roads or infrastructure on Refuge lands except for Refuge operation purposes and would continue its practices of maintaining and restoring forested habitat as resources allow. Conservation agreements with the Cherokee Nation, City of Tulsa, and private landowners would continue to preserve forested and/or cave habitats.

The Refuge manages 3,977 acres of oak-hickory and oak-hickory-pine forest. The protection and management of these forested areas enhances carbon sequestration. The Refuge would continue to restore 70 acres of agricultural land to forested habitat at the Beck Unit (see *Invasive Flora* below). Additionally, the Refuge would maintain approximately 3,977 existing acres of forested habitat. Service staff and university partners would also continue monitoring the known maternity colonies and hibernacula annually. The Refuge would continue contracting with universities and NGOs to monitor mammals, birds, herpetofauna, fish, cave invertebrates, terrestrial insects, and vegetation. The Refuge would continue to implement the White-nose syndrome National Plan. Groundwater mapping efforts and monitoring would also continue.

Partnerships would continue to be an important part of the Refuge's actions to acquire, manage, and conserve lands, inventory and monitor, conduct research, assist in protecting and restoring habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation. The Refuge would continue working with landowners adjacent to and near the Refuge, private businesses, citizen science groups/projects, and nongovernmental organizations (NGOs) to implement conservation agreements, assist with wildlife management through the Partners for Fish and Wildlife program and Section 6 of the Endangered Species Act, and provide technical assistance. These partnerships will continue to help improve habitat quality on adjacent or nearby lands and also will prevent and minimize habitat loss and fragmentation in the Ozarks.

Alternative B: Proposed Action

The programs and activities discussed under Alternative A would continue and be enhanced. This alternative would provide for a proactive approach to making concerted strategic decisions, through the consideration and analysis of the best available science, based on the goals for management of the Refuge. This alternative was developed based on input received from the public, Oklahoma Department of Wildlife Conservation (ODWC), conservation partners, Service staff, and the professional judgment of the planning team. This alternative is based on successful pre-existing management strategies and has incorporated ecological principles that apply to Bailey's Central Interior Broadleaf Forest ecoregion province and Ozark Highlands ecoregion section.

This is the alternative that would best achieve refuge purposes, vision, and goals and would best contribute to the National Wildlife Refuge System mission. Alternative B, with associated goals, objectives, and strategies, comprises the CCP for the Ozark Plateau National Wildlife Refuge. This alternative would also stress the use of adaptive resource management based on observation and the most current scientific research. Additional inventories, monitoring, and studies would be implemented to better manage federally-listed threatened and endangered cave species, other species of concern in the Ozarks, and migratory and resident bird species; better understand the impacts of climate change; manage/control invasive species; and minimize the impacts of white-nose syndrome.

The Service would continue to work with conservation partners and increase collaboration and partnerships at a landscape-level on public and private lands, working toward maintaining the integrity of this isolated and threatened ecosystem. The Refuge would explore opportunities to expand acquisition boundaries in the Ozark ecoregion. The Refuge also would maintain, conserve, and restore up to 15,000 acres of acquired lands within the approved acquisition boundary to native forest habitat. A Fire Management Plan would be developed to increase the use of prescribed fire on up to 1/3 of the Refuge's acreage per year.

Recreational and Environmental Education opportunities would be enhanced and existing facilities improved. The Refuge would acquire and utilize/retrofit an existing building on newly acquired land as a Headquarters Site/Visitor Center or would build a new Headquarters Site/Visitor Center on appropriate areas of newly acquired lands. New maintenance shops and service buildings would be constructed, and residences for Refuge staff would be purchased or constructed. Wood harvesting by the public would only be permitted if Refuge forest and wildlife management needs dictate. In addition, the Refuge would develop a Hunt Plan to allow hunting on the Sally Bull Hollow Unit, adjacent to the State-managed Ozark Plateau Wildlife Management Area.

DECISION: THE SELECTED ALTERNATIVE

Alternative B was selected over the other alternatives because it best meets the Refuge's vision for the future, the purposes for which the refuge was established, and the habitat, wildlife, and visitor services goals identified in the CCP. This alternative is the basis for the Comprehensive Conservation Plan and describes how habitat objectives will be accomplished through a combination of management activities to encourage ecological integrity of caves, springs, streams, wetlands, watersheds, forests, and groundwater recharge areas, improve or maintain habitats for native and migratory wildlife and provide for environmental education and recreational opportunities. Future management actions will have a neutral or positive impact on the local economy and the recommendations in the CCP will ensure that refuge management is consistent with the mission of the National Wildlife Refuge System and U.S. Fish and Wildlife Service.

SUMMARY OF EFFECTS

Implementation of the Service's decision would be expected to result in environmental, social and economic effects as outlined in the CCP/EA and summarized here. The CCP describes habitat management, wildlife management, and land conservation objectives that would result in

improved habitat conditions. The proposed recreational opportunities would result in enhanced experiences for refuge visitors.

The Ozark Plateau NWR would continue to expand in accordance with the 2005 Land Protection Plan. Lands may be acquired if a willing seller or donor becomes available and acquired through fee title acquisition or conservation easement. Ozark Plateau NWR was approved to acquire additional land or easements from willing sellers and donors, up to 15,000 acres in seven counties of northeast Oklahoma. Conservation of these lands will protect valuable foraging areas and movement corridors for the federally listed endangered bats, as well as watersheds and ground water recharge areas important for maintaining surface and ground water quality for the federally listed threatened Ozark cavefish. In addition, sites will take into consideration appropriate geological formations including caves, springs, aquifers, losing and gaining streams, sinkholes, bluffs and talus cracks. Expansion of the Refuge has also provided additional opportunities for various outdoor recreational activities, environmental education, interpretation, and scientific research. Conservation would allow beneficial minor to moderate and long-term effects to air, water, soil and habitats and wildlife. Restoring future acquired lands from non-native invasive flora species to native trees and native vegetation will increase the soil quality, and provide better habitat for native wildlife species, once established. These native plants and wildflowers are adapted to local soil pH, nutrient levels, soil moisture, and weather conditions.

Refuge management activities (prescribed burning, forest management, invasive species control, new construction, etc.) would result in short- and long-term negligible to moderate, both adverse and beneficial impacts to soils, air, water, habitat, and wildlife as described in the EA; however, the long-term impacts are expected to be beneficial. Restoring habitat on and surrounding the Refuge to conditions that promote a more open, and regenerating, mature forest condition (*e.g.*, basal area of 50-60 sq. ft.) is expected to provide an enhanced foraging environment and abundant food source for the endangered Ozark big-eared bat, and protect important flight corridors for endangered gray bats. Another purpose of Ozark Plateau NWR is to protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds such as tanagers, warblers, and flycatchers that must nest some distance from an edge. The forest also plays an important role in preventing degradation of water quality in caves used by the threatened Ozark cavefish and other rare aquatic cave fauna such as the Oklahoma cave crayfish. Large stands of healthy forest also provide natural infiltration and percolation, reducing the amount of sediment, pesticides, and nutrients that might otherwise enter water bodies from surface run-off.

The refuge would increase some public uses and facilities in this alternative. However, any additions to public use opportunities would be small and produce only a minor effect on habitats. New facilities would remain within the already developed footprint so as to prevent habitat loss. Short-term wildlife and habitat disturbance may occur during construction of additional facilities. The public use management actions and associated facilities improvements might have a minor negative impact on habitat at the local scale but would also have a beneficial effect to public use opportunities on the widespread scale. Public use improvements will allow for increased public use and improve the quality and management of those opportunities. Allowing for more public use opportunities, such as hunting and wood harvesting, will improve relationships with the public/local landowners, Tribal Nations, and the State. It will also heighten awareness of what

Ozark Plateau NWR's purposes are. The refuge would also have beneficial impacts on the local economy through purchases, increased visitation and revenue.

Disturbance to wildlife at some level is an unavoidable consequence of any public use program, regardless of the activity involved. Obviously, some activities innately have the potential to be more disturbing than others. The management actions to be implemented have been carefully planned to avoid high levels of impact. As currently proposed, the known and anticipated levels of disturbance associated with management actions are considered minimal and well within the tolerance levels of known wildlife species and populations present in the area.

Implementing the Service's management action is not expected to have any significant adverse effects on wetlands and floodplains, pursuant to Executive Order 11990 and 11988, because there would be no development of refuge facilities within wetland or floodplain areas. There would be no adverse effect on threatened, endangered, proposed or candidate species and/or critical habitat, as documented in the intra-Service Section 7 (Endangered Species) Consultation completed with the Oklahoma Ecological Services Field Office and signed on November 15, 2012. In addition, archeological and/or historical resources would not be impacted.

The Refuge considered other past, present, or reasonably foreseeable future planned actions and no significant cumulative impacts would result from the addition of the proposed refuge management actions, as outlined in Alternative B.

PUBLIC OUTREACH, REVIEW AND COMMENT

Development of the Ozark Plateau National Wildlife Refuge CCP has been coordinated with all interested and/or affected parties.

Formal scoping began with publication of a notice of intent to prepare a comprehensive conservation plan and environmental assessment in the *Federal Register* on June 19, 1998 (63 FR 33693). The Refuge solicited public comments on issues and concerns to aid in CCP development through three open house meetings held in December 2009 at the Tribal Headquarters of the Cherokee Nation in Tahlequah, Oklahoma; the Senior Center in Stilwell, Oklahoma; and the Delaware County Library in Jay, Oklahoma. The Refuge also met on March 3, 2010, with the Cherokee Nation Environmental Protection Commission at the Cherokee Nation Headquarters to understand issues concerning the tribe and discuss potential ways to collaborate on solving issues common to the two agencies. On March 4, 2010, the Refuge met with the Oklahoma Department of Wildlife Conservation staff at the Porter Office in Oklahoma also to discuss their concerns regarding past management, future management, and issues common to both agencies. The feedback received at the conclusion of the public scoping period identified numerous concerns from a variety of stakeholders. This input was used in preparation of the Draft CCP.

The public was notified of the release of the Draft CCP and EA with a Notice of Availability published in the *Federal Register*, Vol. 78, No. 27, on February 8, 2013 ([FWS-R2-R-2012-N277] FR00001273). A postcard also was mailed to everyone on the Refuge mailing list notifying them of the Draft Plan/EA public review process. In addition, the Refuge also advertised in various media outlets (local newspapers and local and national social media sites)

and by posting fliers at local community centers and libraries. The public comment period was open for 30 days, closing on March 8, 2013. The Ozark Plateau NWR hosted three public meetings on February 25, February 26 and February 28, 2013 in the towns of Jay, Stilwell, and Tahlequah, Oklahoma. Approximately 36 participants attended these meetings. The Service received a total of 64 comments (letters, emails, and comments submitted orally and on comment forms during the public meetings). The comments were thoroughly reviewed and addressed in Appendix K (Response to Comments) of the CCP. The CCP did not change substantially based on public comment.

FINDINGS

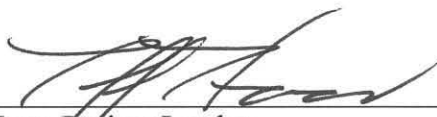
Based on the analysis documented in the environmental assessment and with due consideration given to comments from the public and through consultation with the State of Oklahoma, it is my determination that the proposed action does not constitute a major Federal action that will have a significant effect on the quality of the human environment under the meaning of Section 102 (2) (C) of the National Environmental Policy Act of 1969 (as amended). As such, it is my conclusion that an environmental impact statement is not required for this plan and the selected alternative may be implemented as soon as practicable. This determination is based on the following factors (40 C.F.R. 1508.27), as addressed in the attached Environmental Assessment.

1. Both beneficial and adverse effects have been considered and this action will not have a significant effect on the environment (Environmental Assessment, pages A-77 – A-122).
2. The actions will not have a significant effect on public health and safety (Environmental Assessment, pages A-110 – A-114).
3. The project will not significantly affect any unique characteristics of the geographic area such as proximity to historical or cultural resources, wild and scenic rivers, or ecologically critical areas (Environmental Assessment, pages A-110 – A-111).
4. The effects on the quality of the human environment are not likely to be highly controversial (Environmental Assessment, pages A-78 – A-123).
5. The actions do not involve highly uncertain, unique, or unknown environmental risks to the human environment (Environmental Assessment, pages A-78 – A-123).
6. The actions do not establish a precedent for future actions with significant effects nor do they represent a decision in principle about a future consideration (Appendix A, Environmental Assessment).
7. There will be no cumulatively significant impacts on the environment. Cumulative impacts have been analyzed with consideration of other similar activities on adjacent lands, in past action, and in foreseeable future actions (Environmental Assessment, pages A-114 – A-123).
8. The actions will not significantly affect any site listed in, or eligible for listing in, the National Register of Historic Places, nor will they cause loss or destruction of significant

scientific, cultural, or historic resources (Environmental Assessment, pages A-110 – A-111).

9. The actions are not likely to adversely affect threatened or endangered species, or their habitats (Environmental Assessment, pages A-103 – A-106); Appendix F: Intra-Service Section 7 Consultation).
10. The actions will not lead to a violation of federal, state, or local laws imposed for the protection of the environment (Environmental Assessment, pages A-8).

Recommended:


Jeff Haas, Project Leader
Sequoyah and Ozark Plateau National Wildlife Refuges

4/24/13
Date

Approved:


Dr. Benjamin N. Tuggle, Regional Director
U.S. Fish and Wildlife Service, Region 2

9/12/13
Date

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Appendix B. Compatibility Determinations

Compatibility determinations are included in this appendix. The following uses were found to be appropriate and evaluated to determine their compatibility with the mission of the Refuge System and the purposes of Refuge:

- Environmental Education
- Interpretation
- Wildlife Observation and Photography
- Hunting
- Wood Harvasting

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Compatibility Determination

USE: Environmental Education (EE)

REFUGE NAME: Ozark Plateau National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITY:

- Fish and Wildlife Act of 1956
- Endangered Species Act of 1973

REFUGE PURPOSE(S):

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants” ... 16 U.S.C. 1534 (Endangered Species Act of 1973)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . ” 16 U.S.C. 742(a)(4) and “ . . . for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . ” 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

Ozark Plateau National Wildlife Refuge was established to:

- Prevent the extinction and aid in recovery of federally-listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds;
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee])

DESCRIPTION OF USE:

(a) What is the use?

In accordance with 605 FW 6, environmental education (EE) is a process designed to teach citizens and visitors the history and importance of conservation and the biological and the scientific knowledge of our Nation's natural resources and incorporates on-site, off-site and distance learning materials, activities, programs and products that address the audience's course of study, refuge purposes, physical attributes, ecosystem dynamics, conservation strategies, and the Refuge System mission (605 FW 6.6.D). EE involves courses of study, curriculum, and educational assistance (605 FW 6.6. A through C).

The Refuge staff collaborates with multiple organizations to provide "place-based" and "nature-based" experiential mentoring techniques, training, and educational support including EE topics of geology, biology, ecology, or Native American cultural and environmental studies, for schools, youth groups, nongovernmental organizations (NGOs), universities, and tribes, conducting workshops, classes and other curriculum-based courses of study.

While adhering to a properly outlined curriculum, these programs are predominantly weekend, overnight classes or workshops with the primary goal to connect people to the natural world around them, especially the Ozark cave, karst, and forest resources. Participants experience first-hand the wildlife and habitat representative of the Ozark Highlands ecoregion.

(b) Where is the use conducted?

The Refuge hosts most of their EE programs on the 95-acre, Mary and Murray Looney Unit (Looney Unit), as per deed restrictions. Unlike the typical classroom setting, the Refuge's EE programs and workshops are conducted primarily in the outdoors. The Looney Unit's diverse habitats include Spavinaw Creek and its tributaries, riparian zones, losing streams (a stream that has a permeable bed through which water can seep to the water-table), natural springs, caves, hardwood bottomland floodplains and oak-hickory-pine upland forests offer great spaces for place-based learning of Ozark Highlands ecoregion and karst resources (encyclopedia.com).

The Mary & Murray Looney Education & Research Center (MMLERC), a renovated cabin located on the Looney Unit, is utilized as the initial gathering place, for registration, some lectures, and preparing food for participants. The Refuge also proposes to use the associated pavilion and deck, adjacent to the January-Stansberry cave creek, for an outdoor facility for EE workshops, once it is renovated.

The Refuge also will consider future EE programs to be held on appropriate newly acquired lands in the future, by special use permit only.

Participants access Ozark Plateau NWR representative habitats utilizing approximately 0.6 miles of primitive nature trails. The Refuge proposes to establish an additional 2 miles of primitive trails (without mechanical clearing or removing trees) around the perimeter of the Looney Unit and improve the trail from MMLERC to Pavilion and Spavinaw Creek. The Refuge also proposes to improve the trail (0.25-mile) from the Looney maintenance shop, located at the Guess House (where there is an overflow parking area) to the MMLERC as well as improve the 0.1 mile primitive trail from the parking/camping area on top of the hill down to the MMLERC to ensure safety.

As part of an overnight EE program, participants camp on approximately 3 acres of designated primitive campsites (no vegetation is removed) with one centralized fire ring, located on top of the hill of the Looney Unit, adjacent to the power line right-of-way cutover, (0.25-mile west of the MMLERC). This primitive camping area does not offer amenities such as water, electricity, sewage, or camping platforms. The fire ring is an important centralized place for team-building interactions, as well as reflection and discussion of EE topics.

Cave entry for EE programs is prohibited due to concerns about white-nose syndrome (WNS), a new disease affecting hibernating bats. The fungus believed to be the causative agent of WNS, *Geomyces destructans*, is transmitted primarily through bat-to-bat contact. However, evidence suggests that inadvertent human-assisted movement of fungal spores on clothing, footwear, or gear could play a role in the spread of WNS. Therefore, the Refuge will maintain a controlled cave entry policy (closed to the public) as a necessary management action to help prevent the spread of this disease. Therefore, cave EE programs are limited to the exterior of the cave entrance to conduct EE classes pertaining to karst ecology. Should future Service guidance indicate that refuge caves may be reopened to public entry, the Refuge will consider limited use of caves for EE programs.

(c) When is the use conducted?

Currently, EE programs on the Looney Unit are limited to 10-20 people, 2 or 3 times per month in the spring and fall, 1 or 2 times per month in the summer, and approximately once per month in the winter depending on staff time and availability. However, the Refuge proposes to increase EE visitation within the lifetime of this Comprehensive Conservation Plan (CCP) to 50-100 people per week, with 3-4 visits per week in spring, fall, and summer, and approximately 10-20 people per week with 1-2 visits per week in winter, if increased staff and funding becomes available.

A special use permit will be required for EE programs held on appropriate future acquired lands. The remaining units will continue to be closed to public use.

(d) How is the use conducted?

EE programs are conducted in cooperation with local residents, NGOs, schools, universities, State agencies, Tribal Nations, and Federal agencies (for a full list of partners and subsequent acronyms, see Chapter 5: Table 5-1 of the Final CCP).

The Refuge and its partners have somewhat of a symbiotic relationship in the fact that its partners have the constituents to be able to bring people to the Refuge for these programs (public outreach methods/resources) and to lead the programs (teachers, expertise, curriculum), while the Refuge provides the land-base and logistical support that these agencies need to use for the EE programs.

Currently, the Refuge partners with NGO, Ozark Tracker Society to provide monthly EE programs at MMLERC, following curriculum on ethno-botanical knowledge, edible/medicinal identification/properties, tincture-making, bird language, primitive fire-making, “coyote mentoring” programs, increasing comfort in the wild (nature journaling, hazards identification), tracking (scat, tracks identification), tanning deer-hides, bow drill/hand drill-making, primitive shelter-making, and wilderness survival skills. The Refuge also partners with tribal entities to conduct EE programs for tribal youth to improve communication in native language and promote cultural resources, including healthy living and cooking using native/natural edible plants. The Refuge proposes to construct and maintain an ethno-botanical showcase area to enhance these programs. There are also many more partner-sponsored and partner-led EE programs including BSA (eagle scout projects, badges), GSA (badges), the Missouri Chimney Safety Council (continuing education credits), TNC (wildlife identification, native seed collection education programs), Land Legacy and NRCS (conservation easement education and resources of Spavinaw Creek), ODWC (game wardens provide hunting education for licensure program), Blue Thumb (water quality education monitoring program), and NSS/BCI (cave gate construction education). The Refuge proposes to collaborate and partner with many more NGOs and other agencies in the future in order to offer additional EE programs.

Collegiate-level classes and field trips, by participating universities (such as OSU, OU, RSU, NSU, UCO, SEOSU, UA, University of Southern Mississippi, University of Missouri, Missouri State University, and John Brown University) are conducted on-site by using Refuge resources or in cooperation with adjacent landowners who allow the classes on private lands. The Refuge encourages collaboration with any willing university to create additional EE programs and opportunities in the future. Furthermore, the Refuge proposes to provide a Teacher Continuing Education and General Education Credits Program on the Refuge.

The Refuge encourages local public and private K-12 school classes to utilize the Refuge and MMLERC for Ozark Highland ecoregion, cave and karst lessons, and bat studies. The Refuge would also like to offer after- and home-school student EE programs.

In conjunction with their EE partners, Refuge staff would like to develop curriculum and workbook documents for current and future EE programs. In order to improve EE on the Refuge, it proposes to conduct program evaluation in order to determine effectiveness of current EE programs and better design future programs.

(e) Why is this use being proposed?

The Refuge was established to "...provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks". In addition, during scoping, many local members of the public and tribes expressed interest in having more EE programs on the Refuge.

Increased urbanization in northwest Arkansas and in northeast Oklahoma is having detrimental effects on the Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. Many people from these areas are also unaware of the large and delicate cave (subterranean) ecosystems and native wildlife species that lie underneath their feet. EE programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and understand the importance of their local ecosystems, and be able to pass on that knowledge to future generations.

AVAILABILITY OF RESOURCES:

EE programs are being held at the recently renovated MMLERC, a 1,200 square feet, renovated cabin with one meeting room, one office, 2 bathrooms, one sleeping room, a kitchen, and a large front porch. The MMLERC is accessible by wheelchair from the parking lot to the cabin; however, the bathrooms are currently inaccessible. In order to improve the quality of the interpretation programs at the MMLERC, the Refuge proposes to renovate the roof, add insulation in the roof attic (\$15K install + maintenance), renovate the cabin exterior (replace logs and grout, seal the exterior, paint exterior trim, and repair the retaining wall behind the cabin) (\$45K labor + maintenance), add monitored alarm system (\$10K install + maintenance), renovate the front door and one accessible bathroom/shower for wheelchairs (\$10K install + maintenance), renovate flooring of porch (\$5K install + maintenance), replace plumbing system (\$5K install + maintenance), and finally, install energy-efficient exterior storm windows (\$5K install + maintenance). In addition, the outdoor pavilion (300 square feet enclosed studio space and 200 square feet outdoor patio) needs to be renovated, including expansion of the outdoor patio space to 500 sq. feet that would also bridge the stream in a previously-disturbed site (\$50K labor + maintenance).

To get to the MMLERC, there is a Looney Unit public access drive, which is currently 0.25-miles, unpaved and unimproved (dirt/rock), with a gate. There is an unpaved parking area

(power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available at the Guess Unit (150 yards). With the anticipation of an increase in visitation to the Refuge, it proposes to widen the Looney Unit access drive by 2 feet and improve road and parking area surfaces with gravel (\$20K capital).

There are 0.5-1.0 miles of primitive trails currently used by EE participants on the Refuge. In order to create more hiking/walking opportunities for large groups to participate in place-based education programs, the Refuge proposes to establish a 0.25-mile mostly primitive trail to connect Spavinaw Creek trail to the Guess house trail (\$5K capital for repavement/rakes/shovels/gloves), build a new 2-mile primitive trail (no clearing or removing of trees or large shrubs) around the perimeter of the Looney Unit (\$10K labor + capital), improve the 0.1-mile trail from MMLERC to pavilion (\$5K capital), the 0.25-mile trail from the Looney maintenance shop to the MMLERC (\$5K capital) and improve the 0.1 mile primitive trail from the parking/camping area on top of the hill down to the MMLERC to ensure safety (\$5K capital). The Refuge would also like to install 3 primitive overlook areas on the Looney Unit perimeter trail, which may be used as stopping points during an EE lesson (\$15K capital).

The Refuge owns a limited amount of specialized safety equipment and equipment for caving (\$10K) for visitors, but would like to acquire more, especially if safety protocols for prevention of WNS deem necessary.

Staff oversight is required for implementing and monitoring EE programming and activities. However, currently the Refuge has no funding in their Visitor Services budget for EE programs, therefore, the Refuge has to write grants, oversee contracting, and do all that is necessary to provide funding to its partnering NGOs in order to provide all current EE programming and staffing needs. Refuge staff is available for all on-site EE programs to provide logistical support and assist partners in program instruction. The Refuge also provides material support, including field guides and other Ozark resource references, audio-visual equipment, and ensuring the proper functioning of the MMLERC. The Refuge's funding to support NGO-led EE programs varies year to year. In 2011, the Refuge spent approximately \$12K for the OTS-led programs, which comes from either Challenge Cost Share or other grants (none comes from Refuge budget). The Refuge attempts to get more grant funding for other NGO-led EE programs such as Missouri Chimney Safety Council, and Blue Skywater, when available. In conjunction with these EE programs, approximately 1,000 volunteer hours are recorded each year. In order to guarantee consistency annually in Refuge EE programs for local participants, the Refuge would need dedicated annual funding for its EE programs. An Outdoor Recreation Planner (GS-7/9/11) would be a necessary addition to Refuge staff in order to improve the quality of current EE programs and to plan, develop, lead, and evaluate future programs.

Public outreach needs improvement to increase participation of EE programs. No pamphlets or fliers about the Refuge are currently available however the Refuge proposes to create a flier/brochure to advertise visitor services opportunities, including EE opportunities, at the MMLERC. The Refuge also plans to update their websites (<http://www.fws.gov/southwest/refuges/oklahoma/Ozark/> and <http://www.fws.gov/refuges/profiles/recEdMore.cfm?ID=21645>) to inform the public of current and upcoming EE program opportunities, including contact and location information (while cave locations continue to remain confidential).

ANTICIPATED IMPACTS OF THE USE:

Short-term Impacts:

EE activities occurring on surface habitats may have only temporary or negligible adverse impacts on Refuge trust resources.

EE participants remaining on- or off-trail, will have some short-term direct impacts to the environment including: trampling of native vegetation on the bottomland and/or upland forest; disturbance to wildlife (including noise from large groups of people and light pollution due to headlamps used for overnight camping); shifting of rocks on trails; and compaction of soils.

Renovation plans at the MMLERC (widening of the Looney Unit public access road by 2-feet for 0.25-mile, and establishing a gravel parking lot) will cause short-term impacts only during the construction including: loud levels of noise pollution due to use of mechanical equipment, a temporary increase in CO₂ emissions, and fugitive dust.

Long-Term Impacts:

Widening of the Looney Unit public access road by 2-feet for 0.25-mile will require the removal of vegetation, rocks, top soil, and possibly trees. Establishing a gravel parking lot will allow for a better established parking area, which will prevent visitors from parking in the grass on the side of the road, and will help control soil erosion. In order to establish a primitive trail to connect Spavinaw Creek trail to Guess House trail, some boulders and old concrete will be removed (200 ft.), affecting the physical area.

Increasing visitation permits for future EE programs on the Looney Unit and additional appropriate acquired units, is going to increase human traffic to those areas, which will expose many cave locations to the public. Exposure to cave locations could increase the potential of cave vandalism or break-ins. An increase in human traffic could also increase the amount of trash found on the Refuge. However, these are both unlikely scenarios for this wildlife-dependent use since EE programs aim to encourage people to participate in Leave No Trace (LNT) ethics and to leave participants with an enduring understanding of the importance of cave and karst ecosystems within the Ozarks ecoregion.

Cumulative Impacts:

Cumulatively, current and future EE programs will have beneficial impacts on surrounding communities by increasing community partnerships, increasing environmental knowledge, and especially, for giving present and future generations an opportunity to connect with nature. EE programs at Ozark Plateau NWR are meant to leave visitors with a life-long appreciation and respect for the environmental communities surrounding them and to gain support for U.S. Fish & Wildlife Service conservation efforts. These programs could lead to future conservation easement programs, acquisition of important areas from willing sellers, and instill the value of our environment in future leaders.

PUBLIC REVIEW AND COMMENT:

This compatibility determination for Ozark Plateau NWR was made available for public review and comment in conjunction with the public comment period for the Refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on this compatibility determination were invited and due by March 8, 2013.

DETERMINATION (CHECK ONE BELOW):

- ☐ Use is not compatible
☒ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure that environmental education remains a compatible use on Ozark Plateau National Wildlife Refuge, the following stipulations are necessary:

- The Looney Unit and the MMLERC is used for EE programs by permit only, issued by Refuge staff
- Vehicle and/or all-terrain vehicle use off-road is restricted to prevent damage to Refuge resources
- Cave entry will remain closed due to the potential of spreading WNS to bat species
- If deemed appropriate, EE activities may not require Refuge staff supervision
- Primitive camping is allowed only in a designated area on the MMLERC, in conjunction with EE programs, by permit only, issued by Refuge staff
- The designated centralized fire pit at the MMLERC is the only outdoor fire area in conjunction with EE programs, by permit only (permits only given on low-fire hazard days), issued by Refuge staff
- Campers are responsible for their campfires and shall not leave them unattended
- The Refuge must provide firewood for the fire pit in order to prevent invasive species, pests, and diseases from spreading to the Refuge
- No man-made objects are allowed in fire pit
- Collection of plants or animals, or feeding or disturbing wildlife, is prohibited

- Public use trends and associated impacts from human activity will continue to be monitored. If significant increases in use occur, and/or if impacts to resources are determined significant, the program will be reevaluated and modified as necessary to ensure compatibility.

JUSTIFICATION: These programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. Environmental education is a wildlife-dependent, priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. The USFWS strives to provide priority public uses when compatible with the purposes of the Refuge and the mission of the System. Facilities and activities related to environmental education occur in designated areas of the Refuge, leaving large areas of undisturbed habitat available for wildlife. The stipulations outlined above are specifically designed to and should minimize potential impacts of these activities. The Refuge will continue to monitor uses and adjust programs as necessary to protect Refuge resources. The awareness, enjoyment and education gained from these activities are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that environmental education, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for environmental education has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System.

SIGNATURE:

Refuge Manager

Richard Strick 04/24/13
(Signature and Date)

CONCURRENCE: Regional Chief

[Signature] 9/4/13
(Signature and Date)

MANDATORY 10- OR 15-YEAR RE-EVALUATION DATE: 2028

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Compatibility Determination

USE: Interpretation

REFUGE NAME: Ozark Plateau National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITY:

- Fish and Wildlife Act of 1956
- Endangered Species Act of 1973

REFUGE PURPOSE(S):

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants” ... 16 U.S.C. 1534 (Endangered Species Act of 1973)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . ” 16 U.S.C. 742(a)(4) and “ . . . for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . ” 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

Ozark Plateau National Wildlife Refuge was established to:

- Prevent the extinction and aid in recovery of federally-listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds;
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee])

DESCRIPTION OF USE:

(a) What is the use?

In accordance with 605 FW 7, interpretation programs are activities, talks, publications, audio-visual media, signs and exhibits that convey key natural and cultural resource messages to visitors (605 FW 7.5.C). Interpretation provides opportunities for visitors to make their own connections to the resource (605 FW 7.7).

The Refuge provides interpretation programs that are primarily discussions and/or hikes interpreting natural and cultural information regarding the Ozark ecoregion, karst ecosystem, water resources, Native American cultural resources, ethnobotanical plants, federally listed threatened and endangered species, species of concern, game and nongame species, and migratory birds (including bird language). Programs may also include cave technology demonstrations.

(b) Where is the use conducted?

On-site, the Refuge hosts most of their interpretation programs on the 95-acre, Mary and Murray Looney Unit (Looney Unit), as per deed restrictions. Unlike the typical classroom setting, the Refuge's interpretive programs and workshops are conducted primarily in the outdoors. The Looney Unit's diverse habitats include Spavinaw Creek and its tributaries, riparian zones, losing streams (a stream that has a permeable bed through which water can seep to the water-table), natural springs, caves, hardwood bottomland floodplains and oak-hickory-pine upland forests offer great spaces for place-based learning of Ozark Highlands ecoregion and karst resources (encyclopedia.com).

The Mary & Murray Looney Education & Research Center (MMLERC), a renovated cabin located on the Looney Unit, is utilized as the initial gathering place, for registration, some lectures, and preparing food for participants. The Refuge also proposes to use the associated pavilion and deck, adjacent to the January-Stansberry cave creek, for an outdoor facility for interpretation workshops, once it is renovated.

The Refuge also will consider future interpretation programs to be held on appropriate newly acquired lands in the future, by special use permit only.

Participants access Ozark Plateau NWR representative habitats utilizing approximately 0.6 miles of primitive nature trails. The Refuge proposes to establish an additional 2 miles of primitive trails (without mechanical clearing or removing trees) around the perimeter of the Looney Unit and improve the trail from MMLERC to Pavilion and Spavinaw Creek. The Refuge also proposes to improve the trail (0.25-mile) from the Looney maintenance shop, located at the Guess House (where there is an overflow parking area) to the MMLERC as well as improve the

0.1 mile primitive trail from the parking/camping area on top of the hill down to the MMLERC to ensure safety.

Cave entry for interpretation programs is prohibited due to concerns about white-nose syndrome (WNS), a new disease affecting hibernating bats. The fungus believed to be the causative agent of WNS, *Geomyces descriptans*, is transmitted primarily through bat-to-bat contact. However, evidence suggests that inadvertent human-assisted movement of fungal spores on clothing, footwear, or gear could play a role in the spread of WNS. Therefore, the Refuge will maintain a controlled cave entry policy (closed to the public) as a necessary management action to help prevent the spread of this disease. Therefore, cave interpretive programs are limited to the exterior of the cave entrance to conduct interpretation programs pertaining to karst ecology. Should future Service guidance indicate that refuge caves may be reopened to public entry, the Refuge will consider limited use of caves for interpretation programs.

Off-site, Refuge staff provides approximately one interpretive talk (delivering same on-site messages) per month at schools, civic centers, organizational meetings, state park events, festivals/fairs, wildlife expos, and tribal pow-wows, using power point presentations with many visual photographs of Refuge resources.

(c) When is the use conducted?

On-site, the Refuge provides approximately one interpretive program per month (highest visitation occurs in the summer and fall) to approximately 25 people per event at the Looney Unit/MMLERC.

Off-site, Refuge staff also provides approximately one interpretive talk per month, to a varying audience size from five to several hundred people. The Refuge wants to improve current interpretive programs and considers increasing a limited number of interpretive programs in the future.

In addition, a special use permit will be required for interpretation programs that are held on appropriate future acquired lands. The remaining units will continue to be closed to public use.

(d) How is the use conducted?

These programs are mostly interpretive talks, with the use of technology focusing on bats (thermal imaging, night vision, infrared, anabat acoustic detectors), and short interpretive hikes that primarily interpret natural and cultural information regarding the Ozark ecoregion, cave and karst ecosystem, water resources, Native American cultural resources, federally listed species, species of concern, game and nongame species, and migratory birds.

The Refuge and its partners have somewhat of a symbiotic relationship in the fact that its partners have the constituents to be able to bring people out (public outreach methods/resources) and to perform the programs (leaders, hosts), while the Refuge provides the lands and logistical support that these agencies need to use for interpretation programs. For a full list of partners and associated acronyms, see Chapter 5, Table 5-1 of the Final CCP.

Local NGOs participate and host on-site interpretive talks or programs. Audubon Society hosts some interpretive presentations on birds and bird identification, while Campfire USA hosts interpretive talks about cave resources and cave rescue. In addition to their extensive EE programming, the Refuge also offers many interpretive talks to connect visitors with positive emotions and experiences regarding the Ozark ecoregion, karst ecosystem, water resources, Native American cultural resources, ethnobotanical plants, federally-listed species, species of concern, game and nongame species, and migratory birds (including bird language). Most of these programs or talks are conducted in cooperation with local residents, TNC (The Nature Conservancy), Ozark Tracker Society, NSS (National Speleological Society), Campfire USA, Bat Conservation International (BCI), Becoming an Outdoors Woman (BOW), Boy Scouts of America (BSA), Girl Scouts of America (GSA), Tulsa Audubon Society, Land Legacy, Blue Thumb, Oklahoma Academy of Science, the Wildlife Society, American Fisheries Society, homeschoolers, local public and private schools, Wilderness Awareness School, Rogers State University, Northeastern State University, University of Arkansas, OSU, John Brown University, University of Oklahoma, Oklahoma Department of Wildlife Conservation (ODWC), the tribes, Natural Resource Conservation Service (NRCS), and other agencies/organizations.

On-site, The Refuge proposes to conduct resource interpretation programs to local public, private, and homeschool, K-12 school classes at the MMLERC and Refuge units stated above, in cooperation with local school teachers and interpretive volunteers.

The Refuge also proposes to promote sustainability on-site by showcasing green technologies and sustainable-living methods. The Refuge will demonstrate the use of solar power, which is planned to be installed on the Looney Unit, and discuss the importance of renewable energy in its interpretive programs. In addition, the Refuge would like to demonstrate the practical use of a rainwater collection system and the use of native fruiting and flowering plants and shrubs that can be utilized for landscaping, while also having edible and/or medicinal properties, as well as benefit native wildlife.

Off-site, Refuge staff hosts information booths and makes presentations at public shows, such as at the *Bat-o-Rama* at Devil's Den State Park (Arkansas), the Illinois River Festival and the Wildlife Expo in central Oklahoma. In addition, Refuge staff conducts visits to local K-12 schools, especially in October, to make presentations on bats during the Halloween season. Most of these off-site talks regard the same presentations as on-site.

In conjunction with their partners, Refuge staff would like to develop handouts or fliers for public outreach, advertising of the MMLERC, and general information about the Refuge's cave and karst resources.

(e) Why is this use being proposed?

Increased urbanization in northwest Arkansas and in northeast Oklahoma is having detrimental effects on the Ozark ecoregion. Most people are not conscious of their direct impacts to the environment, and how those, in turn, affect their own lands, water, and resources that they depend on. Many people from these areas are also unaware of the large and delicate cave (subterranean) ecosystems and native wildlife species that lie underneath their feet.

Interpretation programs on Ozark Plateau NWR are crucial in order for both urban and rural people of this region to have an opportunity to experience a connection to and understand the importance of their local ecosystems, and be able to pass on that knowledge to future generations.

AVAILABILITY OF RESOURCES:

Interpretation programs are being held at the recently renovated MMLERC, a 1,200 square feet, renovated cabin with one meeting room, one office, 2 bathrooms, one sleeping room, a kitchen, and a large front porch. The MMLERC is accessible by wheelchair from the parking lot to the cabin; however, the bathrooms are currently inaccessible. In order to improve the quality of the interpretation programs at the MMLERC, the Refuge proposes to renovate the roof, add insulation in the roof attic (\$15K install + maintenance), renovate the cabin exterior (replace logs and grout, seal the exterior, paint exterior trim, and repair the retaining wall behind the cabin) (\$45K labor + maintenance), add monitored alarm system (\$10K install + maintenance), renovate the front door and one accessible bathroom/shower for wheelchairs (\$10K install + maintenance), renovate flooring of porch (\$5K install + maintenance), replace plumbing system (\$5K install + maintenance), and finally, install energy-efficient exterior storm windows (\$5K install + maintenance). In addition, the outdoor pavilion (300 square feet enclosed studio space and 200 square feet outdoor patio) needs to be renovated, including expansion of the outdoor patio space to 500 sq. feet that would also bridge the stream in a previously-disturbed site (\$50K labor + maintenance).

In order to use renewable resources to power the Refuge and conduct interpretive programs regarding sustainability, the Refuge proposes to install solar panels on the Looney Unit (\$40K installation + maintenance). The Refuge also proposes to install a rainwater collection system up by the Looney maintenance shop and construct a 35'x35' circular area, containing 8 individual raised beds garden of native edible/medicinal herbs and plants.

To get to the MMLERC, there is a Looney Unit public access drive, which is currently 0.25-miles, unpaved and unimproved (dirt/rock), with a gate. There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available at the Guess unit (150 yards). With the anticipation of an increase in visitation to the Refuge, it proposes to widen the Looney Unit access drive by 2 feet and improve road and parking area surfaces with gravel (\$20K capital).

There are 0.5-1.0 miles of primitive trails currently used by interpretation participants on the Refuge. In order to create more hiking/walking opportunities for large groups to participate in place-based education programs, the Refuge proposes to establish a 0.25-mile mostly primitive trail to connect Spavinaw Creek trail to the Guess house trail (\$5K capital for repavement/rakes/shovels/gloves), build a new 2-mile primitive trail (no clearing or removing of trees or large shrubs) around the perimeter of the Looney Unit (\$10K labor + capital), improve the 0.1-mile trail from MMLERC to pavilion (\$5K capital), the 0.25-mile trail from the Looney maintenance shop to the MMLERC (\$5K capital) and improve the 0.1 mile primitive trail from the parking/camping area on top of the hill down to the MMLERC to ensure safety (\$5K capital). The Refuge would also like to install 3 primitive overlook areas on the Looney Unit perimeter trail, which may be used as stopping points during an interpretive talk (\$15K capital).

The Refuge plans to install and improve interpretation signs and displays (\$25K capital; 0.1 FTE ORP (GS-9/11)). The Refuge plans to construct a new sign at the MMLERC cabin to say “Mary & Murray Looney Education & Research Center”. The Refuge proposes to create limited interpretive signage on the new perimeter nature trail at the Looney Unit. The Refuge also wants to create displays regarding historical caving equipment and materials, a Refuge survey map of the AD-14 cave interior, and other interpretive and educational information for inside the MMLERC. The Refuge would continue to maintain resources confidentiality by not posting public use signs at unit entrances and/or on public access roadways, except for a small sign marking the “Refuge Headquarters”, where appropriate.

The Refuge owns a limited amount of specialized safety equipment and equipment for caving (\$10K) for visitors, but would like to acquire more, especially if safety protocols for prevention of WNS deem necessary.

Staff oversight is required for implementing and monitoring interpretation programming and activities. However, currently the Refuge has no funding in their Visitor Services budget for interpretive programs, therefore, the Refuge has to write grants, oversee contracting, and do all that is necessary to provide funding to its partnering NGOs in order to provide all current interpretation opportunities on the Refuge. Refuge staff is available for all on-site interpretive programs to provide logistical support and assist partners in program instruction. The Refuge also provides material support, including field guides and other Ozark resource references,

audio-visual equipment, and ensuring the proper functioning of the MMLERC. Currently, the Refuge's funding to support NGO-led interpretation programs varies year to year. In conjunction with interpretation and EE programs, approximately 1,000 volunteer hours are recorded each year. In order to guarantee consistency annually in Refuge interpretation programs for visitors, the Refuge would need dedicated annual funding for its interpretive programs. An Outdoor Recreation Planner (GS-7/9/11) would be a necessary addition to Refuge staff in order to improve the quality of current interpretation programs and to plan, develop, coordinate, and evaluate future programs.

Public outreach needs improvement to increase participation of interpretive programs (\$5K per year; Outdoor Recreation Planner GS-7/9/11). No pamphlets or fliers about the Refuge are currently available however the Refuge proposes to create a flier/brochure to advertise visitor services opportunities, including interpretation opportunities, at the MMLERC. The Refuge also plans to update their website (<http://www.fws.gov/southwest/refuges/oklahoma/Ozark/> and <http://www.fws.gov/refuges/profiles/recEdMore.cfm?ID=21645>) to inform the public of current and upcoming interpretation program opportunities, including contact and location information (while cave locations continue to remain confidential). In addition, the Refuge would stream an online live video of bats within a cave, for interpretation purposes.

ANTICIPATED IMPACTS OF THE USE:

Short-term Impacts:

Interpretation activities occurring only on surface habitats may have negligible or short-term adverse impacts on Refuge trust resources. On the other hand, the programs would have beneficial impacts to visitors and local communities.

Interpretation participants remaining on- or off-trail, will have some short-term direct impacts to the environment including: trampling of native vegetation on the bottomland and/or upland forest; disturbance to wildlife (including noise from large groups of people and light pollution due to headlamps used for overnight camping); shifting of rocks on trails; and compaction of soils.

Renovation plans at the MMLERC (widening of the Looney Unit public access road by 2-feet for 0.25-mile, and establishing a gravel parking lot) will cause short-term, temporary impacts only during the construction including: loud levels of noise pollution due to use of mechanical equipment; increase in CO₂ emissions; and fugitive dust.

Long-Term Impacts:

Widening of the Looney Unit public access road by 2-feet for 0.25-mile will require the removal of vegetation, rocks, top soil, and possibly trees. Establishing a gravel parking lot will allow for a better established parking area, which will prevent visitors from parking in the grass on the side

of the road, and will help control soil erosion. In order to establish a primitive trail to connect Spavinaw Creek trail to Guess House trail, some boulders and old concrete will be removed (200 ft.), affecting the physical area.

Increasing visitation permits for future interpretation programs on the Looney Unit and additional appropriate acquired units, is going to increase human traffic to those areas, which will expose many cave locations to the public. Exposure to cave locations could increase the potential of cave vandalism or break-ins. An increase in human traffic could also increase the amount of trash found on the Refuge. However, these are both unlikely scenarios for this wildlife-dependent use since interpretive programs aim to encourage people to participate in Leave No Trace (LNT) ethics and to leave participants with an enduring understanding of the importance of cave and karst ecosystems within the Ozarks ecoregion.

Cumulative Impacts:

Cumulatively, current and future interpretation programs will have a beneficial impact on surrounding communities by increasing community partnerships, increasing environmental knowledge, and especially, for giving present and future generations an opportunity to connect with nature. Interpretation programs are meant to leave visitors with a life-long appreciation of the outdoors and of U.S. Fish & Wildlife Service conservation efforts. These programs could lead to future conservation easement programs, acquisition of important areas from willing sellers, and instill the value of our environment in future leaders.

PUBLIC REVIEW AND COMMENT:

This compatibility determination for Ozark Plateau NWR was made available for public review and comment in conjunction with the public comment period for the Refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on this compatibility determination were invited and due by March 8, 2013.

DETERMINATION (CHECK ONE BELOW):

☐ Use is not compatible
☒ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure that Environmental Education remains a compatible use on Ozark Plateau National Wildlife Refuge, the following stipulations are necessary:

- The Looney Unit and the MMLERC is used for interpretive programs by permit only, issued by Refuge staff
- Vehicle and/or all-terrain vehicle use off-road is restricted to prevent damage to Refuge resources
- Cave entry will remain closed due to the potential of spreading WNS to bat species

- If deemed appropriate, interpretation activities may not require Refuge staff supervision
- Primitive camping is allowed only in a designated area on the MMLERC, in conjunction with EE or interpretation programs, by permit only, issued by Refuge staff
- The designated centralized fire pit at the MMLERC is the only outdoor fire area in conjunction with EE/interpretation programs, by permit only (permits only given on low-fire hazard days), issued by Refuge staff
- Campers are responsible for their campfires and shall not leave them unattended
- The Refuge must provide firewood for the fire pit in order to prevent invasive species, pests, and diseases from spreading to the Refuge
- No man-made objects are allowed in fire pit
- Collection of plants or animals, or feeding or disturbing wildlife, is prohibited
- Public use trends and associated impacts from human activity will continue to be monitored. If significant increases in use occur, and/or if impacts to resources are determined significant, the program will be reevaluated and modified as necessary to ensure compatibility

JUSTIFICATION: These programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. Interpretation is a wildlife-dependent, priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. The USFWS strives to provide priority public uses when compatible with the purposes of the Refuge and the mission of the System. Facilities and activities related to interpretation occur in designated areas of the Refuge, leaving large areas of undisturbed habitat available for wildlife. The stipulations outlined above are specifically designed to and should minimize potential impacts of these activities. The Refuge will continue to monitor uses and adjust programs as necessary to protect Refuge resources. The awareness, enjoyment and education gained from these activities are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that interpretation, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for interpretation has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System.

SIGNATURE: **Refuge Manager** Rahad Stark 04/24/13
(Signature and Date)

CONCURRENCE: **Regional Chief** Debra M. Curtis 9/4/13
(Signature and Date)

MANDATORY 10- OR 15-YEAR RE-EVALUATION DATE: 2028

Compatibility Determination

USE: Wildlife Observation and Wildlife Photography

REFUGE NAME: Ozark Plateau National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITY:

- Fish and Wildlife Act of 1956
- Endangered Species Act of 1973

REFUGE PURPOSE(S):

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants” ... 16 U.S.C. 1534 (Endangered Species Act of 1973)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . ” 16 U.S.C. 742(a)(4) and “ . . . for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . ” 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

Ozark Plateau National Wildlife Refuge was established to:

- Prevent the extinction and aid in recovery of federally-listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds;
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee])

DESCRIPTION OF USE:

(a) What is the use?

Ozark Plateau National Wildlife Refuge proposes to continue and expand wildlife observation and photography in designated areas of the Refuge that are compatible with Refuge purposes. These activities are wildlife-dependent, priority public uses of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. The continuation and enhancement of these programs will be addressed in this compatibility determination.

Observing wildlife is a public use at Ozark Plateau NWR, with over 3,500 visitors each year participating in the activity. Most visitors come to the Refuge for EE or interpretation, however, many of them also enjoy the opportunity to view and photograph Ozark Plateau NWR's diverse habitats (i.e. forests, streams, and caves) and wildlife (i.e., the migration of multiple bird species to the area, sightings of deer and fish, insects such as butterflies and caterpillars, etc.).

(b) Where is the use conducted?

Wildlife observation and wildlife photography on the Refuge are restricted to the Mary & Murray Looney Unit (Looney Unit), which is on 95 acres of diverse habitats representative of the Ozark Highlands ecoregion, including Spavinaw Creek and its tributaries, riparian zones, losing streams (a stream that has a permeable bed through which water can seep to the water-table), natural springs, caves, hardwood bottomland floodplains and oak-hickory-pine upland forests (encyclopedia.com). Four maintained trails of equal to or less than 0.25-mile each, two of which originate at the Mary & Murray Looney Education & Research Center (MMLERC), are designated areas where wildlife is typically observed and photographed.

Opportunities for increased wildlife observation and photography on other units will be explored as additional land is acquired.

Cave entry for wildlife observation and wildlife photography is currently closed due to concerns about white-nose syndrome (WNS), a new disease affecting hibernating bats. The fungus believed to be the causative agent of WNS, *Geomyces destructans*, is transmitted primarily through bat-to-bat contact. However, evidence suggests that inadvertent human-assisted movement of fungal spores on clothing, footwear, or gear could play a role in the spread of WNS. Therefore, the Refuge believes that closing caves to public entry at this point in time is a necessary management action to help prevent the spread of this disease. Closure of refuge caves to the public is in accordance with current Service guidance issued in a memorandum dated September 2, 2010, regarding bat management of WNS in the National Wildlife Refuge System. Should future Service guidance indicate that refuge caves may be reopened to public entry, Ozark Plateau NWR will consider limited use of caves for wildlife observation and wildlife photography.

(c) When is the use conducted?

Visitors are welcome to engage in wildlife observation and photography on the Looney Unit during most times of the year; however these uses require prior notification and a special use permit. Currently, visitors who wish to engage solely in wildlife observation/photography come to the Refuge approximately 3-4 times per year. The Refuge proposes to increase visitation permits for wildlife observation and photography, aside from EE programs, to approximately twelve times per year, at the Refuge's discretion.

(d) How is the use conducted?

The public is encouraged to participate in wildlife photography at the Looney unit by special use permit and guided only. There are currently no opportunities for unescorted, unpermitted wildlife observation.

Specific wildlife observation occurs primarily during seasons in which there are specific events occurring such as the migration of multiple bird species to the area, vegetative changes in the native flora, and the natural fluctuation in the activity and number of indigenous wildlife populations, such as deer and fish. Wildlife observation of bats is very popular when bats are not hibernating, and takes place on the exterior of caves, with access to caves strictly controlled by the Service to protect federally listed threatened and endangered cave species and other sensitive cave resources. However, flash photography of bat emergence is not permitted.

Wildlife observation and photography also occurs in conjunction with EE and/or interpretation programs conducted in cooperation with many partners (for a full list, see Chapter 5, Table 5-1 of the CCP).

(e) Why is this use being proposed?

Wildlife observation and wildlife photography are being conducted at Ozark Plateau NWR because they are existing refuge uses and are identified as vital wildlife-dependent priority public uses for the National Wildlife Refuge System.

Increased urbanization in northwest Arkansas and in Tulsa, Oklahoma is having detrimental effects on the Ozark ecoregion. Most people are not conscious of their direct connection to the natural environment around them. Many people are also unaware of the large and delicate cave (subterranean) ecosystems and native wildlife species that lie beneath their feet. Wildlife observation and photography on Ozark Plateau NWR is important in order for both urban and rural people of this region to have an opportunity to connect to nature, relax, and appreciate the beauty and wonder of the local, natural resources of the Ozarks including cave, karst, forests, and streams.

AVAILABILITY OF RESOURCES:

To get to the Looney Unit for wildlife observation and photography, a permit is required, which can be obtained at the MMLERC. There is a Looney Unit public access drive, which is currently 0.25-mile, unpaved and unimproved (dirt/rock), with a gate. There is an unpaved parking area (power cut easement), between the entry gate and MMLERC, for approximately 10 vehicles. Excess parking is available at the Guess House (150 yards). With the anticipation of an increase in visitation to the Refuge, it proposes to widen the Looney Unit access drive by 2 feet and improve road and parking area surfaces with gravel (\$20K capital).

There are 0.5-1.0 mile of primitive trails currently used by wildlife observation and photography visitors on the Refuge. In order to create more hiking/walking opportunities for large groups to participate in nature observation, the Refuge proposes to establish a 0.25-mile mostly primitive trail to connect Spavinaw Creek trail to the Guess House trail (\$5K capital for repavement/rakes/shovels/gloves), build a new 2-mile primitive trail (no clearing or removing of trees or large shrubs) around the perimeter of the Looney Unit (\$10K labor + capital), improve the 0.1-mile trail from the MMLERC to pavilion (\$5K capital), and improve the 0.25-mile trail from the Looney maintenance shop to the MMLERC (\$5K capital). The Refuge would also like to install 3 primitive overlook areas on the Looney Unit perimeter trail, which may be used as stopping points for great overlooks or photographic shots (\$15K capital).

The Refuge owns a limited amount of specialized safety equipment and equipment for caving (\$10K) for visitors, but would like to acquire more, especially if safety protocols for prevention of WNS deem necessary.

Staff oversight is required for guiding and monitoring wildlife observation and photography activities. However, currently the Refuge has no funding in their Visitor Services budget for all EE and interpretation programs, therefore, the Refuge has to write grants, oversee contracting, and do all that is necessary to provide funding to its partnering NGOs in order to provide all current EE/interpretation programming and staffing needs, which also supports wildlife observation and photography. Refuge staff is available for all on-site wildlife observation and photography to provide guidance for great observation and viewing areas. In order to guarantee consistency annually in providing opportunities for local participants to engage in wildlife observation and photography, the Refuge would need dedicated annual funding for its programs. An Outdoor Recreation Planner (GS 7/9/11) would be a necessary addition to Refuge staff in order to improve the quality of current wildlife observation and photography opportunities and to plan, guide, and evaluate future opportunities.

Public outreach needs improvement to increase participation of wildlife observation and photography. No pamphlets or fliers about the Refuge are currently available however the Refuge proposes to create a flier/brochure to advertise visitor services opportunities, including

wildlife observation and photography opportunities at the MMLERC. The Refuge also plans to update their websites (<http://www.fws.gov/southwest/refuges/oklahoma/Ozark/> and <http://www.fws.gov/refuges/profiles/recEdMore.cfm?ID=21645>) to inform the public of current and upcoming wildlife observation and photography opportunities, including contact and location information (while cave locations continue to remain confidential).

ANTICIPATED IMPACTS OF THE USE:

Short Impacts:

Wildlife observation and photography occurring only on surface habitats may have negligible or short-term adverse impacts on Refuge trust resources. On the other hand, the programs would have beneficial impacts to visitors and local communities.

Wildlife observers and photographers remaining on- or off-trail, will have some short-term direct impacts to the environment including: trampling of native vegetation on the bottomland and/or upland forest; disturbance to wildlife (including noise from large groups of people and light pollution due to photography flash); shifting of rocks on trails; and mild compaction of soils.

Renovation plans at the MMLERC to improve Visitor Services programs (widening of the Looney Unit public access road by 2-feet for 0.25-mile, and establishing a gravel parking lot) will cause short-term, temporary impacts only during the construction including: loud levels of noise pollution due to use of mechanical equipment; increase in CO₂ emissions; and fugitive dust.

Long-Term Impacts:

Widening of the Looney Unit public access road by 2-feet for 0.25-mile will require the removal of vegetation, rocks, top soil, and possibly trees. Establishing a gravel parking lot will allow for a better established parking area, which will prevent visitors from parking in the grass on the side of the road, and will help control soil erosion. In order to establish a primitive trail to connect Spavinaw Creek trail to Guess House trail, some boulders and old concrete will be removed (200 ft.), affecting the physical area.

Increasing visitation permits for future EE/interpretation programs and/or solely for wildlife observation and photography on the Looney Unit and additional appropriate acquired units, is going to increase human traffic to those areas, which will expose many cave locations to the public. Exposure to cave locations could increase the potential of cave vandalism or break-ins. An increase in human traffic could also increase the amount of trash found on the Refuge. However, these are both unlikely scenarios for this wildlife-dependent use since interpretive programs aim to encourage people to participate in Leave No Trace (LNT) ethics and to leave participants with an enduring understanding of the importance of cave and karst ecosystems within the Ozarks ecoregion.

Cumulative Impacts:

Cumulatively, current and future wildlife observation and photography opportunities will have a beneficial impact on surrounding communities by giving present and future generations an opportunity to connect with nature. Visitor Services programs are meant to leave visitors with a life-long appreciation of the outdoors and of U.S. Fish & Wildlife Service conservation efforts. These programs could lead to future conservation easement programs, acquisition of important areas from willing sellers, and instill the value of our environment in future leaders.

PUBLIC REVIEW AND COMMENT:

This compatibility determination for Ozark Plateau NWR was made available for public review and comment in conjunction with the public comment period for the Refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on this compatibility determination were invited and due by March 8, 2013.

DETERMINATION (CHECK ONE BELOW):

- ☐ Use is Not Compatible
☒ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure that wildlife observation and wildlife photography remain a compatible use on Ozark Plateau National Wildlife Refuge, the following stipulations are necessary:

- Wildlife observation and photography is limited to the Looney Unit, year round, by permit only
- Vehicle and/or all-terrain vehicle use off-road is restricted to prevent damage to Refuge resources
- Cave entry is currently closed, due to the potential of spreading WNS to caves
- If deemed appropriate, all visitors entering caves for wildlife observation and/or photography purposes must wear Refuge- provided, decontaminated, caving equipment (clothing and safety devices, including mandatory hard hats, gloves, and lights)
- Disturbance to caves will be avoided during bat maternity and hibernation periods
- Flash photography of bat emergence from cave exteriors is prohibited
- Collection of plants or animals, or feeding or disturbing wildlife, is prohibited
- Wildlife photography may not be used for commercial purposes, unless Refuge determines compatible and issues a permit
- Visitors are responsible for "Leaving No Trace" (picking up trash, not leaving permanent structures such as blinds, avoiding disturbance to habitat, etc.)
- Pets must be leashed at all times at the Looney Unit
- Public use trends and associated impacts from human activity will continue to be monitored. If significant increases in use occur, and/or if impacts to resources are

determined significant, the program will be reevaluated and modified as necessary to ensure compatibility.

JUSTIFICATION: These programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. Wildlife observation and photography are wildlife-dependent, priority public uses of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. The USFWS strives to provide priority public uses when compatible with the purposes of the Refuge and the mission of the System. Facilities and activities related to wildlife observation and photography occur in designated areas of the Refuge, leaving large areas of undisturbed habitat available for wildlife. The stipulations outlined above are specifically designed to and should minimize potential impacts of these activities. The Refuge will continue to monitor uses and adjust programs as necessary to protect Refuge resources. The awareness, enjoyment and education gained from these activities are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that wildlife observation and photography, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for wildlife observation and photography has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System.

SIGNATURE: **Refuge Manager**


(Signature and Date)

CONCURRENCE: **Regional Chief**


(Signature and Date)

MANDATORY 10- OR 15-YEAR RE-EVALUATION DATE: 2028

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Compatibility Determination

USE: Hunting

REFUGE NAME: Ozark Plateau National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITY:

- Fish and Wildlife Act of 1956
- Endangered Species Act of 1973

REFUGE PURPOSE(S):

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants” ... 16 U.S.C. 1534 (Endangered Species Act of 1973)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . ” 16 U.S.C. 742(a)(4) and “ . . . for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . ” 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

Ozark Plateau National Wildlife Refuge was established to:

- Prevent the extinction and aid in recovery of federally-listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds;
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee])

DESCRIPTION OF USE:

(a) What is the use?

The Refuge does not currently allow hunting, although, if compatible, the Refuge proposes to develop a Hunt Plan in accordance with 605 FW 2.9. Because of the sensitive nature of the federally listed cave species and other cave, spring, stream, and forest resources, public use and recreational opportunities are limited on the Refuge and will need to be monitored to assure protection of these resources.

Hunting, one of the six priority public uses of national wildlife refuges, is an important wildlife management tool used to control populations of some species that may exceed the carrying capacity of their habitat and/or threaten the sustainability of other native wildlife species. Hunting has also been regarded for centuries as an important cultural, recreational, and even spiritual experience for many generations of people, while providing them opportunities to observe nature and enjoy local, natural food.

Therefore, the Refuge proposes to develop a Hunt Plan in coordination with the Oklahoma Department of Wildlife Conservation (ODWC).

(b) Where is the use conducted?

All hunting would be walk-in and on the Sally Bull Hollow Unit only, which lies adjacent to State-managed, Ozark Plateau Wildlife Management Area (WMA). Hunting would take place on surface Refuge tracts of Sally Bull Hollow Unit, at least 100 yards from cave entrances. This will help ensure the protection of T&E cave species and cave species of concern.

Because of the small size of other existing Refuge units and sensitivity of cave resources to human disturbance, the Beck, Boy Scout, Gittin Down Mountain, Lake Eucha, Liver, Looney, Potter and Varmint Units of Ozark Plateau NWR will remain closed to hunting in order to continue to protect other Refuge cave and karst ecosystems and resources.

Additional hunting locations may be considered on additional acquired lands, based on the locality, condition of the local ecosystem, and availability of the natural resources.

(c) When is the use conducted?

Hunting would be conducted during all Oklahoma state hunting seasons, according to updated published regulations (<http://www.odwc.state.ok.us/hunting/seasons.htm>).

(d) How is the use conducted?

After the Sally Bull Hollow Unit has been surveyed and boundaries marked, a Hunt Plan would be developed to ideally allow hunting according to state hunting seasons and regulations, identical to ODWC's adjacent Ozark Plateau WMA. Deer, turkey, squirrel, rabbit, quail and

other small game are examples of what may be hunted according to state regulations. However, if inventorying and monitoring of federally listed species identifies adverse effects due to the public use, hunting regulations may need to be modified in cooperation with ODWC.

(e) Why is this use being proposed?

During scoping, many members of the public and the ODWC expressed high interest in having the opportunity to hunt on the Refuge. ODWC asked that Ozark Plateau NWR allow hunting of Oklahoma State game species (including deer, turkey, squirrels, quail, and rabbits) in accordance with State regulations. As long as hunting is compatible with the purpose of the Refuge, Ozark Plateau NWR agrees to allow this wildlife-dependent use.

AVAILABILITY OF RESOURCES:

Sally Bull Hollow Unit lies on 2,280 acres in fee of high quality continuous mature Ozark oak-hickory and pine upland forest on steep hill sides with numerous bluff faces. There are also narrow high quality oak-hickory bottomland forest, and intermittent rocky bottom Ozark streams used by nesting and migratory Neotropical birds and foraging endangered bats. Numerous important Ozark big-eared bat and gray bat caves are found on the Unit. It is within the Lee Creek drainage basin, an Oklahoma state scenic river, with high gradient, spring fed tributaries. The cave is geologically isolated from other caves in eastern Oklahoma therefore enhancing the probability for a unique fauna.

In order for hunting to be allowed on the Sally Bull Hollow Unit, the boundaries must first be surveyed and marked. Surveying and marking the boundaries and maintenance of the boundary markers will require contracted surveyors and cost approximately \$150,000. No parking is available on Sally Bull Hollow Unit, although there is nearby parking on adjacent county roads.

The Refuge is currently managed as a satellite of the Sequoyah National Wildlife Refuge Complex in Vian, Oklahoma. Ozark Plateau National Wildlife Refuge's staff consists of a Refuge Manager, a Wildlife Refuge Specialist, and a Maintenance Worker, who are assisted by personnel from the Tulsa ES Office and the Sequoyah National Wildlife Refuge for biological, clerical, law enforcement, and maintenance support. Staff oversight is required for implementing and monitoring hunting activities. Hunting on Ozark Plateau NWR will require an increase of law enforcement at Sally Bull Hollow Unit during hunting season to prevent disturbance of caves and enforce Refuge hunting regulations. It will also require a Hunt Plan package, which is a process that takes approximately one year to finish prior to the opening of any hunting grounds on the Refuge.

ANTICIPATED IMPACTS OF THE USE:

Short-Term Impacts:

Hunting practiced only on surface habitats may have negligible or only short-term adverse effects on Service trust resources, as long as human disturbance of the sensitive federally listed T&E cave species and other cave resource does not increase.

Populations of game will be slightly impacted year-to-year as a result of opening this Refuge Unit to hunting, however, as long as hunters are following State regulations, this should not affect animal populations dramatically in the long-term.

In the short-term, the Refuge may have issues controlling access to the Unit on Refuge roads, which could potentially increase illegal vehicle traffic. The Refuge would need to maintain and fix inadequately-designed road gates in order to prevent this from becoming a negative long-term impact. Restricting use to walk-in only access should limit the amount of hunters using the area appropriately. Short-term direct impacts of walking include trampling of native vegetation on the bottomland and upland forest habitats and mild disturbance to rocks and soils. Soil compaction and minor erosion of soil and rocks may occur.

Long-Term Impacts:

By allowing hunting, human traffic to the area is going to increase, which could expose many cave locations to the public thus increasing the potential of cave vandalism or break-ins. In addition, the more people that use the area, the more trash that is likely to be left on the land or to pollute nearby water sources. There is also a potential for people to engage in illegal behavior such as overnight camping or poaching.

If inventorying and monitoring does indicate that increased public use is adversely affecting federally listed T&E cave species populations, hunting regulations will be modified in cooperation with ODWC.

On the other hand, allowing hunting could improve relationships and increase cooperation between nearby landowners, the State, and Tribal Nations in the long-term. It can also give the public and tribes the opportunity to participate and educate its youth in the experience of connecting with nature to hunt one's own food. It could also benefit many species by controlling populations so that long-term sustainability is attainable and so that there is no over-abundance of any one species.

Cumulative Impacts:

Allowing the use of hunting will cumulatively add more hunting opportunities for the State, which the public wants. It should not contribute any adverse cumulative effects on the natural resources of the Ozark Highlands ecoregion.

PUBLIC REVIEW AND COMMENT:

This compatibility determination for Ozark Plateau NWR was made available for public review and comment in conjunction with the public comment period for the Refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on this compatibility determination were invited and due by March 8, 2013.

DETERMINATION (CHECK ONE BELOW):

☐ Use is Not Compatible
☒ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure that hunting remain a compatible use on Ozark Plateau National Wildlife Refuge, the following stipulations are necessary:

- Once the Unit has been surveyed and marked, hunting will be restricted to Sally Bull Hollow of Ozark Plateau NWR by walk-in only
- Hunting will not take place within 100 yards of cave entrances
- Hunters must use nontoxic shot and maintain a safe and courteous distance from other parties, according to FWS Policy 605 FW 2 and 50 CFR 32.2(k)
- Hunters are required to carry out their empty shells and trash
- Hunters utilizing temporary blinds are required to remove decoys and portable blinds daily upon cessation of hunting, and according to State regulations
- No permanent stands (nor steel cleats used for stands) are allowed
- Only temporary stands with temporary non-damaging cleats are allowed for a maximum of 14 days
- The Refuge prohibits the use or possession of alcoholic beverages while on Refuge lands or waters
- The Refuge prohibits off-road vehicle travel and ATV use to retrieve game

JUSTIFICATION: These programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. Hunting is a wildlife-dependent, priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. The USFWS strives to provide priority public uses when compatible with the purposes of the Refuge and the mission of the System. Facilities and activities related to hunting occur in designated areas of the Refuge, leaving large areas of undisturbed habitat available for wildlife. The stipulations outlined above are specifically designed to and should minimize potential impacts of these activities. The Refuge will continue to monitor uses and adjust programs as necessary to protect Refuge resources. The awareness, enjoyment and education gained from these activities are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that

hunting, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System.

SIGNATURE: **Refuge Manager** Richard Stork 04/24/13
(Signature and Date)

CONCURRENCE: **Regional Chief** [Signature] 9/4/13
(Signature and Date)

MANDATORY 10- OR 15-YEAR RE-EVALUATION DATE: 2028

Compatibility Determination

USE: Wood Harvesting

REFUGE NAME: Ozark Plateau National Wildlife Refuge

ESTABLISHING AND ACQUISITION AUTHORITY:

- Fish and Wildlife Act of 1956
- Endangered Species Act of 1973

REFUGE PURPOSE(S):

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants” ... 16 U.S.C. 1534 (Endangered Species Act of 1973)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources . . . ” 16 U.S.C. 742(a)(4) and “ . . . for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude . . . ” 16 U.S.C. 742(b)(1) (Fish and Wildlife Act of 1956).

Ozark Plateau National Wildlife Refuge was established to:

- Prevent the extinction and aid in recovery of federally-listed threatened and endangered Ozark cave species;
- Reduce the need for future listing of species of concern in the Ozarks;
- Protect large continuous stands of Ozark forest essential to interior forest nesting migratory birds;
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

The mission of the System is “to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee])

DESCRIPTION OF USE:**(a) What is the use?**

The Refuge does not currently allow wood harvesting by the public, however, it proposes to allow limited wood harvesting, primarily for firewood, by special permit only, in accordance with Refuge forest management needs and as habitat requirements dictate.

(b) Where is the use conducted?

The Refuge will permit wood harvesting on some or all Refuge Units, depending on forest management needs.

(c) When is the use conducted?

Wood harvesting would only be permitted if Refuge forest and wildlife management needs dictate, such as after ice or wind storms, selective thinning by the Refuge, and for fuel reduction.

(d) How is the use conducted?

The Refuge will contact interested landowners, NGO partners, NRCS, ODWC, and other State and federal agencies, as well as Tribal Nations, and notify the public of wood harvesting opportunities. For interested individuals, a special use permit must be issued. If necessary, the Refuge will contract for the removal and use of excess wood.

The public will not be permitted to cut down any live or dead-standing trees, however, they will be permitted to cut and harvest downed-trees using chain saws, axes, or other handtools, to remove and haul away excessive wood/fuel loads utilizing trucks, trailers and 4WD vehicles on designated Refuge roads.

(e) Why is this use being proposed?

In order for the Refuge to manage for a healthy forest for wildlife needs, some thinning and fuel reduction actions must be conducted, such as after ice or wind storms and for sustainable management of Ozark forests. The Refuge does not have the staffing or funding available to perform all the removal of downed-trees, due to these necessary management activities. Wood harvesting by the public provides economical and efficient means for removal of the Refuge's fuel loads, while also being mutually beneficial for the public.

AVAILABILITY OF RESOURCES:

Ozark Plateau NWR manages for the restoration and conservation primarily of old growth hickory-oak forests on all Refuge Units, especially for the benefit of federally listed T&E bat and other cave species. Availability of forest resources vary year to year depending on weather conditions and management activities.

ANTICIPATED IMPACTS OF THE USE:

Short-term Impacts:

An increase in public use in these areas may trample vegetation surrounding wood piles and temporarily compact soils. In addition, loud noise occurring from the use of chainsaws and other mechanical equipment may temporarily disturb or scare away wildlife. There would also be a temporary increase of vehicle traffic on Refuge roads close to wood harvest pile areas, which would cause noise, a short-term increase in CO₂ emissions, and compaction and erosion of soils on access roads.

Long-term Impacts:

Wood harvesting would aid in a reduction of fuel loads, which is important in order to mitigate hot-burning wildfires (which could destroy valuable old-growth trees). Wood harvesting of downed trees and excessive fuel loads assists the Refuge at attaining the forest conditions necessary for restoration such as “moderately stocked mature oak-hickory-pine with an open understory” in order to provide suitable habitat for its bat, resident, and migratory wildlife species.

In addition, allowing for more public use opportunities, such as wood harvesting, will improve relationships with the public and surrounding tribes. Allowing the public to also gain from this forest restoration process is a good way to engage in sustainability with local communities and provide a beneficial use of our natural resources without creating waste.

Cumulative Impacts:

Cumulatively, wood harvesting promotes healthy regenerative practices of old-growth Ozark forest on a landscape-scale and mitigates uncontrollable/hot wildfires.

PUBLIC REVIEW AND COMMENT:

This compatibility determination for Ozark Plateau NWR was made available for public review and comment in conjunction with the public comment period for the Refuge’s Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). Public comments on this compatibility determination were invited and due by March 8, 2013.

DETERMINATION (CHECK ONE BELOW):

- ☐ Use is Not Compatible
☒ Use is Compatible with Following Stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure that wood harvesting remains a compatible use on Ozark Plateau National Wildlife Refuge, the following stipulations are necessary:

- A special use permit is required

- The Refuge will issue permits and days of harvest, based on need and consideration of hunting seasons/activities, sensitive resources, etc.
- Permittee will provide all his/her own wood harvesting materials, equipment, and supplies
- The Refuge may not be available to directly oversee this use activity
- The Refuge is not liable for injuries occurring as a result of this use; safety is the responsibility of the wood harvester
- All trucks, trailers and 4WD vehicles used for wood harvesting must remain on designated Refuge roads

JUSTIFICATION: These programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. The USFWS strives to provide priority public uses when compatible with the purposes of the Refuge and the mission of the System. Facilities and activities related to wood harvesting occur in designated areas of the Refuge, leaving large areas of undisturbed habitat available for wildlife. The stipulations outlined above are specifically designed to and should minimize potential impacts of these activities. The Refuge will continue to monitor uses and adjust programs as necessary to protect Refuge resources. The benefits gained from public opportunities of wood harvesting are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that wood harvesting, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for wood harvesting has given many people a deeper appreciation of their local natural resources and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System.

SIGNATURE:

Refuge Manager

Richard Stank 04/24/13
(Signature and Date)

CONCURRENCE: Regional Chief

Ann M. [Signature] 9/4/13
(Signature and Date)

MANDATORY 10- OR 15-YEAR RE-EVALUATION DATE: 2023

Appendix C: Species List

Ozark Plateau NWR is in the process of compiling different types of species surveys of those occurring on and/or surrounding the Refuge. So far, a survey titled, “Amphibians and Reptiles of the Ozark Plateau National Wildlife Refuge Adair, Delaware, and Ottawa Counties, Oklahoma [Sally Bull Hollow Unit]” was conducted in 2001 by Janalee P. Caldwell, curator of herpetology as well as professor of zoology, Laurie J. Vitt, of Sam Noble Oklahoma Museum of Natural History, University of Oklahoma, Norman, Oklahoma (see Table C-1). We have included an asterisk (*) next to species names or observations that have updated since this 2001 survey.

In addition, we have also included the species of greatest conservation need according to the Oklahoma Department of Wildlife Conservation Comprehensive Wildlife Conservation Strategy (2005) in Appendix C: Species List (see tables C-2 through C-11) since these species occur within the approved acquisition boundary of Ozark Plateau National Wildlife Refuge.

In Table C-1, species found on the Ozark Plateau National Wildlife Refuge are indicated in the column “collected or observed.” If suitable habitat was present but a species was not found, we indicated that it is likely to be present. In instances where range maps show the geographical range of a species to include the Ozark Plateau NWR but no suitable habitat was observed, we considered that species not likely to be present.

Table C-1. Amphibians and Reptiles Survey of Ozark Plateau NWR (2001).

| FAMILY SPECIES | Collected or observed | Likely to be present | Not likely to be present |
|--|-----------------------|----------------------|--------------------------|
| AMPHIBIANS | | | |
| SALAMANDERS | | | |
| Family Salamandridae | | | |
| <i>Notophthalmus viridescens louisianensis</i> —Central Newt | X | | |
| Family Proteidae | | | |
| <i>Necturus maculosus louisianensis</i> —Red River Mudpuppy | | | X |
| Family Ambystomatidae | | | |
| <i>Ambystoma annulatum</i> —Ringed Salamander | X | | |
| <i>Ambystoma maculatum</i> —Spotted Salamander | X | | |
| <i>Ambystoma tigrinum tigrinum</i> —Eastern Tiger Salamander | X | | |
| <i>Ambystoma texanum</i> —Small-mouthed Salamander | X | | |
| Family Plethodontidae | | | |

Appendix C: Species List

| FAMILY SPECIES | Collected or observed | Likely to be present | Not likely to be present |
|---|-----------------------|----------------------|--------------------------|
| <i>Eurycea longicauda melanopleura</i> —Dark-sided Salamander | X | | |
| <i>Eurycea lucifuga</i> —Cave Salamander | X | | |
| <i>Eurycea tynesensis</i> —Oklahoma Salamander* | X* | | |
| <i>Eurycea spelaeus</i> —Grotto Salamander* | X* | | |
| <i>Plethodon angusticlavius</i> —Ozark Salamander | X | | |
| <i>Plethodon albagula</i> —Western Slimy Salamander | X | | |
| FROGS AND TOADS | | | |
| Family Bufonidae | | | |
| <i>Bufo americanus charlesmithi</i> —Dwarf American Toad | X | | |
| <i>Bufo woodhousii velatus</i> —East Texas Toad | X | | |
| Family Pelobatidae | | | |
| <i>Scaphiopus huerterii</i> —Hurter's Spadefoot | | X | |
| Family Microhylidae | | | |
| <i>Gastrophryne carolinensis</i> —Eastern Narrow-mouthed Toad | X | | |
| <i>Gastrophryne olivacea</i> —Great Plains Narrow-mouthed Toad | | | X |
| Family Hylidae | | | |
| <i>Acris crepitans blanchardi</i> —Blanchard's Cricket Frog | X | | |
| <i>Hyla versicolor</i> / <i>chrysoscelis</i> —Gray Treefrog Complex | X | | |
| <i>Pseudacris crucifer crucifer</i> —Northern Spring Peeper | X | | |
| <i>Pseudacris feriarum feriarum</i> —Upland Chorus Frog | X | | |
| <i>Pseudacris streckeri streckeri</i> —Strecker's Chrous Frog | | X | |
| <i>Pseudacris triseriata</i> —Western Chorus Frog | X | | |
| Family Ranidae | | | |
| <i>Rana areolata circulosa</i> —Northern Crawfish Frog | | | X |
| <i>Rana catesbeiana</i> —American Bullfrog | X | | |
| <i>Rana clamitans melanota</i> —Northern Green Frog | | | X |
| <i>Rana palustris</i> —Pickerel Frog | X | | |
| <i>Rana sphenoccephala utricularia</i> —Southern Leopard Frog | X | | |
| <i>Rana sylvatica</i> —Wood Frog | X | | |
| REPTILES | | | |
| Turtles | | | |
| Family Chelydridae | | | |
| <i>Chelydra serpentina serpentina</i> —Eastern Snapping Turtle | | X | |
| <i>Macrochelys temminckii</i> —Alligator Snapping Turtle | | | X |
| Family Kinosternidae | | | |
| <i>Sternotherus odoratus</i> —Stinkpot | | X | |

Appendix C: Species List

| FAMILY SPECIES | Collected or observed | Likely to be present | Not likely to be present |
|---|--------------------------|-------------------------|-----------------------------|
| Family Emydidae | | | X |
| <i>Graptemys pseudogeographica kohnii</i> —Mississippi Map Turtle | | | X |
| <i>Graptemys ouachitensis ouachitensis</i> —Ouachita Map Turtle | | | X |
| <i>Pseudemys concinna concinna</i> —Eastern River Turtle | | | X |
| <i>Trachemys scripta elegans</i> —Red-eared Slider | X | | |
| <i>Terrapene carolina triunguis</i> —Three-toed Box Turtle | X | | |
| <i>Terrapene ornata ornata</i> —Ornate Box Turtle | | | X |
| Family Trionychidae | | | |
| <i>Apalone mutica mutica</i> —Midland Smooth Softshell | | | X |
| <i>Apalone spinifera hartwegi</i> —Western Spiny Softshell | | | X |
| LIZARDS | | | |
| Family Crotaphytidae | | | |
| <i>Crotaphytus collaris</i> —Eastern Collared Lizard | | X | |
| Family Phrynosomatidae | | | |
| <i>Sceloporus undulatus hyacinthinus</i> —Northern Fence Lizard | X | | |
| Family Teiidae | | | |
| <i>Cnemidophorus sexlineatus viridis</i> —Prairie Racerunner | X | | |
| Family Scincidae | | | |
| <i>Scincella lateralis</i> —Little Brown Skink | X | | |
| <i>Eumeces anthracinus pluvialis</i> —Southern Coal Skink | | X | |
| <i>Eumeces septentrionalis obtusirostris</i> —Southern Prairie Skink | | | X |
| <i>Eumeces fasciatus</i> —Common Five-lined Skink | X | | |
| <i>Eumeces laticeps</i> —Broad-headed Skink | | | X |
| Family Anguidae | | | |
| <i>Ophisaurus attenuatus attenuatus</i> —Western Slender Glass Lizard | | X | |
| SNAKES | | | |
| Family Colubridae | | | |
| <i>Carphophis vermis</i> —Western Wormsnake | X | | |
| <i>Diadophis punctatus arnyi</i> —Prairie Ring-necked Snake | X | | |
| <i>Virginia striatula</i> —Rough Earthsnake | X | | |
| <i>Virginia valeriae elegans</i> —Western Smooth Earthsnake | | X | |
| <i>Tantilla gracilis</i> —Flat-headed Snake | X | | |
| <i>Sonora semiannulata</i> —Groundsnake | | | X |
| <i>Opheodrys aestivus aestivus</i> —Northern Rough Greensnake | X | | |
| <i>Coluber constrictor flaviventris</i> —Eastern Yellow-bellied Racer | X | | |
| <i>Masticophis flagellum flagellum</i> —Eastern Coachwhip | | X | |

Appendix C: Species List

| FAMILY SPECIES | Collected or observed | Likely to be present | Not likely to be present |
|---|--------------------------|-------------------------|-----------------------------|
| <i>Nerodia erythrogaster transversa</i> —Blotched Watersnake | X | | |
| <i>Nerodia sipedon sipedon</i> —Common Watersnake | X | | |
| <i>Nerodia rhombifera</i> —Diamond-backed Watersnake | | X | |
| <i>Heterodon platirhinos</i> —Eastern Hog-nosed Snake | X | | |
| <i>Elaphe guttata emoryi</i> —Great Plains Ratsnake | X | | |
| <i>Elaphe obsoleta obsoleta</i> —Black Ratsnake | X | | |
| <i>Pituophis catenifer sayi</i> —Bullsnake | | | X |
| <i>Lampropeltis calligaster calligaster</i> —Prairie Kingsnake | X | | |
| <i>Lampropeltis getula holbrooki</i> —Speckled Kingsnake | X | | |
| <i>Lampropeltis triangulum sypila</i> —Red Milksnake | X | | |
| <i>Cemophora coccinea copei</i> —Northern Scarletsnake | | X | |
| <i>Storeria dekayi texana</i> —Texas Brownsnake | X | | |
| <i>Storeria occipitomaculata occipitomaculata</i> —Northern Red-bellied Snake | | X | |
| <i>Tropidoclonion lineatum</i> —Lined Snake | | | X |
| <i>Thamnophis proximus proximus</i> —Orange-striped Ribbonsnake | | X | |
| <i>Thamnophis sirtalis parietalis</i> —Red-sided Gartersnake | X | | |
| Family Viperidae | | | |
| <i>Agkistrodon contortrix phaeogaster</i> —Osage Copperhead | X | | |
| <i>Agkistrodon picivorous leucostoma</i> —Western Cottonmouth | | X | |
| <i>Sistrurus miliarius streckeri</i> —Western Pygmy Rattlesnake | | X | |
| <i>Crotalus horridus</i> —Timber Rattlesnake | X | | |
| <i>Crotalus atrox</i> —Western Diamond-backed Rattlesnake | | | X |

Appendix C: Species List

The following 10 tables were published in the Oklahoma Department of Wildlife Conservation Comprehensive Wildlife Conservation Strategy in 2005. Each table describes species of greatest conservation need by habitat type within Omernick's Ozark Ecoregion, encompassing most of the Ozark Plateau National Wildlife Refuge (approved) acquisition boundary.

Table C-2. Limestone Cave Species of Greatest Conservation Need (OWDC, 2005)

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|----------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Grotto Salamander | | | | X | | | | X |
| Amph | Many-ribbed Salamander | | | | X | | | | X |
| Amph | Ozark Salamander | | | | X | | | | X |
| Inve | Bowman's Cave Amphipod | X | | | | | | | X |
| Inve | Caecidotea acuticarpa | X | | | | | | | X |
| Inve | Caecidotea ancyla | X | | | | | | | X |
| Inve | Caecidotea antricola | X | | | | | | | X |
| Inve | Caecidotea macropoda | X | | | | | | | X |
| Inve | Caecidotea simulator | X | | | | | | | X |
| Inve | Caecidotea stiladactyla | X | | | | | | | X |
| Inve | Cave Crayfish | X | | | | | X | | |
| Inve | Kansas Well Amphipod | X | | | | | | | X |
| Inve | Oklahoma Cave Amphipod | X | | | | X | | | |
| Inve | Oklahoma Cave Crayfish | X | | | | | X | | |
| Inve | Ozark Cave Amphipod | X | | | | | | | X |
| Inve | Ozark Cavefish | X | | | | | X | | |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |

Appendix C: Species List

Table C-3. White Oak/Hickory Mesic Forest Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|-----------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Many-ribbed Salamander | | | | X | | | | X |
| Amph | Oklahoma Salamander | | | | X | | | | X |
| Amph | Ozark Salamander | | | | X | | | | X |
| Amph | Ringed Salamander | | | | X | | | | X |
| Bird | American Woodcock | X | | | | | | | X |
| Bird | Cerulean Warbler | X | | | | X | | | |
| Bird | Hooded Warbler | X | | | | | | | X |
| Bird | Kentucky Warbler | | X | | | | | | X |
| Bird | Red-headed Woodpecker | | X | | | X | | | |
| Bird | Whip-poor-will | | X | | | | | | X |
| Bird | Wood Thrush | X | | | | | | | X |
| Bird | Worm-eating Warbler | X | | | | | | | X |
| Inve | American Burying Beetle | | X | | | | | | X |
| Mamm | Eastern Small-footed Myotis | | | | X | | | | X |
| Mamm | Eastern Spotted Skunk | | | | X | | | | X |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Mamm | Southeastern Myotis | | | | X | | | | X |
| Rept | Northern Scarletsnake | | | | X | | | | X |

Appendix C: Species List

Table C-4. Shortleaf Pine-Oak-Hickory Woodlands Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|------------------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Bird | American Woodcock | X | | | | | | | X |
| Bird | Bachman's Sparrow | X | | | | | | | X |
| Bird | Blue-winged Warbler | X | | | | | | | X |
| Bird | Brown-headed Nuthatch | X | | | | | | | X |
| Bird | Kentucky Warbler | | X | | | | | | X |
| Bird | Northern Bobwhite | | X | | | X | | | |
| Bird | Prairie Warbler | | X | | | | | | X |
| Bird | Red-headed Woodpecker | | X | | | X | | | |
| Bird | Whip-poor-will | | X | | | | | | X |
| Inve | American Burying Beetle | | X | | | | | | X |
| Inve | Diana Fritillary | X | | | | | | | X |
| Mamm | Eastern Spotted Skunk | | | | X | | | | X |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Long-tailed Weasel | | | | X | | | | X |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Rept | Western Diamond-backed Rattlesnake | | | | X | | | | X |

Appendix C: Species List

Table C-5. Post Oak/Blackjack Oak-Hickory Woodlands and Forests Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|------------------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Bird | American Woodcock | X | | | | | | | X |
| Bird | Bachman's Sparrow | X | | | | | | | X |
| Bird | Blue-winged Warbler | X | | | | | | | X |
| Bird | Harris's Sparrow | | X | | | | | | X |
| Bird | Kentucky Warbler | | X | | | | | | X |
| Bird | Northern Bobwhite | | X | | | X | | | |
| Bird | Painted Bunting | | X | | | | | | X |
| Bird | Prairie Warbler | | X | | | | | | X |
| Bird | Red-headed Woodpecker | | X | | | X | | | |
| Bird | Whip-poor-will | | X | | | | | | X |
| Inve | American Burying Beetle | | X | | | | | | X |
| Mamm | Eastern Spotted Skunk | | | | X | | | | X |
| Mamm | Long-tailed Weasel | | | | X | | | | X |
| Rept | Western Diamond-backed Rattlesnake | | | | X | | | | X |

Appendix C: Species List

Table C-6. Herbaceous Wetlands Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|-------------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Crawfish Frog | | | | X | | | | X |
| Bird | American Golden Plover | | X | | | | | | X |
| Bird | American Woodcock | X | | | | | | | X |
| Bird | Buff-breasted Sandpiper | X | | | | X | | | |
| Bird | Canvasback | X | | | | | | | X |
| Bird | Hudsonian Godwit | | | | X | | | | X |
| Bird | King Rail | | | | X | | | | X |
| Bird | LeConte's Sparrow | | X | | | | | | X |
| Bird | Lesser Scaup | | X | | | X | | | |
| Bird | Little Blue Heron | | X | | | | | | X |
| Bird | Nelson's Sharp-tailed Sparrow | X | | | | | | | X |
| Bird | Northern Pintail | | X | | | X | | | |
| Bird | Peregrine Falcon | X | | | | | | | X |
| Bird | Prothonotary Warbler | | X | | | | | | X |
| Bird | Snowy Egret | | | | | | | | |
| Bird | Solitary Sandpiper | X | | | | | | | X |
| Bird | Trumpeter Swan | X | | | | | | | X |
| Bird | Upland Sandpiper | | | | X | | X | | |
| Bird | Willow Flycatcher | X | | | | | | | X |
| Bird | Yellow Rail | | | | X | | | | X |
| Inve | Ozark Clubtail | X | | | | | | | X |
| Inve | Ozark Emerald | X | | | | | | | X |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Marsh Rice Rat | | | | X | | | | X |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Mamm | River Otter | | X | | | | | X | |
| Mamm | Swamp Rabbit | | | | X | | | | X |
| Rept | Midland Smooth Softshell | | | | X | | | | X |

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Rept | Spiny Softshell Turtle | | | | X | | | | X |

Table C-7. Prairie Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|--------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Crawfish Frog | | | | X | | | | X |
| Bird | American Golden Plover | | X | | | | | | X |
| Bird | Bell's Vireo | | X | | | X | | | |
| Bird | Buff-breasted Sandpiper | X | | | | X | | | |
| Bird | Harris's Sparrow | | X | | | | | | X |
| Bird | Henslow's Sparrow | X | | | | | | | X |
| Bird | LeConte's Sparrow | | X | | | | | | X |
| Bird | Loggerhead Shrike | | X | | | X | | | |
| Bird | Northern Bobwhite | | X | | | X | | | |
| Bird | Red-headed Woodpecker | | X | | | X | | | |
| Bird | Short-eared Owl | | | | X | | | | X |
| Bird | Smith's Longspur | X | | | | | | | X |
| Bird | Sprague's Pipit | | | | X | | | | X |
| Bird | Upland Sandpiper | | | | X | | X | | |
| Inve | Byssus Skipper | X | | | | | | | X |
| Inve | Prairie Mole Cricket | X | | | | X | | | |
| Inve | Rattlesnake Master Borer | X | | | | | | | X |
| Mamm | Eastern Harvest Mouse | | | | X | | | | X |
| Mamm | Eastern Spotted Skunk | | | | X | | | | X |
| Mamm | Long-tailed Weasel | | | | X | | | | X |

Table C-8. Spring Species of Greatest Conservation Need (ODWC, 2005).

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|-----------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Grotto Salamander | | | | X | | | | X |
| Amph | Many-ribbed Salamander | | | | X | | | | X |
| Amph | Oklahoma Salamander | | | | X | | | | X |
| Amph | Ozark Salamander | | | | X | | | | X |
| Amph | Ringed Salamander | | | | X | | | | X |
| Bird | Louisiana Waterthrush | | X | | | | | | X |
| Fish | Arkansas Darter | X | | | | | | | X |
| Fish | Cardinal Shiner | | | X | | | X | | |
| Fish | Ozark Minnow | | | X | | | X | | |
| Fish | Plains Topminnow | X | | | | X | | | |
| Fish | Redspot Chub | | X | | | | X | | |
| Fish | Southern Brook Lamprey | | X | | | | | | X |
| Fish | Sunburst (Stippled) Darter | | X | | | | X | | |
| Inve | Bowman's Cave Amphipod | X | | | | | | | X |
| Inve | Caecidotea acuticarpa | X | | | | | | | X |
| Inve | Caecidotea macropoda | X | | | | | | | X |
| Inve | Caecidotea simulator | X | | | | | | | X |
| Inve | Cave Crayfish | X | | | | | X | | |
| Mamm | Eastern Small-footed Myotis | | | | X | | | | X |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Mamm | River Otter | | X | | | | | X | |

Table C-9. Gravel-bottom Streams and Associated Riparian Forests Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | Status | Trend |
|---------------------------------------|--------|-------|
|---------------------------------------|--------|-------|

Appendix C: Species List

| <i>Group</i> | <i>Common Name</i> | <i>Low</i> | <i>Medium</i> | <i>Abundant</i> | <i>Unknown</i> | <i>Declining</i> | <i>Stable</i> | <i>Increasing</i> | <i>Unknown</i> |
|--------------|----------------------------|------------|---------------|-----------------|----------------|------------------|---------------|-------------------|----------------|
| Amph | Grotto Salamander | | | | X | | | | X |
| Amph | Many-ribbed Salamander | | | | X | | | | X |
| Amph | Oklahoma Salamander | | | | X | | | | X |
| Amph | Ringed Salamander | | | | X | | | | X |
| Bird | American Woodcock | X | | | | | | | X |
| Bird | Bell's Vireo | | X | | | X | | | |
| Bird | Kentucky Warbler | | X | | | | | | X |
| Bird | Little Blue Heron | | X | | | | | | X |
| Bird | Louisiana Waterthrush | | X | | | | | | X |
| Bird | Prothonotary Warbler | | X | | | | | | X |
| Bird | Red-headed Woodpecker | | X | | | X | | | |
| Fish | Arkansas Darter | X | | | | | | | X |
| Fish | Blackside Darter | | X | | | | X | | |
| Fish | Bluntnose Shiner | X | | | | | | | X |
| Fish | Cardinal Shiner | | | X | | | X | | |
| Fish | Longnose Darter | X | | | | | | | X |
| Fish | Ozark Minnow | | | X | | | X | | |
| Fish | Plains Topminnow | X | | | | X | | | |
| Fish | Redspot Chub | | X | | | | X | | |
| Fish | River Darter | X | | | | | X | | |
| Fish | Shorthead Redhorse | X | | | | | | | X |
| Fish | Southern Brook Lamprey | | X | | | | | | X |
| Fish | Sunburst (Stippled) Darter | | X | | | | X | | |
| Fish | Wedgespot Shiner | X | | | | | | | X |
| Inve | Linda's Roadside Skipper | X | | | | | | | X |
| Inve | Little Spectaclecase | | | X | | | X | | |
| Inve | Louisiana Fatmucket | X | | | | X | | | |
| Inve | Ohio River Pigtoe | X | | | | X | | | |
| Inve | Orconectes nana | | | | X | | | | X |
| Inve | Ouachita Creekshell | X | | | | X | | | |
| Inve | Ouachita Kidneyshell | | X | | | X | | | |
| Inve | Procambarus tenuis | X | | | | X | | | |

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|----------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Inve | Threeidge Mussel | | | X | | | X | | |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Mamm | River Otter | | X | | | | | X | |
| Mamm | Swamp Rabbit | | | | X | | | | X |
| Rept | Alligator Snapping Turtle | | | | X | | | | X |
| Rept | Eastern River Cooter | | | | X | | | | X |
| Rept | Midland Smooth Softshell | | | | X | | | | X |
| Rept | Mississippi Map Turtle | | | | X | | | | X |
| Rept | Northern Map Turtle | | | | X | | | | X |
| Rept | Ouachita Map Turtle | | | | X | | | | X |

Table C-10. Small River Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Amph | Many-ribbed Salamander | | | | X | | | | X |
| Amph | Oklahoma Salamander | | | | X | | | | X |
| Bird | Bald Eagle | X | | | | | | X | |
| Bird | Canvasback | X | | | | | | | X |
| Bird | Lesser Scaup | | X | | | X | | | |
| Bird | Little Blue Heron | | X | | | | | | X |
| Bird | Louisiana Waterthrush | | X | | | | | | X |
| Bird | Prothonotary Warbler | | X | | | | | | X |
| Bird | Snowy Egret | | | | | | | | |
| Bird | Solitary Sandpiper | X | | | | | | | X |

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Bird | Trumpeter Swan | X | | | | | | | X |
| Fish | Alabama Shad | X | | | | | | | X |
| Fish | Blackside Darter | | X | | | | X | | |
| Fish | Blue Sucker | X | | | | | | | X |
| Fish | Bluntnose Shiner | X | | | | | | | X |
| Fish | Longnose Darter | X | | | | | | | X |
| Fish | Paddlefish | | X | | | | X | | |
| Fish | Pallid Shiner (Chub) | X | | | | | | | X |
| Fish | Redspot Chub | | X | | | | X | | |
| Fish | River Darter | X | | | | | X | | |
| Fish | Shorthead Redhorse | X | | | | | | | X |
| Fish | Southern Brook Lamprey | | X | | | | | | X |
| Fish | Spotfin Shiner | X | | | | | | | X |
| Fish | Wedgespot Shiner | X | | | | | | | X |
| Inve | Bleufer | | | X | | | X | | |
| Inve | Butterfly Mussel | | X | | | X | | | |
| Inve | Elktoe | X | | | | X | | | |
| Inve | Faxonella blairi | | | | X | | | | X |
| Inve | Little Spectaclecase | | | X | | | X | | |
| Inve | Louisiana Fatmucket | X | | | | X | | | |
| Inve | Monkeyface Mussel | | | X | | | X | | |
| Inve | Neosho Mucket | X | | | | X | | | |
| Inve | Ohio River Pigtoe | X | | | | X | | | |
| Inve | Ouachita Creekshell | X | | | | X | | | |
| Inve | Ouachita Kidneyshell | | X | | | X | | | |
| Inve | Plain Pocketbook | | X | | | X | | | |
| Inve | Purple Lilliput | X | | | | X | | | |
| Inve | Rabbitsfoot | X | | | | X | | | |
| Inve | Threeridge Mussel | | | X | | | X | | |
| Inve | Wartyback Mussel | | X | | | | X | | |
| Inve | Washboard | | | X | | | X | | |

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|----------------------------|------------|---------------|-----------------|----------------|------------------|---------------|-------------------|----------------|
| <i>Group</i> | <i>Common Name</i> | <i>Low</i> | <i>Medium</i> | <i>Abundant</i> | <i>Unknown</i> | <i>Declining</i> | <i>Stable</i> | <i>Increasing</i> | <i>Unknown</i> |
| Inve | Western Fanshell | X | | | | X | | | |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | Ozark Big-eared Bat | X | | | | | X | | |
| Mamm | River Otter | | X | | | | | X | |
| Rept | Alligator Snapping Turtle | | | | X | | | | X |
| Rept | Eastern River Cooter | | | | X | | | | X |
| Rept | Midland Smooth Softshell | | | | X | | | | X |
| Rept | Mississippi Map Turtle | | | | X | | | | X |
| Rept | Ouachita Map Turtle | | | | X | | | | X |
| Rept | Spiny Softshell Turtle | | | | X | | | | X |

Appendix C: Species List

Table C-11. Large River Species of Greatest Conservation Need (ODWC, 2005).

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|----------------------------|--------|--------|----------|---------|-----------|--------|------------|---------|
| Group | Common Name | Low | Medium | Abundant | Unknown | Declining | Stable | Increasing | Unknown |
| Bird | American Golden Plover | | X | | | | | | X |
| Bird | Bald Eagle | X | | | | | | X | |
| Bird | Canvasback | X | | | | | | | X |
| Bird | Lesser Scaup | | X | | | X | | | |
| Bird | Little Blue Heron | | X | | | | | | X |
| Bird | Northern Pintail | | X | | | X | | | |
| Bird | Peregrine Falcon | X | | | | | | | X |
| Bird | Prothonotary Warbler | | X | | | | | | X |
| Bird | Snowy Egret | | | | | | | | |
| Bird | Solitary Sandpiper | X | | | | | | | X |
| Bird | Trumpeter Swan | X | | | | | | | X |
| Fish | Alligator Gar | X | | | | X | | | |
| Fish | Blue Sucker | X | | | | | | | X |
| Fish | Paddlefish | | X | | | | X | | |
| Fish | Pallid Shiner (Chub) | X | | | | | | | X |
| Fish | River Darter | X | | | | | X | | |
| Fish | Shorthead Redhorse | X | | | | | | | X |
| Fish | Shovelnose Sturgeon | X | | | | | | | X |
| Inve | Black Sandshell | X | | | | X | | | |
| Inve | Bleufer | | | X | | | X | | |
| Inve | Monkeyface Mussel | | | X | | | X | | |
| Inve | Ohio River Pigtoe | X | | | | X | | | |
| Inve | Ozark Pigtoe | X | | | | | | | X |
| Inve | Plain Pocketbook | | X | | | X | | | |
| Inve | Threeridge Mussel | | | X | | | X | | |
| Inve | Washboard | | | X | | | X | | |
| Mamm | Gray Myotis | | X | | | | | X | |
| Mamm | Indiana Myotis | X | | | | X | | | |
| Mamm | Northern Long-eared Myotis | | | | X | | | | X |
| Mamm | River Otter | | X | | | | | X | |

Appendix C: Species List

| Species of Greatest Conservation Need | | Status | | | | Trend | | | |
|---------------------------------------|---------------------------|------------|---------------|-----------------|----------------|------------------|---------------|-------------------|----------------|
| <i>Group</i> | <i>Common Name</i> | <i>Low</i> | <i>Medium</i> | <i>Abundant</i> | <i>Unknown</i> | <i>Declining</i> | <i>Stable</i> | <i>Increasing</i> | <i>Unknown</i> |
| Rept | Alligator Snapping Turtle | | | | X | | | | X |
| Rept | Eastern River Cooter | | | | X | | | | X |
| Rept | Midland Smooth Softshell | | | | X | | | | X |
| Rept | Mississippi Map Turtle | | | | X | | | | X |
| Rept | Ouachita Map Turtle | | | | X | | | | X |
| Rept | Spiny Softshell Turtle | | | | X | | | | X |

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Appendix D: Vegetative Alliances

Table D-1. Plants Occurring on Ozark Plateau NWR (Survey by Dr. Ron Tyrl of OSU) (2001-2008).

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|---|---------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Acanthaceae | <i>Dicliptera brachiata</i> (Pursh) Spreng. | branched foldwing | occasional | native | DIBR2 |
| Acanthaceae | <i>Ruellia humilis</i> Nutt. | fringed wild petunia | occasional | native | RUHU |
| Acanthaceae | <i>Ruellia pedunculata</i> Torr. ex A. Gray | stalked wild petunia | occasional | native | RUPE4 |
| Aceraceae | <i>Acer negundo</i> L. | boxelder | occasional | native | ACNE2 |
| Aceraceae | <i>Acer rubrum</i> L. | red maple | frequent | native | ACRU |
| Aceraceae | <i>Acer saccharum</i> Marsh. | sugar maple | frequent | native | ACSA3 |
| Amaranthaceae | <i>Amaranthus hybridus</i> L. | slim amaranth | infrequent | native | AMHY |
| Anacardiaceae | <i>Rhus aromatica</i> Aiton | fragrant sumac | frequent | native | RHAR4 |
| Anacardiaceae | <i>Rhus copallinum</i> L. | winged sumac | frequent | native | RHCO |
| Anacardiaceae | <i>Rhus glabra</i> L. | clustered beaksedge | frequent | native | RHGL3 |
| Anacardiaceae | <i>Toxicodendron radicans</i> (L.) Kuntze | eastern poison ivy | frequent | native | TORA2 |
| Annonaceae | <i>Asimina triloba</i> (L.) Dunal | pawpaw | occasional | native | ASTR |
| Apiaceae | <i>Anthriscus caucalis</i> M. Bieb. | burchervil | occasional | native | ANCA14 |
| Apiaceae | <i>Chaerophyllum tainturieri</i> Hook. | hairyfruit chervil | occasional | native | CHTA |
| Apiaceae | <i>Daucus carota</i> L. | Queen Anne's lace | occasional | introduced | DACA6 |
| Apiaceae | <i>Eryngium yuccifolium</i> Michx. | button eryngo | infrequent | native | ERYU |
| Apiaceae | <i>Osmorhiza longistylis</i> (Torr.) DC. | longstyle sweetroot | occasional | native | OSLO |
| Apiaceae | <i>Polytaenia nuttallii</i> DC. | Nuttall's prairie parsley | frequent | native | PONU4 |
| Apiaceae | <i>Sanicula canadensis</i> L. | Canadian blacksnakeroot | occasional | native | SACA15 |
| Apiaceae | <i>Sanicula odorata</i> (Raf.) K.M. Pryer & L.R. Phillippe | clustered blacksnakeroot | occasional | native | SAOD |
| Apiaceae | <i>Spermolepis inermis</i> (Nutt. ex DC.) Mathias & Constance | Red River scaleseed | occasional | native | SPIN |
| Apiaceae | <i>Taenidia integerrima</i> (L.) Drude | yellow pimpernel | frequent | native | TAIN |
| Apiaceae | <i>Torilis arvensis</i> (Huds.) Link | spreading hedgeparsley | occasional | introduced | TORA |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|------------------|---|-----------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Apiaceae | <i>Trepocarpus aethusae</i> Nutt. ex DC. | whitenymph | occasional | native | TRAE2 |
| Apiaceae | <i>Zizia aurea</i> (L.) W.D.J. Koch | golden zizia | frequent | native | ZIAU |
| Apocynaceae | <i>Amsonia tabernaemontana</i> Walter | eastern bluestar | occasional | native | AMTA2 |
| Apocynaceae | <i>Apocynum cannabinum</i> L. | Indian hemp | occasional | native | APCA |
| Aquifoliaceae | <i>Ilex decidua</i> Walter | possum haw | infrequent | native | ILDE |
| Araceae | <i>Arisaema dracontium</i> (L.) Schott | green dragon | infrequent | native | ARDR3 |
| Araceae | <i>Arisaema triphyllum</i> (L.) Schott | Jack in the Pulpit | infrequent | native | ARTR |
| Aristolochiaceae | <i>Asarum canadense</i> L. | Canadian wild ginger | infrequent | native | ASCA11 |
| Asclepiadaceae | <i>Asclepias quadrifolia</i> Jacq. | fourleaf milkweed | occasional | native | ASQU |
| Asclepiadaceae | <i>Asclepias tuberosa</i> L. | butterfly milkweed | infrequent | native | ASTU |
| Asclepiadaceae | <i>Asclepias variegata</i> L. | redring milkweed | occasional | native | ASVA |
| Asclepiadaceae | <i>Asclepias verticillata</i> L. | whorled milkweed | occasional | native | ASVE |
| Asclepiadaceae | <i>Cynanchum laeve</i> (Michx.) Pers. | honeysuckle | occasional | native | CYLA |
| Asclepiadaceae | <i>Matelea baldwyniana</i> (Sweet) Woodson | Baldwin's milkvine | occasional | native | MABA3 |
| Asclepiadaceae | <i>Matelea gonocarpos</i> (Walter) Shinnars | angularfruit milkvine | occasional | native | MAGO |
| Aspleniaceae | <i>Asplenium platyneuron</i> (L.) Britton, Sterns & Poggenb. | ebony spleenwort | frequent | native | ASPL |
| Aspleniaceae | <i>Asplenium rhizophyllum</i> L. | walking fern | occasional | native | ASRH2 |
| Asteraceae | <i>Achillea millefolium</i> L. | common yarrow | occasional | introduced | ACMI2 |
| Asteraceae | <i>Ageratina altissima</i> (L.) King & H. Rob. var. <i>altissima</i> | white snakeroot | occasional | native | AGALA |
| Asteraceae | <i>Ambrosia artemisiifolia</i> | annual ragweed | frequent | native | AMAR2 |
| Asteraceae | <i>Ambrosia bidentata</i> Michx. | lanceleaf ragweed | occasional | native | AMBI2 |
| Asteraceae | <i>Ambrosia psilostachya</i> DC. | cuman ragweed | frequent | native | AMPS |
| Asteraceae | <i>Ambrosia trifida</i> L. [including both forma <i>trifida</i> and forma <i>integrifolia</i>] | great ragweed | frequent | native | AMTR |
| Asteraceae | <i>Amphiachyris dracunculoides</i> (DC.) Nutt. | prairie broomweed | frequent | native | AMDR |
| Asteraceae | <i>Antennaria parlinii</i> Fernald | Parlin's pussytoes | frequent | native | ANPA9 |
| Asteraceae | <i>Antennaria parlinii</i> Fernald ssp. <i>fallax</i> (Greene) Bayer & Stebbins | Parlin's pussytoes | frequent | native | ANPAF |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|------------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Asteraceae | <i>Arctium minus</i> Bernh. | lesser burdock | occasional | introduced | ARM12 |
| Asteraceae | <i>Arnoglossum plantagineum</i> Raf. | groovestem indian plantain | occasional | native | ARPL4 |
| Asteraceae | <i>Artemisia ludoviciana</i> Nutt. | white sagebrush | infrequent | native | ARLU |
| Asteraceae | <i>Astranthium integrifolium</i> (Michx.) Nutt. | entireleaf western daisy | infrequent | native | ASIN9 |
| Asteraceae | <i>Bidens aristosa</i> (Michx.) Britton | bearded beggarticks | infrequent | native | BIAR |
| Asteraceae | <i>Bidens bipinnata</i> L. | Spanish needles | occasional | native | BIB17 |
| Asteraceae | <i>Centaurea americana</i> Nutt. | American starthistle | infrequent | native | CEAM2 |
| Asteraceae | <i>Chrysopsis pilosa</i> Nutt. | soft goldenaster | occasional | native | CHPI8 |
| Asteraceae | <i>Cirsium altissimum</i> (L.) Hill | tall thistle | occasional | native | CIAL2 |
| Asteraceae | <i>Conoclinium coelestinum</i> (L.) DC. | bluemist flower | infrequent | native | COCO13 |
| Asteraceae | <i>Conyza canadensis</i> (L.) Cronquist | Canadian horseweed | occasional | native | COCA5 |
| Asteraceae | <i>Coreopsis lanceolata</i> L. | lanceleaf tickseed | occasional | native | COLA5 |
| Asteraceae | <i>Coreopsis palmata</i> Nutt. | stiff tickseed | occasional | native | COPA10 |
| Asteraceae | <i>Coreopsis pubescens</i> Elliot | startickseed | occasional | native | COPU2 |
| Asteraceae | <i>Coreopsis tinctoria</i> Nutt. | golden tickseed | occasional | native | COTI3 |
| Asteraceae | <i>Echinacea pallida</i> (Nutt.) Nutt. | pale purple coneflower | occasional | native | ECPA |
| Asteraceae | <i>Echinacea purpurea</i> (L.) Moench | eastern purple coneflower | occasional | native | ECPU |
| Asteraceae | <i>Elephantopus carolinianus</i> Raeusch. | carolina elephantsfoot | occasional | native | ELCA3 |
| Asteraceae | <i>Erechtites hieraciifolia</i> (L.) Raf. ex DC. | American burnweed | occasional | native | ERHI2 |
| Asteraceae | <i>Erigeron pulchellus</i> Michx. | robin's plantain | frequent | native | ERPU |
| Asteraceae | <i>Erigeron strigosus</i> Muhl. ex Willd. | prairie fleabane | frequent | native | ERST3 |
| Asteraceae | <i>Eupatorium altissimum</i> L. | tall thoroughwort | frequent | native | EUAL3 |
| Asteraceae | <i>Eupatorium serotinum</i> Michx. | lateflowering thoroughwort | occasional | native | EUSE2 |
| Asteraceae | <i>Fleischmannia incarnata</i> (Walter) King & H. Rob. | pink thoroughwort | infrequent | native | FLIN2 |
| Asteraceae | <i>Gamochaeta purpurea</i> (L.) Cabrera | spoonleaf purple everlasting | infrequent | native | GAPU3 |
| Asteraceae | <i>Grindelia papposa</i> G.L. Nesom & Suh | Spanish gold | occasional | native | GRPA8 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|-------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Asteraceae | <i>Grindelia squarrosa</i> (Pursh) Dunal | curlycup gumweed | occasional | native | GRSQ |
| Asteraceae | <i>Helenium amarum</i> (Raf.) H. Rock | yellowdicks | occasional | native | HEAM |
| Asteraceae | <i>Helenium flexuosum</i> Raf. | purplehead sneezeweed | occasional | native | HEFL |
| Asteraceae | <i>Helianthus ×laetiflorus</i> Pers. | cheerful sunflower | infrequent | native | HELA |
| Asteraceae | <i>Helianthus grosseserratus</i> M. Martens | sawtooth sunflower | occasional | native | HEGR4 |
| Asteraceae | <i>Helianthus hirsutus</i> Raf. | hairy sunflower | occasional | native | HEHI2 |
| Asteraceae | <i>Helianthus mollis</i> Lam. | ashy sunflower | occasional | native | HEMO2 |
| Asteraceae | <i>Heliopsis helianthoides</i> (L.) Sweet | smooth oxeye | occasional | native | HEHE5 |
| Asteraceae | <i>Heterotheca subaxillaris</i> (Lam.) Britton & Rusby | camphorweed | occasional | native | HESU3 |
| Asteraceae | <i>Heterotheca villosa</i> (Pursh) Shinnars | hairy false goldenaster | occasional | native | HEVI5 |
| Asteraceae | <i>Hieracium gronovii</i> L. | queendevil | occasional | native | HIGR3 |
| Asteraceae | <i>Ionactis linariifolius</i> (L.) Greene | flaxleaf whitetop aster | rare | native | IOLI2 |
| Asteraceae | <i>Lactuca canadensis</i> L. | Canada lettuce | occasional | native | LACA |
| Asteraceae | <i>Lactuca ludoviciana</i> (Nutt.) Riddell | biannual lettude | occasional | native | LALU |
| Asteraceae | <i>Leucanthemum vulgare</i> Lam. | oxeye daisy | occasional | introduced | LEVU |
| Asteraceae | <i>Liatris aspera</i> Michx. | tall blazing star | occasional | native | LIAS |
| Asteraceae | <i>Liatris elegans</i> (Walter) Michx. | pinkscale blazing star | occasional | native | LIEL |
| Asteraceae | <i>Liatris squarrosa</i> (L.) Michx. | scaly blazing star | occasional | native | LISQ |
| Asteraceae | <i>Mikania scandens</i> (L.) Willd. | climbing hempvine | occasional | native | MISC |
| Asteraceae | <i>Oligoneuron rigidum</i> (L.) Small var. <i>rigidum</i> | stiff goldenrod | occasional | native | OLRIR |
| Asteraceae | <i>Packera glabella</i> (Poir.) C. Jeffrey | butterweed | occasional | native | PAGL17 |
| Asteraceae | <i>Packera obovata</i> (Muhl. ex Willd.) W.A. Weber & A. Löve | roundleaf ragwort | occasional | native | PAOB6 |
| Asteraceae | <i>Parthenium integrifolium</i> L. | wild quinine | infrequent | native | PAIN2 |
| Asteraceae | <i>Pluchea odorata</i> (L.) Cass. | sweetscent | occasional | native | PLOD |
| Asteraceae | <i>Polymnia canadensis</i> L. | whiteflower leafcup | occasional | native | POCA11 |
| Asteraceae | <i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & B.L. Burt | rabbit tobacco | occasional | native | PSOB3 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|---|-----------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Asteraceae | <i>Pyrrhopappus carolinianus</i> (Walt.)DC. | Carolina desert chicory | infrequent | native | PYCA |
| Asteraceae | <i>Ratibida pinnata</i> (Vent.) Barnhart | prairie coneflower | occasional | native | RAPI |
| Asteraceae | <i>Rudbeckia hirta</i> L. | blackeyed susan | occasional | native | RUHI2 |
| Asteraceae | <i>Rudbeckia triloba</i> L. | browneyed susan | occasional | native | RUTR2 |
| Asteraceae | <i>Smallanthus uvedalius</i> (L.) Mack. ex Small | hairy leafcup | occasional | native | SMUV |
| Asteraceae | <i>Solidago canadensis</i> L. | Canada goldenrod | frequent | native | SOCA6 |
| Asteraceae | <i>Solidago hispida</i> Muhl. ex Willd. | hairy goldenrod | frequent | native | SOHI |
| Asteraceae | <i>Solidago missouriensis</i> Nutt. | missouri goldenrod | frequent | native | SOMI2 |
| Asteraceae | <i>Solidago petiolaris</i> Aiton | downy ragged goldenrod | frequent | native | SOPE |
| Asteraceae | <i>Solidago ulmifolia</i> Muhl. ex Willd. | elmleaf goldenrod | frequent | native | SOUL2 |
| Asteraceae | <i>Symphiotrichum anomalum</i> (Engelm.) G.L. Nesom | manray aster | frequent | native | SYAN2 |
| Asteraceae | <i>Symphiotrichum drummondii</i> (Lindl.) G.L. Nesom var. <i>texanum</i> (Burgess) G.L. Nesom | Drummond's aster | frequent | native | SYDRT |
| Asteraceae | <i>Symphiotrichum oblongifolium</i> (Nutt.) G.L. Nesom | aromatic aster | frequent | native | SYOB |
| Asteraceae | <i>Symphiotrichum patens</i> (Aiton) G.L. Nesom var. <i>patens</i> | late purple aster | frequent | native | SYAP2 |
| Asteraceae | <i>Symphiotrichum turbinellum</i> (Lindl.) G.L. Nesom | smooth violet prairie aster | occasional | native | SYTU2 |
| Asteraceae | <i>Taraxacum officinale</i> F.H. Wigg. | common dandelion | occasional | introduced | TAOF |
| Asteraceae | <i>Verbesina alternifolia</i> (L.) Britton ex Kearney | wingstem | occasional | native | VEAL |
| Asteraceae | <i>Verbesina helianthoides</i> Michx. | gravelweed | occasional | native | VEHE |
| Asteraceae | <i>Verbesina virginica</i> L. | white crownbeard | occasional | native | VEVI3 |
| Asteraceae | <i>Vernonia baldwinii</i> Torr. | Baldwin's ironweed | occasional | native | VEBA |
| Asteraceae | <i>Vernonia gigantea</i> (Walter) Trel. | giant ironweed | occasional | native | VEGI |
| Balsaminaceae | <i>Impatiens capensis</i> Meerb. | jewelweed | occasional | native | IMCA |
| Balsaminaceae | <i>Impatiens pallida</i> Nutt. | pale touch me not | rare | native | IMPA |
| Berberidaceae | <i>Podophyllum peltatum</i> L. | mayapple | frequent | native | POPE |
| Betulaceae | <i>Ostrya virginiana</i> (Mill.) K. Koch | hophornbeam | occasional | native | OSVI |
| Bignoniaceae | <i>Campsis radicans</i> (L.) Seem. ex Bureau | trumpet creeper | frequent | native | CARA2 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|-------------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Bignoniaceae | <i>Catalpa speciosa</i> (Warder) Warder ex Engelm. | Northern catalpa | infrequent | native | CASP8 |
| Boraginaceae | <i>Buglossoides arvensis</i> (L.) I.M. Johnst. | corn gromwell | infrequent | native | BUAR3 |
| Boraginaceae | <i>Cynoglossum virginianum</i> L. | wild comfrey | infrequent | native | CYVI |
| Boraginaceae | <i>Hackelia virginiana</i> (L.) I.M. Johnst. | beggar's lice | occasional | native | HAVI2 |
| Boraginaceae | <i>Lithospermum canescens</i> (Michx.) Lehm. | hoary puccoon | infrequent | native | LICA12 |
| Boraginaceae | <i>Lithospermum multiflorum</i> Torr. ex A. Gray | manyflowered stone seed | occasional | native | LIMU |
| Boraginaceae | <i>Myosotis verna</i> Engelm. | spring forget-me-not | occasional | native | MYVE1 |
| Brassicaceae | <i>Arabis canadensis</i> L. | sicklepod | infrequent | native | ARCA |
| Brassicaceae | <i>Arabis laevigata</i> (Muhl. ex Willd.) Poir. | smooth rockcress | occasional | native | ARLA |
| Brassicaceae | <i>Arabis missouriensis</i> Greene | green rockcress | occasional | native | ARM15 |
| Brassicaceae | <i>Arabis shortii</i> (Fernald) Gleason | short's rockcress | rare | native | ARSH2 |
| Brassicaceae | <i>Barbarea vulgaris</i> W.T. Aiton | garden yellowrocket | occasional | native | BAVU |
| Brassicaceae | <i>Cardamine concatenata</i> (Michx.) Sw. | cutleaf toothwort | infrequent | native | CACO26 |
| Brassicaceae | <i>Cardamine parviflora</i> L. | sand bittercress | infrequent | native | CAPA12 |
| Brassicaceae | <i>Lepidium densiflorum</i> Schrad. | common pepperweed | infrequent | native | LEDE |
| Brassicaceae | <i>Lepidium virginicum</i> L. | Virginia pepperweed | frequent | native | LEVI13 |
| Brassicaceae | <i>Nasturtium officinale</i> W.T. Aiton | watercress | infrequent | introduced | NAOF |
| Cactaceae | <i>Opuntia macrorhiza</i> Engelm. | twistspine pricklypear | infrequent | native | OPMA2 |
| Campanulaceae | <i>Campanulastrum americanum</i> (L.) Small | American bellflower | infrequent | native | CAAM18 |
| Campanulaceae | <i>Lobelia appendiculata</i> A.DC. | pale lobelia | infrequent | native | LOAP |
| Campanulaceae | <i>Lobelia cardinalis</i> L. | cardinal flower | rare | native | LOCA2 |
| Campanulaceae | <i>Lobelia inflata</i> L. | Indian tobacco | infrequent | native | LOIN |
| Campanulaceae | <i>Lobelia spicata</i> Lam. | palespike lobelia | infrequent | native | LOSP |
| Campanulaceae | <i>Lobelia siphilitica</i> L. | great blue lobelia | infrequent | native | LOSI |
| Campanulaceae | <i>Triodanis perfoliata</i> (L.) Nieuwl. | clasping Venus' looking glass | occasional | native | TRPE4 |
| Capparaceae | <i>Cleome serrulata</i> Pursh | toothed spiderflower | infrequent | native | CLSE2 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|-------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Caprifoliaceae | <i>Sambucus nigra</i> L. | black elderberry | infrequent | native | SANI4 |
| Caprifoliaceae | <i>Lonicera japonica</i> Thunb. | Japanese honeysuckle | infrequent | introduced | LOJA |
| Caprifoliaceae | <i>Symphoricarpos orbiculatus</i> Moench | coralberry | abundant | native | SYOR |
| Caprifoliaceae | <i>Viburnum prunifolium</i> L. | blach haw | frequent | native | VIPR |
| Caprifoliaceae | <i>Viburnum rufidulum</i> Raf. | rusty blackhaw | frequent | native | VIRU |
| Caryophyllaceae | <i>Dianthus armeria</i> L. | deptford pink | occasional | introduced | DIAR |
| Caryophyllaceae | <i>Minuartia patula</i> (Michx.) Mattf. | pitcher's stichwort | occasional | native | MIPA6 |
| Caryophyllaceae | <i>Saponaria officinalis</i> L. | bouncing bet | occasional | introduced | SAOF4 |
| Caryophyllaceae | <i>Silene regia</i> Sims | royal catchfly | occasional | native | SIRE2 |
| Caryophyllaceae | <i>Silene stellata</i> (L.) W.T. Aiton | widiwsfrill | occasional | native | SIST |
| Caryophyllaceae | <i>Silene virginica</i> L. | firepink | occasional | native | SIVI4 |
| Caryophyllaceae | <i>Stellaria media</i> (L.) Vill. | common chickweed | occasional | introduced | STME2 |
| Celastraceae | <i>Euonymus atropurpureus</i> Jacq. | burningbush | infrequent | native | EUAT5 |
| Chenopodiaceae | <i>Chenopodium album</i> L. | lambsquarters | occasional | introduced | CHAL7 |
| Chenopodiaceae | <i>Chenopodium ambrosioides</i> L. | Mexican tea | infrequent | introduced | CHAM |
| Clusiaceae | <i>Hypericum hypericoides</i> (L.) Crantz | St Andrew's cross | occasional | native | HYHY |
| Clusiaceae | <i>Hypericum punctatum</i> Lam. | spotted St. John's wort | occasional | native | HYPV |
| Commelinaceae | <i>Commelina communis</i> L. | asiatic dayflower | occasional | introduced | COCO3 |
| Commelinaceae | <i>Commelina erecta</i> L. | whitemouth dayflower | occasional | native | COER |
| Commelinaceae | <i>Tradescantia ohiensis</i> Raf. | bluejacket | occasional | native | TROH |
| Commelinaceae | <i>Tradescantia ozarkana</i> E.S. Anderson & Woodson | Ozark spiderwort | rare | native | TROZ |
| Convolvulaceae | <i>Ipomoea coccinea</i> L. | redstar | occasional | introduced | IPCO3 |
| Convolvulaceae | <i>Ipomoea pandurata</i> (L.) G. Mey. | man of the earth | occasional | native | IPPA |
| Cornaceae | <i>Cornus drummondii</i> C.A. Mey. | roughleaf dogwood | abundant | native | CODR |
| Cornaceae | <i>Cornus florida</i> L. | flowering dogwood | abundant | native | COFL2 |
| Cornaceae | <i>Nyssa sylvatica</i> Marsh. | blackgum | occasional | native | NYSY |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|---------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Crassulaceae | <i>Sedum pulchellum</i> Michx. | widowscross | infrequent | native | SEPU |
| Cucurbitaceae | <i>Melothria pendula</i> L. | Guadeloupe cucumber | occasional | native | MEPE3 |
| Cupressaceae | <i>Juniperus virginiana</i> L. | Eastern redcedar | occasional | native | JUVI |
| Cuscutaceae | <i>Cuscuta pentagona</i> Engelm. | fiveangled dodder | infrequent | native | CUPE3 |
| Cuscutaceae | <i>Cuscuta</i> sp. | dodder | occasional | native | CUSCU |
| Cyperaceae | <i>Carex albicans</i> Willd. ex Spreng. | whitetinge sedge | occasional | native | CAAL25 |
| Cyperaceae | <i>Carex aureolensis</i> Steudel | goldenfruit sedge | occasional | native | n/a |
| Cyperaceae | <i>Carex cephalophora</i> Muhl. ex Willd. | oval-leaf sedge | infrequent | native | CACE |
| Cyperaceae | <i>Carex cherokeensis</i> Schwein. | Cherokee sedge | occasional | native | CACH3 |
| Cyperaceae | <i>Carex digitalis</i> Willd. | slender woodland sedge | occasional | native | CADI5 |
| Cyperaceae | <i>Carex festucacea</i> Schkuhr ex Willd. | fescue sedge | occasional | native | CAFE3 |
| Cyperaceae | <i>Carex gracilescens</i> Steud. | slender looseflower sedge | rare | native | CAGR8 |
| Cyperaceae | <i>Carex grisea</i> Wahlenb. | inflated narrowleaf sedge | occasional | native | CAGR24 |
| Cyperaceae | <i>Carex hirsutella</i> Mack. | fuzzy wuzzy sedge | occasional | native | CAHI6 |
| Cyperaceae | <i>Carex meadii</i> Dewey | Mead's sedge | occasional | native | CAME2 |
| Cyperaceae | <i>Carex muehlenbergii</i> Schkur ex Willd. | Muhlenberg's sedge | infrequent | native | CAMU4 |
| Cyperaceae | <i>Carex oligocarpa</i> Schkuhr ex Willd. | richwoods sedge | occasional | native | CAOL2 |
| Cyperaceae | <i>Carex retroflexa</i> Muhl. ex Willd. | reflexed sedge | occasional | native | CARE9 |
| Cyperaceae | <i>Carex socialis</i> Mohlenbr. & Schwegm. | low woodland sedge | infrequent | native | CASO |
| Cyperaceae | <i>Cyperus echinatus</i> (L.) Wood | globe flatsedge | occasional | native | CYEC2 |
| Cyperaceae | <i>Cyperus lupulinus</i> (Spreng.) Marcks | Great Plains flatsedge | occasional | native | CYLU2 |
| Cyperaceae | <i>Cyperus odorata</i> L. | fragrant flatsedge | infrequent | native | CYOD |
| Cyperaceae | <i>Cyperus strigosus</i> L. | strawcolored flatsedge | infrequent | native | CYST |
| Cyperaceae | <i>Eleocharis lanceolata</i> Fernald | daggerleaf spikerush | occasional | native | ELLA |
| Cyperaceae | <i>Luzula bulbosa</i> (Alph. Wood) Smyth & Smyth | bulbous woodrush | infrequent | native | LUBU |
| Cyperaceae | <i>Rhynchospora glomerata</i> (L.) Vahl | clustered beaksedge | occasional | native | RHGL3 |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|----------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Cyperaceae | <i>Scirpus atrovirens</i> Willd. | green bulrush | infrequent | native | SCAT2 |
| Cyperaceae | <i>Scirpus pendulus</i> Muhl. | roflous bulrush | occasional | native | SCPE4 |
| Cyperaceae | <i>Scleria oligantha</i> Michx. | littlehead nutrush | occasional | native | SCOL2 |
| Cyperaceae | <i>Dryopteris filix-mas</i> (L.) Schott | male fern | rare | native | DRFI2 |
| Dioscoreaceae | <i>Dioscorea villosa</i> L. | wild yam | infrequent | native | DIVI4 |
| Dryopteridaceae | <i>Cystopteris tennesseensis</i> Shayer | Tennessee bladder fern | occasional | native | CYTE3 |
| Dryopteridaceae | <i>Polystichum acrostichoides</i> (Michx.) Schott | Christmas fern | frequent | native | POAC4 |
| Dryopteridaceae | <i>Woodsia obtusa</i> (Spreng.) Torr. | bluntlobe cliff fern | occasional | native | WOOB2 |
| Ebenaceae | <i>Diospyros virginiana</i> L. | common persimmon | occasional | native | DIVI5 |
| Elaeagnaceae | <i>Elaeagnus angustifolia</i> L. | Russian olive | infrequent | native | ELAN |
| Ericaceae | <i>Vaccinium arboreum</i> Marsh. | farkleberry | abundant | native | VAAR |
| Euphorbiaceae | <i>Acalypha gracilens</i> Gray | slender threeseed mercury | occasional | native | ACGR2 |
| Euphorbiaceae | <i>Acalypha monococca</i> (Engelm. ex A.Gray) Lill. W.Mill. & Gandhi | threeseed mercury | frequent | native | ACMO4 |
| Euphorbiaceae | <i>Acalypha ostryifolia</i> Riddell | pineland threeseed mercury | occasional | native | ACOS |
| Euphorbiaceae | <i>Acalypha rhomboidea</i> Raf. | common threeseed mercury | occasional | native | ACRH |
| Euphorbiaceae | <i>Chamaesyce missurica</i> (Raf.) Shinnars | prairie sandmat | occasional | native | CHMI8 |
| Euphorbiaceae | <i>Chamaesyce nutans</i> (Lag.) Small | eyebane | occasional | native | CHNU9 |
| Euphorbiaceae | <i>Croton glandulosus</i> L. | vente conmigo | occasional | native | CRGL2 |
| Euphorbiaceae | <i>Croton lindheimerianus</i> Scheele | threeseed croton | occasional | native | CRLI2 |
| Euphorbiaceae | <i>Croton monanthogynus</i> Michx. | prairie tea | occasional | native | CRMO6 |
| Euphorbiaceae | <i>Crotonopsis michauxii</i> G.L. Webster | Michaux's croton | O | native | CRMI8 |
| Euphorbiaceae | <i>Euphorbia corollata</i> L. | flowering spurge | occasional | native | EUCO10 |
| Euphorbiaceae | <i>Euphorbia dentata</i> Michx. | toothed spurge | occasional | native | EUDE4 |
| Euphorbiaceae | <i>Euphorbia spathulata</i> Lam. | warty spurge | occasional | native | EUSP |
| Euphorbiaceae | <i>Phyllanthus caroliniensis</i> Walter | Carolina leafflower | infrequent | native | PHCA9 |
| Euphorbiaceae | <i>Albizia julibrissin</i> Durazz. | sliktree | infrequent | introduced | ALJU |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|---|--------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Fabaceae | <i>Amphicarpaea bracteata</i> (L.) Fernald | American hogpeanut | infrequent | native | AMBR2 |
| Fabaceae | <i>Astragalus canadensis</i> L. | Canadian milkvetch | occasional | native | ASCA11 |
| Fabaceae | <i>Astragalus racemosus</i> Pursh | cream milkvetch | infrequent | native | ASRA2 |
| Fabaceae | <i>Baptisia bracteata</i> Muhl. ex Elliot var. <i>leucophaea</i> (Nutt.) Kartesz & Gandhi | longbract wild indigo | occasional | native | BABRL2 |
| Fabaceae | <i>Cercis canadensis</i> L. | eastern redbud | frequent | native | CECA4 |
| Fabaceae | <i>Chamaecrista fasciculata</i> (Michx.) Greene | partridge pea | occasional | native | CHFA2 |
| Fabaceae | <i>Chamaecrista nictitans</i> (L.) Moench | sensitive partidge pea | occasional | native | CHNI2 |
| Fabaceae | <i>Clitoria mariana</i> L. | Atlantic pigeonwings | occasional | native | CLMA4 |
| Fabaceae | <i>Crotalaria sagittalis</i> L. | arrowhead rattlebox | occasional | native | CRSA4 |
| Fabaceae | <i>Dalea candida</i> Michx. ex Willd. | white prairie clover | occasional | native | DACA7 |
| Fabaceae | <i>Desmanthus illinoensis</i> (Michx.) MacMill. ex B.L. Rob. & Fernald | Illinois bundleflower | occasional | native | DEIL |
| Fabaceae | <i>Desmodium canescens</i> (L.) DC. | showy ticktrefoil | occasional | native | DECA8 |
| Fabaceae | <i>Desmodium glutinosum</i> (Muhl. ex Willd.) Wood | pointedleaf ticktefoil | frequent | native | DEGL5 |
| Fabaceae | <i>Desmodium laevigatum</i> (Nutt.) DC. | smooth ticktrefoil | occasional | native | DELA |
| Fabaceae | <i>Desmodium nudiflorum</i> (L.) DC. | nakedflower ticktrefoil | frequent | native | DENU4 |
| Fabaceae | <i>Desmodium paniculatum</i> (L.) DC. | panickedleaf ticktrefoil | occasional | native | DEPA6 |
| Fabaceae | <i>Desmodium pauciflorum</i> (Nutt.) DC. | fewflower ticktrefoil | rare | native | DEPA7 |
| Fabaceae | <i>Desmodium rotundifolium</i> DC. | prostrate ticktrefoil | occasional | native | DERO3 |
| Fabaceae | <i>Desmodium sessilifolium</i> (Torr.) Torr. & A.Gray | sessile ticktrefoil | occasional | native | DESE |
| Fabaceae | <i>Galactia regularis</i> (L.) Britton, Sterns & Poggenb. | eastern milkpea | infrequent | native | GARE2 |
| Fabaceae | <i>Gleditsia triacanthos</i> L. | honey locust | infrequent | native | GLTR |
| Fabaceae | <i>Glycyrrhiza lepidota</i> Pursh | American licorice | infrequent | native | GLLE |
| Fabaceae | <i>Kummerowia stipulacea</i> (Maxim.) Makino | Korean clover | occasional | introduced | KUST |
| Fabaceae | <i>Lespedeza cuneata</i> (Dum. Cours.) G. Don | sericia lespedeza | occasional | introduced | LECU |
| Fabaceae | <i>Lespedeza frutescens</i> (L.) Hornem. | shrubby lespedeza | occasional | native | LEFR5 |
| Fabaceae | <i>Lespedeza hirta</i> (L.) Hornem. | hairy lespedeza | occasional | native | LEHI2 |

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|-----------------|---|-----------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Fabaceae | <i>Lespedeza procumbens</i> Michx. | trailing lespedeza | occasional | native | LEPR |
| Fabaceae | <i>Lespedeza repens</i> (L.) W.Bart. | creeping lespedeza | infrequent | native | LERE2 |
| Fabaceae | <i>Lespedeza violacea</i> (L.) Pers. | violet lespedeza | occasional | native | LEVI6 |
| Fabaceae | <i>Lespedeza virginica</i> (L.) Britton | slender lespedeza | occasional | native | LEVI7 |
| Fabaceae | <i>Melilotus alba</i> Medikus | white sweetclover | occasional | introduced | MEAL12 |
| Fabaceae | <i>Melilotus officinalis</i> (L.) Lam. | yellow sweetclover | occasional | introduced | MEOF |
| Fabaceae | <i>Mimosa quadrivalvis</i> L. | fourvalve mimosa | occasional | native | MIQU2 |
| Fabaceae | <i>Orbexilum pedunculatum</i> (Mill.) Rydb. | Sampson's snakeroot | infrequent | native | ORPE |
| Fabaceae | <i>Rhynchosia latifolia</i> Nutt. ex Torr. & A. Gray | prairie snoutbean | infrequent | native | RHLA5 |
| Fabaceae | <i>Senna marilandica</i> (L.) Link | Maryland senna | infrequent | native | SEMA11 |
| Fabaceae | <i>Strophostyles helvola</i> (L.) Elliott | amberique bean | occasional | native | STHE9 |
| Fabaceae | <i>Strophostyles leiosperma</i> (Torr. & A. Gray) Piper | slickseed fuzzybean | occasional | native | STLE6 |
| Fabaceae | <i>Strophostyles umbellata</i> (Muhl. ex Willd.) Britt. | pink fuzzybean | infrequent | native | STUM2 |
| Fabaceae | <i>Stylosanthes biflora</i> (L.) Britton, Sterns & Poggenb. | Mexican umbrella fern | occasional | native | STBI2 |
| Fabaceae | <i>Tephrosia virginiana</i> (L.) Pers. | Virginia tephrosia | occasional | native | TEVI |
| Fabaceae | <i>Trifolium campestre</i> Schreb. | field clover | occasional | introduced | TRCA5 |
| Fabaceae | <i>Trifolium dubium</i> Sibth. | suckling clover | infrequent | introduced | TRDU2 |
| Fabaceae | <i>Trifolium hybridum</i> L. | alsike clover | occasional | introduced | TRHY |
| Fabaceae | <i>Trifolium repens</i> L. | white clover | infrequent | introduced | TRRE3 |
| Fabaceae | <i>Vicia minutiflora</i> F.G. Dietr. | pygmyflower vetch | occasional | native | VIMI |
| Fagaceae | <i>Castanea pumila</i> (L.) P. Mill. var. <i>ozarkensis</i> (Ashe) Tucker | Ozark chinkapin | rare | native | CAPUO |
| Fagaceae | <i>Quercus alba</i> L. | white oak | occasional | native | QUAL |
| Fagaceae | <i>Quercus falcata</i> Michx. | southern red oak | abundant | native | QUFA |
| Fagaceae | <i>Quercus macrocarpa</i> Michx. | buroak | abundant | native | QUMA2 |
| Fagaceae | <i>Quercus marilandica</i> Münchh. | blackjack oak | abundant | native | QUMA3 |
| Fagaceae | <i>Quercus muehlenbergii</i> Engelm. | chinkapin oak | abundant | native | QUMU |

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|------------------|---|-------------------------|------------|---------------|---------------|
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| Fagaceae | <i>Quercus prinoides</i> Willd. | dwarf chinkapin oak | occasional | native | QUPR |
| Fagaceae | <i>Quercus rubra</i> L. | Northern red oak | abundant | native | QURU |
| Fagaceae | <i>Quercus shumardii</i> Buckley | Shumard's oak | abundant | native | QUSH |
| Fagaceae | <i>Quercus stellata</i> Wangenh. | post oak | abundant | native | QUST |
| Fagaceae | <i>Quercus velutina</i> Lam. | black oak | abundant | native | QUVE |
| Fumariaceae | <i>Corydalis flavula</i> (Raf.) DC. | yellow fumewort | infrequent | native | COFL3 |
| Fumariaceae | <i>Dicentra cucullaria</i> (L.) Bernh. | Dutchman's breeches | occasional | native | DICU |
| Geranianaceae | <i>Geranium carolinianum</i> L. | Carolina geranium | infrequent | native | GECA5 |
| Geranianaceae | <i>Geranium maculatum</i> L. | spotted geranium | infrequent | native | GEMA |
| Hippocastanaceae | <i>Aesculus glabra</i> Willd. | Ohio buckeye | infrequent | native | AEGL |
| Hamamelidaceae | <i>Hamamilis vernalis</i> Sarg. | Ozark witchhazel | occasional | native | HAVE2 |
| Hamamelidaceae | <i>Liquidambar styraciflua</i> L. | sweetgum | occasional | native | LIST2 |
| Hydrangeaceae | <i>Hydrangea arborescens</i> L. | wild hydrangea | infrequent | native | HYAR |
| Iridaceae | <i>Belamcanda chinensis</i> (L.) DC. | blackberry lily | infrequent | introduced | BECH |
| Iridaceae | <i>Sisyrinchium campestre</i> E.P. Bicknell | prairie blue-eyed grass | occasional | native | SICA9 |
| Juglandaceae | <i>Carya alba</i> (L.) Nutt. | mockernut hickory | abundant | native | CAAL27 |
| Juglandaceae | <i>Carya cordiformis</i> (Wangenh.) K. Koch | bitternut hickory | abundant | native | CACO15 |
| Juglandaceae | <i>Carya glabra</i> (Mill.) Sweet | pignut hickory | abundant | native | CAGL8 |
| Juglandaceae | <i>Carya ovalis</i> (Wangenh.) Sarg. | red hickory | abundant | native | CAOV3 |
| Juglandaceae | <i>Carya ovata</i> (Mill.) K. Koch | shagbark hickory | abundant | native | CAOV2 |
| Juglandaceae | <i>Carya texana</i> Buckley | black hickory | abundant | native | CATE9 |
| Juglandaceae | <i>Juglans nigra</i> L. | black walnut | abundant | native | JUNI |
| Juncaceae | <i>Juncus interior</i> Wiegand | inland rush | occasional | native | JUIN2 |
| Juncaceae | <i>Juncus marginatus</i> Rostk. | grassleaf rush | occasional | native | JUMA4 |
| Juncaceae | <i>Juncus secundus</i> P. Beauv. ex Poir. | lopsided rush | occasional | native | JUSE |
| Juncaceae | <i>Juncus tenuis</i> Willd. | poverty rush | occasional | native | JUTE |

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| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Juncaceae | <i>Luzula bulbosa</i> (Alph. Wood) Smyth & Smyth | bulbous woodrush | occasional | native | LUBU |
| Lamiaceae | <i>Blephilia ciliata</i> (L.) Benth. | downny pagoda-plant | frequent | native | BLCL |
| Lamiaceae | <i>Clinopodium arkansanum</i> (Nutt.) House | limestone calamint | infrequent | native | CLAR5 |
| Lamiaceae | <i>Cunila origanoides</i> (L.) Britton | common dittany | occasional | native | CUOR |
| Lamiaceae | <i>Isanthus brachiatus</i> (L.) Britton, Sterns & Poggenb. | fluxweed | infrequent | native | ISBR3 |
| Lamiaceae | <i>Lamium purpureum</i> L. | purple deadnettle | infrequent | introduced | LAPU2 |
| Lamiaceae | <i>Lycopus americanus</i> Muhl. ex W.Bartram | American water horehound | occasional | native | LYAM |
| Lamiaceae | <i>Monarda bradburiana</i> Beck | Eastern beebalm | occasional | native | MOBR2 |
| Lamiaceae | <i>Monarda citriodora</i> Cerv. ex Lag. | lemon beebalm | occasional | native | MOCI |
| Lamiaceae | <i>Monarda fistulosa</i> L. | wild bergamot | occasional | native | MOFI |
| Lamiaceae | <i>Monarda punctata</i> L. | spotted beebalm | infrequent | native | MOPU |
| Lamiaceae | <i>Monarda russeliana</i> Nutt. ex Sims | redpurple beebalm | occasional | native | MORU |
| Lamiaceae | <i>Perilla frutescens</i> (L.) Britton | beefsteak plant | frequent | introduced | PEFR4 |
| Lamiaceae | <i>Prunella vulgaris</i> L. | common selfheal | occasional | native | PRVU |
| Lamiaceae | <i>Pycnanthemum albescens</i> Torr. & A.Gray | whiteleaf mountain mint | infrequent | native | PYAL |
| Lamiaceae | <i>Pycnanthemum tenuifolium</i> Schrad. | narrowleaf mountain mint | occasional | native | PYTE |
| Lamiaceae | <i>Salvia azurea</i> L. | azure bluesage | occasional | native | SAAZ |
| Lamiaceae | <i>Salvia lyrata</i> L. | lyreleaf sage | occasional | native | SALY2 |
| Lamiaceae | <i>Scutellaria elliptica</i> Muhl.ex Spreng. | hairy skullcap | occasional | native | SCEL |
| Lamiaceae | <i>Scutellaria ovata</i> Hill. | heartleaf skullcap | occasional | native | SCOV |
| Lamiaceae | <i>Teucrium canadense</i> L. | Canada germander | occasional | native | TECA3 |
| Lauraceae | <i>Lindera benzoin</i> (L.) Blume | northern spicebush | frequent | native | LIBE3 |
| Lauraceae | <i>Sassafras albidum</i> (Nutt.) Nees | sassafras | frequent | native | SAAL5 |
| Liliaceae | <i>Allium canadense</i> L. | meadow garlic | infrequent | native | ALCA3 |
| Liliaceae | <i>Camassia scilloides</i> (Raf.) Cory | Atlantic camass | infrequent | native | CACS5 |
| Liliaceae | <i>Erythronium albidum</i> Nutt. | white fawnlily | occasional | native | ERAL9 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|-----------------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Liliaceae | <i>Erythronium americanum</i> Ker Gawl. | dogtooth violet | occasional | native | ERAM5 |
| Liliaceae | <i>Erythronium rostratum</i> W. Wolf | yellow troutlily | occasional | native | ERRO5 |
| Liliaceae | <i>Maianthemum racemosum</i> (L.) Link ssp. <i>racemosum</i> | feathery false lily of the valley | infrequent | native | MARAR |
| Liliaceae | <i>Narcissus tazetta</i> L. | cream narcissus | infrequent | introduced | NATA2 |
| Liliaceae | <i>Nothoscordum bivalve</i> (L.) Britton | crowpoison | occasional | native | NOBI2 |
| Liliaceae | <i>Polygonatum biflorum</i> (Walter) Elliot | smooth Solomon's seal | infrequent | native | POBI2 |
| Liliaceae | <i>Trillium viride</i> Beck | wood wakerobin | occasional | native | TRVI4 |
| Liliaceae | <i>Trillium viridescens</i> Nutt. | tapertip wakerobin | occasional | native | TRVI5 |
| Liliaceae | <i>Uvularia grandiflora</i> Sm. | largeflower bellwort | rare | native | UVGR |
| Lythraceae | <i>Cuphea viscosissima</i> Jacq. | blue waxweed | occasional | native | CUVI |
| Malvaceae | <i>Callirhoe digitata</i> Nutt. | winecup | occasional | native | CADI2 |
| Malvaceae | <i>Sida spinosa</i> L. | prickly fanpetals | occasional | native | SISP |
| Menispermaceae | <i>Cocculus carolinus</i> (L.) DC. | carolina coralbead | occasional | native | COCA |
| Monotropaceae | <i>Monotropa uniflora</i> L. | Indianpipe | rare | native | MOUN3 |
| Moraceae | <i>Maclura pomifera</i> (Raf.) C.K. Schneid. | osage orange | occasional | native | MAPO |
| Moraceae | <i>Morus rubra</i> L. | red mulberry | frequent | native | MORU2 |
| Nyctaginaceae | <i>Mirabilis albida</i> (Walter) Heimerl | white four o'clock | occasional | native | MIAL4 |
| Oleaceae | <i>Fraxinus americana</i> L. | white ash | frequent | native | FRAM2 |
| Oleaceae | <i>Fraxinus pennsylvanica</i> Marsh. | green ash | frequent | native | FRPE |
| Onagraceae | <i>Gaura longiflora</i> Spach. | longflower beeblossom | occasional | native | GALO3 |
| Onagraceae | <i>Ludwigia decurrens</i> Walter | wingleaf primrose willow | occasional | native | LUDE4 |
| Onagraceae | <i>Oenothera biennis</i> L. | common evening primrose | occasional | native | OEBI |
| Onagraceae | <i>Oenothera fruticosa</i> L. | narrowleaf evening primrose | infrequent | native | OEFR |
| Onagraceae | <i>Oenothera macrocarpa</i> Nutt. | bigfruit evening primrose | infrequent | native | OEMA |
| Ophioglossaceae | <i>Botrychium bitermum</i> (Sav.) Underw. | sparseglobe bitternatum | occasional | native | BOBOI |
| Ophioglossaceae | <i>Botrychium virginianum</i> (L.) Sw. | rattlesnake fern | occasional | native | BOVI |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|---------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Orchidaceae | <i>Corallorhiza odontorhiza</i> (Willd.) Poir. | autumn coralroot | rare | native | COOD7 |
| Orchidaceae | <i>Spiranthes cernua</i> (L.) Rich. | nodding lady's tresses | infrequent | native | SPCE |
| Orchidaceae | <i>Spiranthes tuberosa</i> Raf. | little lady's tresses | infrequent | native | SPTU |
| Orchidaceae | <i>Triphora trianthophora</i> (Sw.) Rydb. | threebirds orchid | infrequent | native | TRTR3 |
| Oxalidaceae | <i>Oxalis dillenii</i> Jacq. | slender yellow woodsorrel | infrequent | native | OXDI2 |
| Oxalidaceae | <i>Oxalis violaceae</i> L. | violet woodsorrel | infrequent | native | OXVI |
| Papaveraceae | <i>Sanguinaria canadensis</i> L. | bloodroot | occasional | native | SACA13 |
| Passifloraceae | <i>Passiflora incarnata</i> L. | purple passionflower | infrequent | native | PAIN6 |
| Passifloraceae | <i>Passiflora lutea</i> L. | yellow passionflower | infrequent | native | PALU2 |
| Phytolaccaceae | <i>Phytolacca americana</i> L. | American pokeweed | occasional | native | PHAM4 |
| Pinaceae | <i>Pinus echinata</i> Mill. | shortleaf pine | infrequent | native | PIEC2 |
| Plantaginaceae | <i>Plantago aristata</i> Michx. | largebracted plantain | occasional | native | PLAR3 |
| Plantaginaceae | <i>Plantago elongata</i> Pursh | prairie plantain | occasional | native | PLEL |
| Plantaginaceae | <i>Plantago lanceolata</i> L. | narrowleaf plantain | occasional | introduced | PLLA |
| Plantaginaceae | <i>Plantago major</i> L. | common plantain | occasional | native | PLMA2 |
| Plantaginaceae | <i>Plantago patagonica</i> Jacq. | wooly plantain | occasional | native | PLPA2 |
| Plantaginaceae | <i>Plantago rugelii</i> Decne. | blackseed plantain | occasional | native | PLRU |
| Plantaginaceae | <i>Plantago virginica</i> L. | Virginia plantain | occasional | native | PLVI |
| Platanaceae | <i>Platanus occidentalis</i> L. | American sycamore | occasional | native | PLOC |
| Poaceae | <i>Agrostis hyemalis</i> (Walter) Britton, Sterns & Poggenb. | winter bentgrass | occasional | native | AGHY |
| Poaceae | <i>Agrostis perennans</i> (Walter) Tuck. | upland bentgrass | occasional | native | AGPE |
| Poaceae | <i>Aira elegans</i> Willd. ex Kunth | annual silver hairgrass | occasional | introduced | AIEL4 |
| Poaceae | <i>Andropogon gerardii</i> Vitman | big bluestem | occasional | native | ANGE |
| Poaceae | <i>Andropogon ternarius</i> Michx. | splitbeard bluestem | occasional | native | ANTE2 |
| Poaceae | <i>Andropogon virginicus</i> L. | broomsedge bluestem | occasional | native | ANVI2 |
| Poaceae | <i>Aristida dichotoma</i> Michx. | churchmouse threeawn | occasional | native | ARDI4 |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|---------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Poaceae | <i>Aristida purpurea</i> Nutt. | purple threeawn | occasional | native | ARPU9 |
| Poaceae | <i>Arundinaria gigantea</i> (Walt.) Muhl. | giant cane | rare | native | ARGI |
| Poaceae | <i>Brachyelytrum erectum</i> (Schreb. ex Spreng.) P.Beauv | bearded shorthusk | frequent | native | BRER2 |
| Poaceae | <i>Bromus arvensis</i> L. | field brome | infrequent | introduced | BRAR5 |
| Poaceae | <i>Bromus pubescens</i> Muhl. ex Willd. | hairy woodland brome | occasional | native | BRPU6 |
| Poaceae | <i>Chasmanthium latifolium</i> (Michx.) Yates | Indian woodoats | occasional | native | CHLA5 |
| Poaceae | <i>Cinna arundinacea</i> L. | sweet woodreed | occasional | native | CIAR2 |
| Poaceae | <i>Dactylis glomerata</i> L. | orchard grass | occasional | introduced | DAGL |
| Poaceae | <i>Danthonia spicata</i> (L.) P. Beauv. ex Roem. & Schult. | poverty oat grass | frequent | native | DASP |
| Poaceae | <i>Diarrhena americana</i> P. Beauv. | American beakgrain | rare | native | DIAM |
| Poaceae | <i>Diarrhena obovata</i> (Gleason) Brandenburg | obovate beakgrain | occasional | native | DIOB3 |
| Poaceae | <i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark | tapered rosette grass | occasional | native | DIAC2 |
| Poaceae | <i>Dichanthelium boscii</i> (Poir.) Gould & C.A.Clark | Bosc's panicgrass | occasional | native | DIBO |
| Poaceae | <i>Dichanthelium laxiflorum</i> (Lam.) Gould | openflower rosette grass | occasional | native | DILA9 |
| Poaceae | <i>Dichanthelium linearifolium</i> (Scribn. ex Nash) Gould | slimleaf panicgrass | infrequent | native | DILI2 |
| Poaceae | <i>Dichanthelium malacophyllum</i> (Nash) Gould | softleaf rosette grass | occasional | native | DIMA5 |
| Poaceae | <i>Dichanthelium oligosanthes</i> (Schult.) Gould | Heller's rosette grass | occasional | native | DIOL |
| Poaceae | <i>Dichanthelium ravenelii</i> (Scribn. & Merr.) Gould | Ravenel's rosette grass | frequent | native | DIRA |
| Poaceae | <i>Dichanthelium sphaerocarpon</i> (Ell.) Gould | roundseed panicgrass | occasional | native | DISP2 |
| Poaceae | <i>Digitaria cognata</i> (Schult.) Pilg. | fall witchgrass | frequent | native | DICO6 |
| Poaceae | <i>Digitaria sanguinalis</i> (L.) Scop. | hairy crabgrass | occasional | native | DISA |
| Poaceae | <i>Digitaria violascens</i> Link | violet crabgrass | occasional | introduced | DIVI2 |
| Poaceae | <i>Echinochloa crus-galli</i> (L.) P. Beauv. | barnyardgrass | occasional | native | ECCR |
| Poaceae | <i>Elymus hystrix</i> L. | eastern bottlebrush grass | rare | native | ELHY |
| Poaceae | <i>Elymus virginicus</i> L. | Virginia wildrye | frequent | native | ELVI3 |
| Poaceae | <i>Eragrostis hirsuta</i> (Michx.) Nees | bigtop lovegrass | frequent | native | ERHI |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|---|-------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Poaceae | <i>Eragrostis intermedia</i> Hitchc. | plains lovegrass | frequent | native | ERIN |
| Poaceae | <i>Eragrostis spectabilis</i> (Pursh) Steud. | purple lovegrass | frequent | native | ERSP |
| Poaceae | <i>Festuca subverticillata</i> (Pers.) Alexeev | nodding fescue | frequent | native | FESU3 |
| Poaceae | <i>Glyceria striata</i> (Lam.) Hitchc. | fowl mannagrass | occasional | native | GLST |
| Poaceae | <i>Leersia virginica</i> Willd. | white grass | infrequent | native | LEVI2 |
| Poaceae | <i>Melica nitens</i> (Scribn.) Nutt. ex Piper | threeflower melic grass | infrequent | native | MENI |
| Poaceae | <i>Microstegium vimineum</i> (Trin.) A. Camus | Nepalese browntop | frequent | introduced | MIVI |
| Poaceae | <i>Muhlenbergia sobolifera</i> (Muhl. ex Willd.) Trin. | rock muhly | occasional | native | MUSO |
| Poaceae | <i>Panicum anceps</i> Michx. | beaked panicgrass | occasional | native | PAAN |
| Poaceae | <i>Panicum flexile</i> (Gattinger) Scribn. | wiry panicgrass | occasional | native | PAFL |
| Poaceae | <i>Panicum philadelphicum</i> Bernh. ex Trin. | Philadelphia panicgrass | occasional | native | PAPH |
| Poaceae | <i>Poa annua</i> L. | annual bluegrass | occasional | introduced | POAN |
| Poaceae | <i>Poa compressa</i> L. | canada bluegrass | occasional | introduced | POCO |
| Poaceae | <i>Poa sylvestris</i> A. Gray | woodland bluegrass | occasional | native | POSY |
| Poaceae | <i>Schizachyrium scoparium</i> (Michx.) Nash | little bluestem | frequent | native | SCSC |
| Poaceae | <i>Setaria parviflora</i> (Poir.) Kerguelen | marsh bristlegrass | occasional | native | SEPA10 |
| Poaceae | <i>Setaria pumila</i> (Poir.) Roem. & Schult. | yellow foxtail | frequent | native | SEPU8 |
| Poaceae | <i>Sorghum halepense</i> (L.) Pers. | Johnsongrass | infrequent | introduced | SOHA |
| Poaceae | <i>Sphenopholis obtusata</i> (Michx.) Scribn. | prairie wedgescale | infrequent | native | SPOB |
| Poaceae | <i>Sporobolus compositus</i> (Poir.) Merr. var. <i>compositus</i> | composite dropseed | frequent | native | SPCOC2 |
| Poaceae | <i>Steinchisma hians</i> (Elliot) Nash | gaping grass | occasional | native | STHI |
| Poaceae | <i>Tridens flavus</i> (L.) Hitchc. | purpletop tridens | frequent | native | TRFL2 |
| Poaceae | <i>Vulpia octoflora</i> (Walter) Rydb. | sixweeks fescue | frequent | native | VUOC |
| Polemoniaceae | <i>Phlox divaricata</i> L. | wild blue phlox | frequent | native | PHDI5 |
| Polemoniaceae | <i>Phlox pilosa</i> L. | downy phlox | frequent | native | PHPI |
| Polygonaceae | <i>Polygonum convolvulus</i> L. | black bindweed | occasional | introduced | POCO10 |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|--|---------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Polygonaceae | <i>Polygonum hydropiperoides</i> Michx. | swamp smartweed | occasional | native | POHY2 |
| Polygonaceae | <i>Polygonum pennsylvanicum</i> L. | Pennsylvania smartweed | occasional | native | POPE2 |
| Polygonaceae | <i>Polygonum persicaria</i> L. | spotted ladysthumb | occasional | native | POPE3 |
| Polygonaceae | <i>Polygonum punctatum</i> Elliot | dotted smartweed | occasional | native | POPU5 |
| Polygonaceae | <i>Polygonum scandens</i> L. | climbing false buckwheat | occasional | native | POSC3 |
| Polygonaceae | <i>Polygonum setaceum</i> Baldw. | bog smartweed | occasional | native | POSE6 |
| Polygonaceae | <i>Polygonum virginianum</i> L. | jumpseed | occasional | native | POVI2 |
| Polygonaceae | <i>Rumex crispus</i> L. | curly dock | occasional | native | RUCR |
| Polypodiaceae | <i>Pleopeltis polypodioides</i> (L.) Andrews & Windham | ressurrection fern | occasional | native | PLPO2 |
| Portulacaceae | <i>Claytonia virginica</i> L. | Virginia springbeauty | occasional | native | CLVI3 |
| Portulacaceae | <i>Phemeranthus parviflora</i> (Nutt.) Kiger | sunbright | infrequent | native | PHPA29 |
| Primulaceae | <i>Dodecatheon meadia</i> L. | pride of Ohio | infrequent | native | DOME |
| Primulaceae | <i>Samolus valerandi</i> L. | seaside brookweed | infrequent | native | SAVA3 |
| Pteridaceae | <i>Adiantum pedatum</i> L. | northern maidenhair | occasional | native | ADPE |
| Pteridaceae | <i>Cheilanthes alabamensis</i> (Buckl.) Kunze | Alabama lipfern | occasional | native | CHAL5 |
| Pteridaceae | <i>Cheilanthes lanosa</i> (Michx.) D.C. Eaton | hairy lipfern | occasional | native | CHLA2 |
| Pteridaceae | <i>Pellaea atropurpurea</i> (L.) Link | purple cliffbreak | occasional | native | PEAT2 |
| Ranunculaceae | <i>Anemone virginiana</i> L. | tall thimbleweed | occasional | native | ANVI3 |
| Ranunculaceae | <i>Aquilegia canadensis</i> L. | red columbine | infrequent | native | AQCA |
| Ranunculaceae | <i>Clematis versicolor</i> Small ex Rydb. | pale leather flower | infrequent | native | AQVE |
| Ranunculaceae | <i>Clematis virginiana</i> L. | devil's darning needles | infrequent | native | CLVI5 |
| Ranunculaceae | <i>Delphinium carolinianum</i> Walter | Carolina larkspur | infrequent | native | DECA8 |
| Ranunculaceae | <i>Delphinium tricornis</i> Michx. | dwarf larkspur | infrequent | native | DETR |
| Ranunculaceae | <i>Enemion biternatum</i> Raf. | eastern false rue anemone | occasional | native | ENBI |
| Ranunculaceae | <i>Ranunculus fascicularis</i> Muhl. ex Bigelow | early buttercup | occasional | native | RAFA |
| Ranunculaceae | <i>Ranunculus harveyi</i> (A. Gray) Britton | Harvey's buttercup | occasional | native | RAHA |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
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| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Ranunculaceae | <i>Ranunculus micranthus</i> Nutt. | rock buttercup | infrequent | native | RAMI2 |
| Ranunculaceae | <i>Ranunculus sardous</i> Crantz | hairy buttercup | occasional | introduced | RASA |
| Raunculaceae | <i>Ranunculus scleratus</i> L. | cursed buttercup | infrequent | native | RASC3 |
| Rhamnaceae | <i>Thalictrum thalictroides</i> (L.) Eames & B. Boivin | rue anemone | occasional | native | THTH2 |
| Rhamnaceae | <i>Ceanothus americanus</i> L. | New Jersey tea | occasional | native | CEAM |
| Rhamnaceae | <i>Ceanothus herbaceus</i> Raf. | Jersey tea | occasional | native | CEHE |
| Rosaceae | <i>Frangula caroliniana</i> (Walter) A. Gray | Carolina buckthorn | occasional | native | FRCA13 |
| Rosaceae | <i>Agrimonia pubescens</i> Wallr. | soft agrimony | infrequent | native | AGPU |
| Rosaceae | <i>Crataegus crus-galli</i> L. | cockspur hawthorn | occasional | native | CRCR2 |
| Rosaceae | <i>Fragaria virginiana</i> Duchesne | Virginia strawberry | occasional | native | FRVI |
| Rosaceae | <i>Galium aparine</i> L. | stickywilly | occasional | native | GAAP2 |
| Rosaceae | <i>Geum canadense</i> Jacq. | white avens | occasional | native | GECA7 |
| Rosaceae | <i>Geum vernum</i> (Raf.) Torr. & A. Gray | spring avens | occasional | native | GEVE |
| Rosaceae | <i>Gillenia stipulata</i> (Muhl. ex Willd.) Baill. | American ipecac | occasional | native | GIST5 |
| Rosaceae | <i>Potentilla recta</i> L. | sulphur cinquefoil | occasional | introduced | PORE5 |
| Rosaceae | <i>Prunus americana</i> Marsh. | American plum | occasional | native | PRAM |
| Rosaceae | <i>Prunus mexicana</i> S.Wats. | Mexican plum | occasional | native | PRME |
| Rosaceae | <i>Prunus persica</i> (L.) Batsch | peach | infrequent | introduced | PRPE3 |
| Rosaceae | <i>Rosa carolina</i> L. | Carolina rose | occasional | native | ROCA4 |
| Rosaceae | <i>Rosa multiflora</i> Thunb. | multiflora rose | occasional | introduced | ROMU |
| Rosaceae | <i>Rosa woodsii</i> Lindl. | Wood's rose | rare | native | ROWO |
| Rosaceae | <i>Rubus aboriginum</i> Rydb. | garden dewberry | occasional | native | RUAB |
| Rosaceae | <i>Rubus allegheniensis</i> Porter | Allegheny blackberry | occasional | native | RUAL |
| Rosaceae | <i>Rubus occidentalis</i> L. | black raspberry | occasional | native | RUOC |
| Rosaceae | <i>Spiraea prunifolia</i> Sieb. & Zucc. | bridalwreath spirarea | rare | introduced | SPPR |
| Rubiaceae | <i>Cephalanthus occidentalis</i> L. | common buttonush | infrequent | native | CEOC2 |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|------------------|---|----------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Rubiaceae | <i>Diodia teres</i> Walter | poorjoe | occasional | native | DITE2 |
| Rubiaceae | <i>Diodia virginiana</i> L. | Virginiana buttonweed | infrequent | native | DIVI3 |
| Rubiaceae | <i>Galium aparine</i> L. | stickywilly | occasional | native | GAAP2 |
| Rubiaceae | <i>Galium arkansansum</i> A.Gray | Arkansas bedstraw | infrequent | native | GAAR4 |
| Rubiaceae | <i>Galium pilosum</i> Aiton | hairy bedstraw | occasional | native | GAPI2 |
| Rubiaceae | <i>Galium triflorum</i> Michx. | fragrant bedstraw | infrequent | native | GATR3 |
| Rubiaceae | <i>Houstonia caerulea</i> L. | azure bluet | occasional | native | HOCA4 |
| Rubiaceae | <i>Houstonia ouachitana</i> (E.B. Sm.) Terrell | Ouachita bluet | occasional | native | HOOU |
| Rubiaceae | <i>Houstonia purpurea</i> Schoepf | Venus's pride | infrequent | native | HOPUP3 |
| Rubiaceae | <i>Houstonia pusilla</i> Schoepf | tiny bluet | occasional | native | HOPU3 |
| Salicaceae | <i>Populus deltoides</i> Bartram ex Marsh. | eastern cottonwood | frequent | native | PODE3 |
| Salicaceae | <i>Salix caroliniana</i> Michx. | coastal plains willow | occasional | native | SACA5 |
| Sapotaceae | <i>Sideroxylon lanuginosum</i> Michx. ssp. <i>lanuginosum</i> | gumbully | frequent | native | SILAL3 |
| Saxifragaceae | <i>Heuchera americana</i> L. | American alumroot | occasional | native | HEAM6 |
| Saxifragaceae | <i>Penthorum sedoides</i> L. | ditch stonecrop | infrequent | native | PESE6 |
| Saxifragaceae | <i>Saxifraga virginensis</i> Michx. | early saxifrage | occasional | native | SAVI5 |
| Scrophulariaceae | <i>Agalinis tenuifolia</i> (Vahl) Raf. | slenderleaf false foxglove | occasional | native | AGTE3 |
| Scrophulariaceae | <i>Aureolaria grandiflora</i> (Benth.) Pennell | large yellow foxglove | occasional | native | AUGR |
| Scrophulariaceae | <i>Collinsia violacea</i> Nutt. | violet blue-eyed Mary | occasional | native | COVI2 |
| Scrophulariaceae | <i>Lindernia dubia</i> (L.) Pennell | yellowseed false pimpernel | infrequent | native | LIDU |
| Scrophulariaceae | <i>Mimulus alatus</i> Aiton | sharpwing monkey flower | occasional | native | MIAL2 |
| Scrophulariaceae | <i>Pedicularis canadensis</i> L. | Canadian lousewort | occasional | native | PECA |
| Scrophulariaceae | <i>Penstemon tubiflorus</i> Nutt. | white wand beardtongue | occasional | native | PETU |
| Scrophulariaceae | <i>Scrophularia marilandica</i> L. | carpenter's square | occasional | native | SCMA2 |
| Scrophulariaceae | <i>Verbascum blattaria</i> L. | moth mullein | occasional | introduced | VEBL |
| Scrophulariaceae | <i>Verbascum thapsus</i> L. | common mullien | infrequent | introduced | VETH |

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| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|------------------|--|-------------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Scrophulariaceae | <i>Veronica arvensis</i> L. | corn speedwell | infrequent | introduced | VEAR |
| Scrophulariaceae | <i>Veronica polita</i> Fr. | gray field speedwell | infrequent | introduced | VEPO |
| Smilacaceae | <i>Smilax bona-nox</i> L. | saw greenbrier | occasional | native | SMBO2 |
| Smilacaceae | <i>Smilax herbacea</i> L. | smooth carrionflower | occasional | native | SMHE |
| Smilacaceae | <i>Smilax rotundiflora</i> L. | roundleaf greenbrier | occasional | native | SMRO |
| Solanaceae | <i>Datura stramonium</i> L. | jimsonweed | infrequent | introduced | DAST |
| Solanaceae | <i>Physalis longifolia</i> Nutt. | longleaf groundcherry | infrequent | native | PHLO4 |
| Solanaceae | <i>Physalis pubescens</i> L. | husk tomato | infrequent | native | PHPU7 |
| Solanaceae | <i>Solanum carolinense</i> L. | Carolina horsenettle | infrequent | native | SOCA3 |
| Solanaceae | <i>Solanum elaeagnifolium</i> Cav. | silverleaf nightshade | infrequent | native | SOEL |
| Solanaceae | <i>Solanum ptychanthum</i> Dunal | West Indian nightshade | occasional | native | SOPT3 |
| Staphyleaceae | <i>Staphylea trifolia</i> L. | American bladdernut | infrequent | native | STTR |
| Tiliaceae | <i>Tilia amaricana</i> L. | American basswood | infrequent | native | TIAM |
| Ulmaceae | <i>Celtis laevigata</i> Willd. | sugarberry | frequent | native | CELA |
| Ulmaceae | <i>Celtis occidentalis</i> L. | common hackberry | frequent | native | CEOC |
| Ulmaceae | <i>Ulmus alata</i> Michx. | winged elm | frequent | native | ULAL |
| Ulmaceae | <i>Ulmus americana</i> L. | American elm | frequent | native | ULAM |
| Ulmaceae | <i>Ulmus rubra</i> Muhl. | slippery elm | frequent | native | ULRU |
| Urticaceae | <i>Boehmeria cylindrica</i> (L.) Sw. | smallspike false nettle | infrequent | native | BOCY |
| Urticaceae | <i>Parietaria pensylvanica</i> Muhl. ex Willd. | Pennsylvania pellitory | occasional | native | PAPE5 |
| Urticaceae | <i>Pilea pumila</i> (L.) A.Gray | Canadian clearweed | occasional | native | PIPU2 |
| Urticaceae | <i>Urtica chamaedryoides</i> Pursh | heartleaf nettle | rare | native | URCH3 |
| Urticaceae | <i>Urtica dioica</i> L. | stinging nettle | frequent | native | URDI |
| Valerianaceae | <i>Valerianella radiata</i> (L.) Dufr. | beaked cornsalad | occasional | native | VARA |
| Verbenaceae | <i>Callicarpa americana</i> L. | American beauty | occasional | native | CAAM2 |
| Verbenaceae | <i>Glandularia canadensis</i> (L.) Nutt. | rose mock vervain | occasional | native | GLCA2 |

Appendix D: Vegetative Alliances

| LIST OF SPECIES | COLLECTED IN 6 TRACTS OF OPNWR (2001-2008) | | | | |
|-----------------|---|---------------------|------------|---------------|---------------|
| Family | Species | Common name | Abundance | U.S. Nativity | PLANTS symbol |
| Verbenaceae | <i>Phryma leptostachya</i> L. | American lopseed | occasional | native | PHLE5 |
| Verbenaceae | <i>Verbena bonariensis</i> L. | purpletop vervain | occasional | introduced | VEBO |
| Verbenaceae | <i>Verbena simplex</i> Lehm. | narrowleaf vervain | occasional | native | VESI |
| Verbenaceae | <i>Verbena stricta</i> Vent. | hoary verbena | occasional | native | VEST |
| Verbenaceae | <i>Verbena urticifolia</i> L. | white vervain | occasional | native | VEUR |
| Violaceae | <i>Viola bicolor</i> Pursh | field pansy | occasional | native | VIBI |
| Violaceae | <i>Viola lanceolata</i> L. | bog white violet | occasional | native | VILA4 |
| Violaceae | <i>Viola pedata</i> L. | birdfoot violet | occasional | native | VIPE |
| Violaceae | <i>Viola pubescens</i> Aiton | downy yellow violet | occasional | native | VIPU3 |
| Violaceae | <i>Viola sagittata</i> Aiton | arrowleaf violet | occasional | native | VISA2 |
| Violaceae | <i>Viola sororia</i> Willd. | common blue violet | occasional | native | VISO |
| Vitaceae | <i>Viola triloba</i> Schwein. | three lobed violet | occasional | native | VITR2 |
| Vitaceae | <i>Parthenocissus quinquefolia</i> (L.) Planch. | Virginia creeper | frequent | native | PAQU2 |
| Vitaceae | <i>Vitis cinerea</i> (Engelm.) Engelm. ex Millard | graybark grape | occasional | native | VICI2 |
| Vitaceae | <i>Vitis mustangensis</i> Buckley | mustang grape | rare | native | VIMU2 |
| Vitaceae | <i>Vitis rotundifolia</i> Michx. | muscadine | occasional | native | VIRO3 |
| Vitaceae | <i>Vitis vulpina</i> L. | frost grape | frequent | native | VIVU |

Appendix E: Wilderness Review

1.0 Introduction

Wilderness Reviews (Reviews) are a required element of Comprehensive Conservation Plans (CCP), and each refuge must follow the Review process outlined in 602 FW 1-3 and 610 FW 1-4. The process includes interagency and tribal coordination, public involvement, and National Environmental Policy Act (NEPA) compliance (610 FW 4.4 A). The purpose of the Review is to identify lands and waters that merit inclusion in the National Wilderness Preservation System (NWPS) and recommend suitable lands for Congressional designation (610 FW 4.4 A).

There are three phases to the Review process: (1) inventory; (2) study; and (3) recommendation. During the inventory phase, we identify lands and waters that meet the minimum criteria for Wilderness designation (610 FW 4.4 B). Lands and waters that meet the minimum criteria for designation are called Wilderness Study Areas (WSAs). In the study phase, we assess a range of management alternatives to determine if a WSA is suitable for Wilderness designation and corresponding management or if management under an alternate set of goals and objectives is more appropriate (610 FW 4.12 A). The findings of the study phase determine whether we will recommend a WSA for designation in the final CCP. If we determine that the Refuge contains lands and/or waters that are suitable for Wilderness designation, we report the recommendation from the Director through the Secretary and the President to Congress in a subsequent Wilderness Study Report (610 FW 4.4).

The following team was assembled to perform the Ozark Plateau NWR's Wilderness Review:

Table E-1. Wilderness Review Team

| Team Member | Title/Affiliation | Email |
|----------------------|------------------------------|-----------------------|
| Steve Hensley | Refuge Manager | Steve_hensley@fws.gov |
| Shea Hammond | Refuge Operations Specialist | Shea_hammond@fws.gov |
| Richard Stark | ES Biologist | Richard_stark@fws.gov |
| Sarah Catchot | Planning Team Leader | Sarah_catchot@fws.gov |

2.0 Wilderness Inventory

Section 2 (c) of the Wilderness Act states that Wilderness is an area that is “untrammeled by man, where man himself is a visitor who does not remain.” The Act identifies the minimum criteria that an area must meet to be eligible for Wilderness. U.S. Fish and Wildlife Service policy states that we use the Act's minimum criteria to identify potential Wilderness areas. These criteria include size, apparent naturalness, and outstanding opportunities for solitude or primitive recreation. Supplemental values are evaluated and documented but are not required for

a WSA. Ozark Plateau NWR's Wilderness Review Team met on September 21, 2011 to perform the inventory phase of the review.

2.1 Identification of Lands that Meet the Size Criteria

First, the team identified lands that meet the size criteria outlined by 610 FW 4.8 and described below:

- An area with more than 5,000 contiguous acres. State and private lands are not included in making this acreage determination.
- A roadless island of any size. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features (610 FW 1.5 Z).
- An area of less than 5,000 contiguous acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.
- An area of less than 5,000 contiguous Federal acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Lands and waters that meet any of these four size criteria are identified as inventory units during the review process. Ozark Plateau NWR contains (1) inventory unit that meet the size criteria. These lands and waters are identified in the Figure E-1 map and each inventory unit is evaluated for Wilderness criteria in Table E-2.

2.2 Evaluation of the Naturalness Criteria

Section 2 (c) of the Wilderness Act defines Wilderness as an area that "...generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable." In addition to the size criteria, U.S. Fish and Wildlife Service policy states that an inventory unit must meet the naturalness criteria to qualify as a WSA. Although the area must appear natural to the average visitor, policy does not require that the land is in a pristine historic state (610 FW 4.9 A). During the inventory phase, the team evaluated each inventory unit and deemed (0) units to qualify under the naturalness criteria. The findings are noted in Table E-2.

2.3 Evaluation of Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation

In addition to meeting the size and naturalness criteria, an inventory unit must provide outstanding opportunities for solitude or primitive recreation to qualify as a WSA. The Wilderness Act does not define what was intended by solitude or a primitive and unconfined

type of recreation. The Service, however, defines solitude as “a state of mind, a mental freedom that emerges from settings where visitors experience nature essentially free of the reminds of society, its inventions, and conventions; privacy and isolation are important components, but solitude is enhanced by the absence of distractions, such as large groups, mechanization, unnatural noise and light, unnecessary managerial presence (such as signs), and other modern artifacts (610 FW 1.5 AA).” The Service defines primitive and unconfined recreation as “activities that provide dispersed, undeveloped recreation and do not generally require permanent facilities (610 FW 1.5 R).” According to 610 FW 4.10, an area does not need to have outstanding opportunities for both solitude and primitive recreation nor does the area need to have outstanding opportunities on every acre.

During the inventory process, the Wilderness Review Team deemed (0) units that qualify for opportunities for solitude or primitive and unconfined recreation. The results of the inventory are also displayed in Table E-2.

3.0 Wilderness Inventory Summary

After completing the inventory phase of the Wilderness Review, we have concluded that none of Ozark Plateau NWR’s lands and waters meet the minimum criteria for a Wilderness Study Area. Therefore, the Team does not recommend that the Wilderness Study portion of the Review be performed. This concludes the Wilderness Review process at this time. The process will be replicated in accordance with policy at the time of the next CCP revision.

Appendix E: Wilderness Review

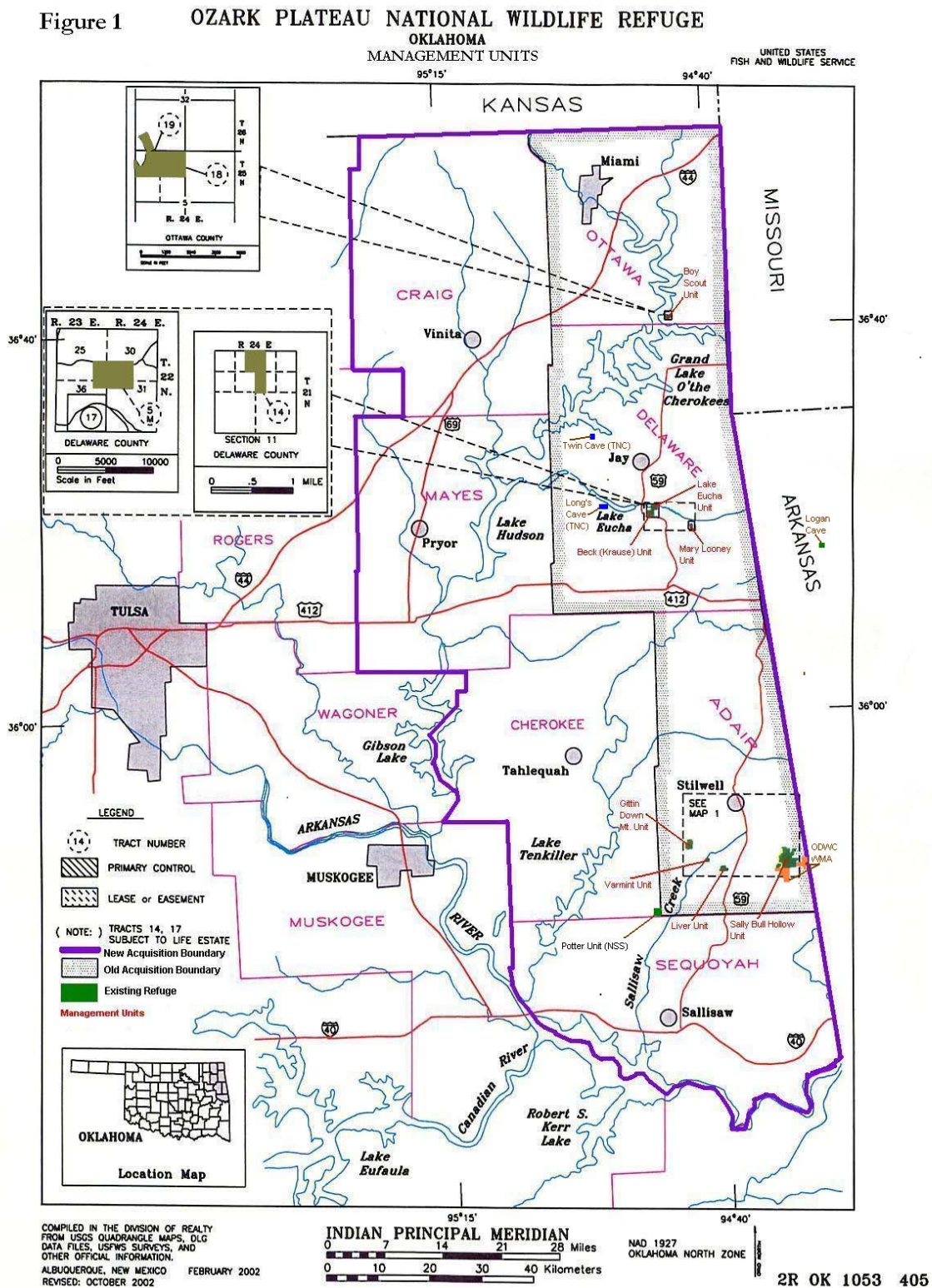
Table E-2. Wilderness Review Inventory Matrix for Ozark Plateau NWR.

| Inventory Unit | | | | | |
|---------------------------|-------------|---|---|--|---|
| Name | Size | (1) has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition or is a roadless island; | (2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; | (3) has outstanding opportunities for solitude or primitive and unconfined recreation; | Parcel qualifies as a Wilderness Study Area (meets criteria 1, 2, and 3)? |
| Beck (Krause) Unit | 360 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Boy Scout Unit | 78 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Gittin Down Mountain Unit | 480 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Lake Eucha Unit | 130 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Liver Unit | 90 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Mary & Murray Looney Unit | 95 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Potter Unit | 189 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |
| Sally Bull Hollow Unit | 2,280 acres | Yes, Unit is of sufficient size to make practicable its preservation and use in an unconfined condition, however, management of the area includes the use of mechanized equipment for invasive species, prescribed burns, and the Refuge does not have the appropriate staffing to neither establish Wilderness boundaries nor enforce regulations. | No, the Unit contains 11 visibly noticeable man-made cave gates, which also require frequent maintenance by steel welders and the use of mechanical equipment. Therefore, the average visitor would not perceive the Unit to be in its "natural" state. | N/A | No. |

Appendix E: Wilderness Review

| Inventory Unit | | | | | |
|----------------|----------|--|---|--|---|
| Name | Size | (1) has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition or is a roadless island; Minimum Criteria for Wilderness | (2) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; | (3) has outstanding opportunities for solitude or primitive and unconfined recreation; | Parcel qualifies as a Wilderness Study Area (meets criteria 1, 2, and 3)? |
| Varmint Unit | 60 acres | No, not of sufficient size to make practicable its preservation and use in an unconfined condition. | N/A | N/A | No. |

Figure E-1. Inventory Units of Ozark Plateau National Wildlife Refuge.



INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person:

Steve Hensley, Refuge Manager

Telephone Number:

918-382-4507

Date:

October 31, 2012

I. Region:

Southwest (Region 2)

II. Service Activity (Program):

Implementation of the Comprehensive Conservation Plan (CCP) of Ozark Plateau National Wildlife Refuge (NWRs) (*Estimated to be complete in 2013*).

III. Pertinent Species and Habitat:

The action area is defined as the entire area within the approved acquisition boundary of Ozark Plateau NWR. This is also defined as within the boundaries of the following seven northeastern counties of Oklahoma: Craig, Ottawa, Delaware, Mayes, Cherokee, Adair, and Sequoyah. However, the approved boundary expansion plan limits the amount of potential land acquired to (up to) 15,000 acres, via fee title acquisition, land and conservation easements from willing sellers and/or conservation agreements with private landowners, conservation organizations, state, Tribal Nations, and other federal agencies.

Species listed below with an asterisk (*) are those occurring on current Refuge management units, those occurring on lands that are currently co-managed by the Refuge, and/or those that are most likely to occur on future acquired lands using a Strategic Habitat Conservation (SHC) approach that is based on Refuge purposes and goals (see section VI). These species will be the focus of discussion in sections III – IX.

A. Listed species and/or their critical habitat within the action area:

Federally listed: endangered

- *Ozark big-eared bat (*Corynorhinus townsendii ingens*) [Mammal] (No critical habitat rules have been published)
- *Gray bat (*Myotis grisescens*) [Mammal] (No critical habitat rules have been published)
- Indiana bat (*Myotis sodalis*) [Mammal] (Critical habitat designation [09/24/1976] [41 FR 41914])

- American burying beetle (*Nicrophorus americanus*) [Insect] (No critical habitat rules have been published)
- Winged Mapleleaf (*Quadrula fragosa*) [Clam] (No critical habitat rules have been published)
- Interior least tern (*Sterna antillarum*) [Bird] (No critical habitat rules have been published)

Federally listed: threatened

- *Ozark cavefish (*Amblyopsis rosae*) [Fish] (No critical habitat rules have been published)
- Neosho madtom (*Noturus placidus*) [Fish] (No critical habitat rules have been published)
- Piping plover (*Charadrius melodus*) [Bird] (Designation of critical habitat for the Northern Great Plains breeding population [09/11/2002 67 FR 57638 57717])

B. Proposed species and/or proposed critical habitat within the action area

- Neosho mucket (*Lampsilis rafinesqueana*) [Clam] (Proposed endangered status; Proposed critical habitat designation [10/16/12 77 FR 63439 63536])
- Rabbitsfoot (*Quadrula cylindrica cylindrica*) [Clam] (Proposed threatened status; Proposed critical habitat designation [10/16/12 77 FR 63439 63536])

C. Candidate species within the action area:

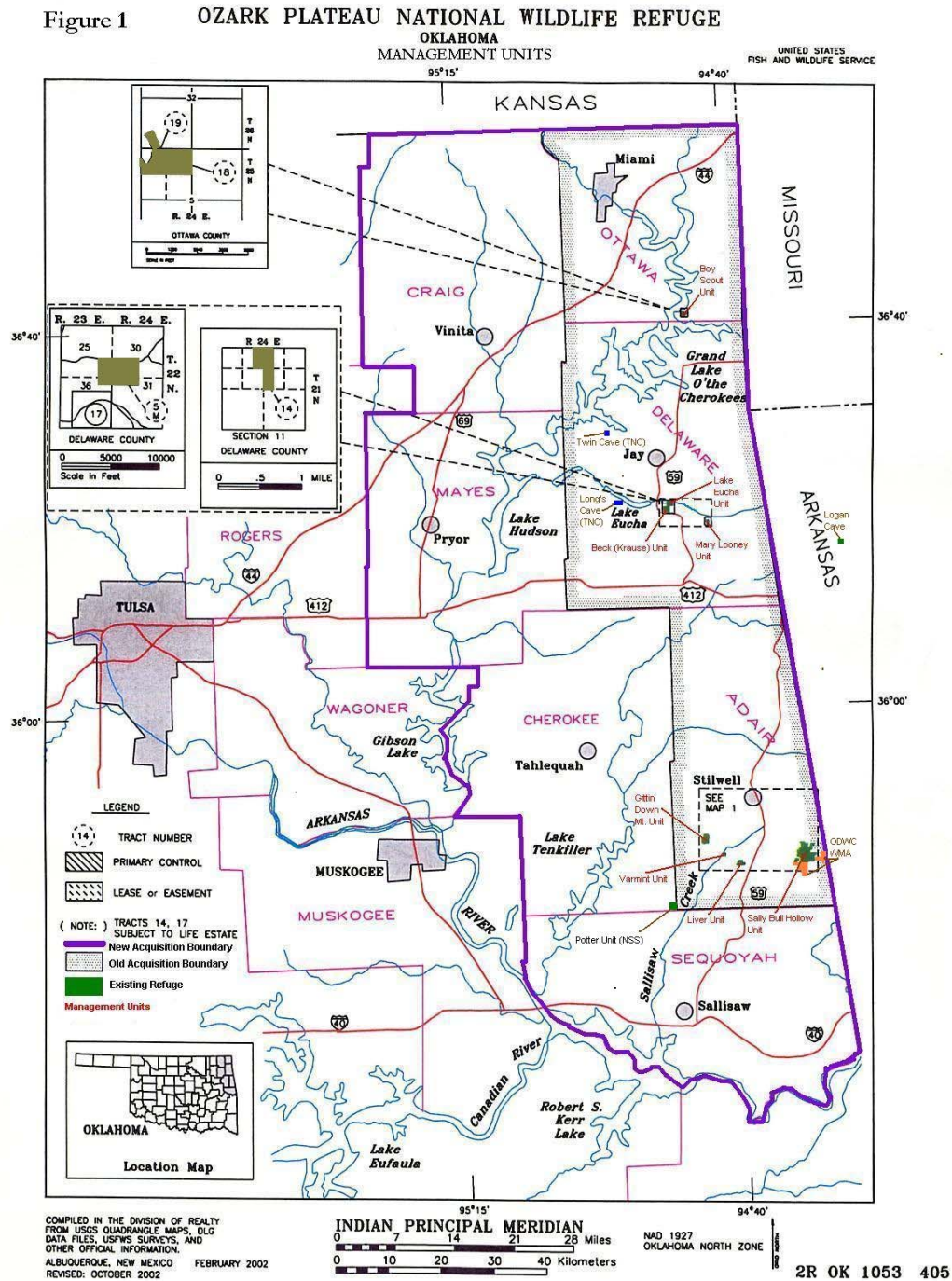
- Arkansas darter (*Etheostoma cragini*) [Fish]
- Sprague's pipit (*Anthus spragueii*) [Bird]

IV. Geographic area or station name and action:

Station Name: Ozark Plateau National Wildlife Refuge

Action: Implementation of the Comprehensive Conservation Plan of Ozark Plateau National Wildlife Refuge

V. **Location:** Figure F-1. Acquisition boundary and current Refuge management units.



A. Ecoregion:

Ozark Plateau NWR is located within The Nature Conservancy's, Bailey's, and Omernik's "Ozarks ecoregion", an area encompassing nearly 34 million acres in parts of Missouri, Arkansas, Oklahoma, Illinois, and a small corner of Kansas. Oklahoma's portion of the Ozarks ecoregion constitutes approximately 5.8 million acres, or roughly 17% of the total ecoregion acreage. Along with the Ouachita region to the south, the Ozarks form the only significant highland region in mid-continental North America. Parts of this region have been continually exposed for at least 225 million years. Because of high habitat diversity and antiquity of the landscape, Ozark biota is characterized by an unusually high level of species disjunctions and endemism, with more than 160 endemic species documented from the ecoregion. (TNC, 2003)

B. County and State:

Craig, Ottawa, Mayes, Delaware, Cherokee, Adair, and Sequoyah Counties of Oklahoma

C. Section, township, and range (or latitude and longitude):

Refuge Headquarters, currently located at the Mary & Murray Looney Education & Research Center (MMLERC) at 36°18'54.31"N, 94°42'29.61"W

D. Distance (miles) and direction to nearest town:

The MMLERC/Refuge Headquarters lies 8.8 miles south of Jay, OK

E. Species/habitat occurrence:***Ozark big-eared bat**

Refuge units that occur in Adair and Cherokee Counties provide important cave and foraging habitat for the Ozark big-eared bat species. There are twelve known essential caves, defined as a cave used by a maternity colony or as a hibernaculum, in Oklahoma, six of which occur on the Ozark Plateau National Wildlife Refuge (USFWS and NRCS, 2010). Five of the six are used as maternity caves and three as hibernacula. Approximately one-third of the known Oklahoma maternity colonies roost in caves that occur on the Refuge, while over 50% of the entire known population of Ozark big-eared bats hibernate in caves that occur on the Refuge. In addition, the seven-county acquisition area encompasses the existing known range of the federally endangered Ozark big-eared bat in Oklahoma, which is generally associated with caves, cliffs, and rock ledges in well drained, oak-hickory Ozark forests. Maternity caves and hibernacula occur in a number of different surroundings, from large continuous blocks of forest, to smaller forest tracts interspersed with open areas. Forested habitats are an important source of food for the Ozark big-eared bat. Approximately 97% of Refuge lands are currently forested habitat. A recent study on the diet of the Ozark big-eared bat and prey abundance in Arkansas found that the bats prey on a wide diversity of moth species, and that most of the species are dependent upon woody forest plants as a host (Dodd, 2006). The study also found a positive correlation between woody species richness and moth occurrence. Conservation of the Ozark big-eared bat, therefore,

requires not only protection of important caves but also forested habitat that supports abundant and diverse moth populations (Leslie and Clark, 2002; Dodd, 2006; Dodd and Lacki, 2007). Conservation practices that encourage a diversity of woody forest plant species (e.g., prescribed fire, selective thinning) to provide a rich prey base of moths should benefit Ozark big-eared bat colonies. The Ozark big-eared bat has been shown to selectively forage in both edge and forested habitats and also to use habitats in proportion to their availability.

*Gray bat

Gray bats are one of the few species of bats in North America that inhabit caves year-round, migrating each year between winter and summer caves. Gray bats have been documented to regularly migrate from 17 to 437 km between summer maternity caves and winter hibernacula (Tuttle 1976b; Hall and Wilson 1966). A portion of the gray bat population migrates to northeastern Oklahoma in the summer to raise their young in maternity caves. Ozark Plateau NWR manages or assists with management of approximately 10 important gray bat maternity caves. Gray bats frequently return year after year to use these same caves. Ozark Plateau NWR also protects multiple streams, creeks, and other water bodies important to the gray bat for foraging habitat. Gray bats feed on flying insects over bodies of water including rivers, streams, lakes and reservoirs. Mayflies, caddisflies, and stoneflies make up the major part of their diet, but beetles and moths also are consumed (Harvey, 1994; Tuttle and Kennedy, 2005). Gray bats are known to travel up to 35 kilometers from caves to prime feeding areas (La Val et al., 1977; Tuttle and Kennedy, 2005). However, most caves are within 1-4 km (0.6 – 2.5 miles) of foraging areas (Tuttle, 1976b). The fungus that causes white-nose syndrome (WNS) *Geomyces destructans* was first documented on gray bats in Missouri during the spring of 2010. WNS (i.e., skin infection by the fungus) was then confirmed in gray bats in Tennessee during April 2012. Mortality events attributable to WNS have not occurred in any gray bat populations to date. However, confirmation of WNS in gray bats is cause for concern. Conservation biologists are concerned that gray bat populations may be impacted during future hibernation seasons. Because a large percentage of the gray bat population hibernates in a limited number of caves, disease transmission could occur rapidly and the resulting impacts could be severe.

*Ozark cavefish

The Refuge manages many caves inhabited by Ozark cavefish. It also has management agreements (conservation agreements) with various partners to protect other caves, ground water recharge areas, and aquifers also used by Ozark cavefish. Ozark cavefish are true troglobites (i.e., obligatory cave or aquifer inhabitants). The Ozark cavefish has only rudimentary eyes and no optic nerve since their lives are spent in the darkness of caves. The Ozark cavefish is difficult to distinguish from other cavefish species in the field. Differentiation is based on degrees of cave adaptation. A range wide estimate of countable cavefish using recent population monitoring numbers suggests about 220 individuals (Graening et al., 2009; David Kampwerth, previous USWFS Recovery Lead, pers. comm.). However, it must be noted that the population

size of the Ozark cavefish is difficult to estimate. Biologists can only enter those "portals" (i.e., caves with streams, sink holes, wells) large enough to accommodate our size. Because we are unable to access groundwater conduits that the fish are distributed throughout, we can only count fish in accessible reaches of caves and wells.

Indiana bat

The Indiana bat is primarily found in the eastern and midwestern United States. The species is rare in eastern Oklahoma, which represents the western limit of its range. The Indiana bat is a migratory species that hibernates in cool caves and mines in the winter and spends the spring and summer in wooded areas. Only a small percentage of caves and cave-like structures meet the specific conditions required by Indiana bats, which explains why so much of the known population hibernates in just a few sites. Summer roosting habitat consist of trees (alive or dead) with exfoliating bark, cracks, or crevices or snags that are ≥ 3 inches diameter at breast height. Indiana bats forage for insects along forest edges, in or beneath forest canopy, over ponds, and along streams.

Indiana bats have not been observed or captured within the Ozark Highlands of northeastern Oklahoma or on the Refuge for at least 30 years. Neither summer maternity colonies nor solitary males have been located during summer surveys. Indiana bats also are not observed during winter hibernacula surveys in caves that occur on the Refuge or on private land. While this species is not currently known to occur on the Refuge, there is potential, due to the presence of suitable habitat (forest and caves), for the Indiana bat to occur on current Refuge lands in the future or on future acquired Refuge lands. Refuge staff will continue to monitor for this species.

American burying beetle

The American burying beetle is a large carrion beetle that is active in summer and inactive during winter. American burying beetles bury themselves in the soil to overwinter when temperatures drop below 60°F (15°C). When temperatures are above 60°F (15°C) they emerge from the soil and begin mating and reproduction. American burying beetles are scavengers dependent on carrion for their life cycle. Reproduction involves burying a small vertebrate carcass and laying eggs beside the carcass. Larvae then feed on the carcass until maturity.

The American burying beetle has been found in various habitat types including open fields and grasslands, oak-pine woodlands, oak-hickory forest, and edge habitat (Creighton *et al.*, 1993; Lomolino and Creighton, 1996; Lomolino *et al.*, 1995; U.S. Fish and Wildlife Service, 1991). Although American burying beetles are known to occupy numerous habitat types, they exhibit close associations with carrion availability and suitable soil. Soil conditions where the species occurs must be conducive to American burying beetle excavation (Anderson, 1982; Lomolino and Creighton, 1996). Soils in the vicinity of captures of this species typically are well drained and include sandy loam and silt loam, with a clay component noted at most sites. Level

topography and a well formed detritus layer at the ground surface are common (USFWS, 1991). Areas with soils not conducive to excavation and burial are likely not suitable for this species. For example, land where greater than 80% of the soil surface is comprised of rock or where greater than 80% of the subsurface soil structure within the top 4 inches is comprised of rock are likely not suitable, and unlikely to be occupied by the species.

Existing Refuge units and the approved acquisition area occurs within the known range of the American burying beetle. Surveys specifically targeting this species on the Refuge have not occurred. However, the results of all presence/absence surveys conducted in close proximity to existing Refuge units (i.e., within 5 miles) have been negative and suggest that occurrence on the Refuge also is unlikely (e.g., survey conducted in Adair County in 2010 less than one mile north of the Sally Bull Hollow Unit; surveys conducted in Adair County in 2005 and 2009 about 2.5 and 1.5 miles, respectively, from the Gittin' Down Mountain Unit; surveys conducted in Delaware County in 2005 and 2007 about 4.5 and 3.5 miles, respectively, from the Beck and Eucha Units; survey conducted in Delaware County in 2005 about 3.5 miles from the Boy Scout Unit). The American burying beetle likely does not occur on Refuge tracts or occurs in very low abundance due to the rocky soils and karst topography (i.e., thin soils over bedrock) of these areas. Lands that contain habitat deemed suitable for the American burying beetle may be acquired in the future. The Refuge anticipates conducting surveys for the American burying beetle on portions of the Refuge that appear to provide suitable habitat for this species.

Winged mapleleaf

The winged mapleleaf is a species of freshwater mussel found in rivers. The winged mapleleaf historically is reported from the Neosho River in Ottawa County. The winged mapleleaf does not occur on current Refuge lands. The Refuge does not anticipate acquiring suitable habitat for this species in the future.

Interior least tern

The interior least tern is a migratory bird that breeds along inland river systems. Interior least terns nest on sandy islands and river sandbars along the Arkansas River in Sequoyah County. The interior least tern does not occur on current Refuge lands nor does the Refuge anticipate acquiring suitable habitat for the interior least tern in the future.

Neosho madtom

The Neosho madtom inhabits gravel riffles and runs in the main channel of rivers. In Oklahoma, it occurs in the Spring and Neosho Rivers in Craig and Ottawa Counties. The species does not occur on current Refuge lands. However, important cave resources occur in close proximity to the Spring River. The river and its tributaries, and associated riparian and upland forests also provide important foraging and commuting habitat for bats. Neotropical migratory birds also use these habitats for foraging, breeding, nesting, and as movement corridors. Therefore, acquisition

of suitable habitat for this species, while not targeted, could occur in the future. Surveys to determine presence of this species on the Refuge will be conducted should areas of suitable habitat be acquired.

Piping plover

The Piping plover is a small migratory shorebird that breeds along the Atlantic Coast, the Northern Great Plains of the United States and Canada, and around the Great Lakes, and winters along the southern Atlantic and Gulf coasts, and in the Bahamas and West Indies. This species migrates through central and eastern Oklahoma each spring and fall. Piping plovers use sand-bottom rivers, mudflats, and reservoir beaches during migration. Piping plovers are known to occur in all seven counties of the potential acquisition area. However, the occurrence of the species within the acquisition area is likely only transitory during the migration season. The piping plover does not occur on current Refuge lands nor does the Refuge anticipate acquiring suitable habitat for the Piping plover in the future.

Neosho mucket

The Neosho mucket is a species of freshwater mussel that historically occurred in the Verdigris, Spring, Neosho, Caney, and Illinois Rivers of northeastern Oklahoma, which lie within Craig, Ottawa, Delaware, Cherokee, and Adair counties. Based on recent survey efforts, the species currently is known only from a portion of the Illinois River in Cherokee and Adair counties. Proposed critical habitat for the Neosho mucket occurs within the approved acquisition area and includes the Illinois River from the Arkansas State line down to the headwaters of Lake Tenkiller, and the Elk River in Delaware County. The Neosho mucket does not occur on current Refuge lands. However, important cave resources occur in close proximity to the Illinois River. The Illinois River and its tributaries, and associated riparian and upland forests also provide important foraging and commuting habitat for bats. Neotropical migratory birds also use these habitats for foraging, breeding, nesting, and as movement corridors. Therefore, acquisition of suitable habitat for this species, while not targeted, could occur in the future. Surveys to determine presence of this species on the Refuge will be conducted should areas of suitable habitat be acquired.

Rabbitsfoot

The rabbitsfoot is a species of freshwater mussel that primarily inhabits small to medium-sized streams and some rivers. Proposed critical habitat for the rabbitsfoot would not be within the approved acquisition area. However, within the acquisition boundary, the species is known to occur in the Illinois River in Adair and Cherokee Counties. The rabbitsfoot does not occur on current Refuge lands. However, important cave resources occur in close proximity to the Illinois River. The Illinois River and its tributaries, and associated riparian and upland forests also provide important foraging and commuting habitat for bats. Neotropical migratory birds also use these habitats for foraging, breeding, nesting, and as movement corridors. Therefore, acquisition

of suitable habitat for this species, while not targeted, could occur in the future. Surveys to determine presence of this species on the Refuge will be conducted should areas of suitable habitat be acquired.

Arkansas darter

The Arkansas darter occurs in Cherokee, Craig, Delaware, Mayes and Ottawa Counties. Arkansas darters are small fish that inhabit spring-fed creeks. They primarily occur in spring-fed streams that have an abundance of watercress and other aquatic plants. The Arkansas darter currently is not known to occur on current Refuge lands. However, springs and spring-fed streams are important karst resources often associated with important cave habitat. The Refuge, therefore, could acquire suitable habitat for the Arkansas darter in the future. Surveys to determine presence of this species on Refuge lands will be conducted should areas of suitable habitat be acquired.

Sprague's pipit

The Sprague's pipit is a migratory grassland bird species that breeds and winters on the North American prairie. The migration route between the breeding and wintering range occurs primarily through the central Great Plains and includes parts of Oklahoma. Within the acquisition boundary, the Sprague's pipit is reported to occur in Mayes County. However, the occurrence of the species within the acquisition boundary is likely only transitory during the migration season. The Sprague's pipit does not occur on current Refuge lands nor does the Refuge anticipate acquiring suitable habitat for the Sprague's pipit in the future.

VI. Description of proposed action:

The proposed action is to implement the Comprehensive Conservation Plan (CCP) for Ozark Plateau National Wildlife Refuge over the next 15 years. The Plan emphasizes: taking a Strategic Habitat Conservation approach to acquire up to 15,000 acres of habitat for federally listed Ozark cave species and Neotropical migratory birds; build and maintain landscape level partnerships to protect and restore mature oak-hickory or oak-hickory-pine forest and cave habitats essential to T&E species and other species of concern; enhance and/or develop new I&M programs; and increase public environmental awareness in order to accomplish CCP goals and the purposes of the Refuge.

The Ozark Plateau NWR purpose(s) of establishment (1986):

- Assure the continuing existence, and aid in recovery of federally listed endangered and threatened Ozark cave species
- Reduce the need for future listing of species of concern in the Ozarks
- Protect large continuous stands of Ozark forest essential to migratory interior forest birds
- Provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks

The CCP is divided into a series of goals, objectives, and strategies that will be implemented throughout the 15-year period of this CCP. Outlined below are the specific goals and subsequent objective descriptions associated with the future management direction in Chapter 4 of the CCP. (Please refer to pages 4-4 through 4-65 for full objectives and action strategies).

Goal 1: Landscape-level Context

Contribute to the implementation of Strategic Habitat Conservation on a landscape-level to prevent extinction and recover federally listed threatened and endangered Ozark cave species as well as prevent the need for listing other species of concern.

- **Objective 1:** Continue Building Landscape-Level Partnerships.
- **Objective 2:** Coordinate Across FWS Regions to Better Manage Federally Listed Ozark Cave Species on a Landscape-Level.
- **Objective 3:** Acquire Lands within Approved Acquisition Area.
- **Objective 4:** Implement Climate Change Monitoring & Mitigation Program.
- **Objective 5:** Implement Water Quantity & Quality Monitoring & Management Program.
- **Objective 6:** Assist with White-nose Syndrome Research, Monitoring, Prevention, and Recovery.
- **Objective 7:** Identify Migration Routes/Habitat Corridors.

Goal 2: Wildlife Habitat & Population Management

Protect, enhance, conserve and restore Ozark natural caves, springs, streams, aquifers, wetlands, watersheds, forests, and groundwater recharge areas to prevent extinction and recover federally listed cave species as well as prevent the need for listing other native species including migratory birds and other species of concern in the Ozarks to promote natural species diversity on a landscape-level.

- **Objective 1:** Protect, Enhance, and/or Restore Forested Habitat.
- **Objective 2:** Protect, Enhance, and/or Restore Aquatic Habitat.
- **Objective 3:** Provide Undisturbed, Safe, and Protected Cave Habitat.
- **Objective 4:** Locate Additional Caves.
- **Objective 5:** Delineate Recharge Area of Cavefish and Crayfish Caves.
- **Objective 6:** Inventory & Monitor to Increase Scientific Knowledge Regarding Federally Listed Cave Species and Species of Concern.
- **Objective 7:** Inventory & Monitor to Increase Scientific Knowledge Regarding Resident Non-T&E Species.
- **Objective 8:** Inventory & Monitor Migratory and Resident Bird Species Utilizing the Refuge and Surrounding Landscape.
- **Objective 9:** Map, Monitor, Research, and Implement Adaptive Management to Control Invasive Non-native Flora.

- **Objective 10:** Map, Monitor, Research, and Implement Adaptive Management to Control Invasive Non-native Fauna.

Goal 3: Visitor Services

Provide safe, high quality, compatible, wildlife dependent use opportunities for visitors, students, and nearby residents, to give them an understanding of the importance and value of Ozark cave, spring, aquifer, stream, wetland, watershed, groundwater recharge areas, and forest, wildlife habitat conservation efforts.

- **Objective 1:** Establish a Friends Group and Increase Volunteers.
- **Objective 2:** Increase Public Awareness via Outreach.
- **Objective 3:** Collaborate to Increase Program Opportunities for Environmental Education.
- **Objective 4:** Collaborate to Promote and Conduct Interpretation Programs.
- **Objective 5:** Promote Opportunities for Wildlife Observation & Photography.
- **Objective 6:** Collaborate with ODWC to Provide Hunting Opportunities.
- **Objective 7:** Create More Hiking/Nature-viewing Opportunities.
- **Objective 8:** Design and Display Refuge Signs.
- **Objective 9:** Survey and Mark Refuge Boundaries.

Goal 4: Refuge Infrastructure & Administration

Provide administrative support and appropriate facilities required to ensure that Refuge goals and objectives are met through effective landscape conservation management of Ozark habitats, fish and wildlife, and visitor services and for the primary purpose of preventing extinction and recovering federally listed threatened and endangered Ozark cave species.

- **Objective 1:** Ensure Workforce and Volunteer Training and Safety.
- **Objective 2:** Protect and Survey Historical, Archeological, and Paleontological Sites.
- **Objective 3:** Establish a Refuge Headquarters Site.
- **Objective 4:** Renovate and Repair the MMLERC.
- **Objective 5:** Improve and Widen Access Roads and Parking Areas.
- **Objective 6:** Construct Building Facilities Associated with Maintenance.
- **Objective 7:** Provide Housing for Refuge Staff, Interns, Volunteers, Researchers, and Educators.

Implementation actions of the CCP are consistent with the goals of the Refuge, the National Wildlife Refuge System, and the mission of the U.S. Fish & Wildlife Service.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III. A, B, and C:

Effects on federally listed cave species (Ozark big-eared bat, gray bat, Indiana bat, and Ozark cavefish)

Within this CCP, Ozark Plateau NWR proposes actions that will protect, enhance, and/or restore up to 15,000 acres of forest and cave habitats, in addition to important watersheds, aquifers, and/or groundwater recharge areas in order to achieve its purpose of assuring the continuing existence and/or recovery of federally listed endangered and threatened Ozark cave species. This responsibility encompasses recovery activities beyond the borders of the Refuge. For this reason, the Refuge highlights working at a landscape level - by building landscape level partnerships and working with various landowners, NGOs, cities, universities, state agencies, Tribal Nations, and other federal agencies - to achieve its goals.

Protection, restoration and maintenance of forest habitat includes using the following management tools: taking a Strategic Habitat Conservation (SHC) approach to prioritizing land acquisition of up to 15,000 acres via fee title acquisition and conservation easements from willing sellers within the approved acquisition boundary and/or conservation agreements; monitoring invasive species and if necessary, developing a step-down Integrated Pest Management Plan which would outline control actions; developing a Fire Management Plan for all Units of the Refuge to mimic the naturally-occurring, historic, fire-regime (burn up to 1/3 of Refuge lands in a 3-5 year rotation); and implementing multiple I&M programs to best inform an adaptive management approach. For as long as management activities are carried out and the resulting habitat improvements persist for forest, cave and groundwater recharge areas, targeted species (Ozark big-eared bat, gray bat, Indiana bat and Ozark cavefish) will benefit from long-term conservation efforts.

Prescribed fire in forest habitat would have long-term beneficial impacts to federally listed Ozark cave species. Upland oak-hickory forests historically had a fire regime and fires have played a significant role in their composition and structure (Lorimer, 2001; Abrams, 2005; Hutchinson et al., 2008). Most ecologists believe that, prior to European settlement, the Ozarks supported a lower-density forest, and that tree density generally has increased while the cover of herbaceous understory vegetation has been reduced due to fire suppression (Sauer, 1920; Howell and Kucera, 1956; Heikens, 1999). Ozark Plateau NWR would adopt objectives to attain an open canopy, moderately stocked, mature oak-hickory forest with an herbaceous understory.

The immediate effect of prescribed fire on bats in general is not well understood due to a lack of scientific research on the subject (Clark et al., 2002; Lacki et al., 2009). However, converting a forest that has become overcrowded due to fire suppression to a moderately stocked condition is anticipated to benefit the Ozark big-eared bat by creating an enhanced foraging environment and

by creating a more open movement corridor for the gray bat to travel to its foraging habitat (streams, springs, etc.). During a recent study on the response of northern long-eared bats (*M. septentrionalis*) to prescribed fire, Lacki et al. (2009) found the bats to be tolerant of prescribed fires. The bats responded to habitat alterations by shifting foraging areas to track insect abundance. We believe that the Ozark big-eared and gray bat also would be tolerant of prescribed fire while burns are being implemented. Because bats are mobile, the bats should be able to avoid areas during the burn to avoid any possible direct effects of smoke and heat. Bats also may selectively forage in or near the area due to increased dispersal of insects from the burn site. Should foraging bats avoid the area, suitable foraging habitat should not be significantly limited due to the temporary nature of the fire. Lacki et al. (2009) also found that the abundance of all insects combined was shown to increase following the prescribed burns. An increase in insects would benefit the Ozark big-eared and gray bat by providing more prey items in the environment. Gray bats are adapted at foraging in open areas, such as over a stream, or gaps in a forest, and are a relatively less maneuverable flier than the Ozark big-eared bat. However, they utilize forested areas for protection from predators such as screech owls as they travel between caves and foraging sites. Converting a forest that has become overcrowded due to fire suppression to a moderately stocked condition would be anticipated to benefit the gray bat by creating a more open environment through which it should be easier to navigate and avoid predation.

On the other hand, prescribed fire used for forest restoration has the potential to cause short-term adverse effects to federally listed cave species due to smoke entering caves and/or temporary cave temperature changes. For this reason, the Refuge proposes to implement conservation measures that would prevent adverse impacts to federally listed cave species (see section VII, B). Activities implemented to protect, enhance, and restore upland forests and riparian areas (*e.g.*, prescribed fire, plantings, and selective thinning) within the recharge zone of caves used by the Ozark cavefish would have long-term beneficial effects to the Ozark cavefish. Upland forests provide valuable canopy cover for ground temperature regulation and soil moisture retention. Vegetated riparian buffers help improve and protect water quality by filtering and reducing the amount of sediment, organic material, nutrients and pesticides that enter water bodies from surface runoff (Naiman and Decamps, 1997). Restoring, enhancing and/or maintaining a healthy, wooded riparian zone along water bodies that occur within the recharge areas of caves used by this species would help protect and improve surface and ground water quality.

Monitoring invasive species should not adversely affect federally-listed, proposed and/or candidate species on the Refuge. Should non-native flora species be identified as a threat to the habitat value and function of the Refuge, an Integrated Pest Management Plan would be developed. Within the Integrated Management Plan, the Refuge would propose to use control methods such as prescribed fire (described above), and mechanical removal (including hand tools, chainsaws, and mowing with a tractor). The Refuge also would use, if necessary,

herbicides to spot-treat invasive flora species such as: Japanese honeysuckle; sericea lespedeza; Chinese privet; shrubby lespedeza; tall fescue; yellow sweetclover; puncturevine; stinkgrass; shepherd's-purse; watercress; fivestamen tamarisk; barnyardgrass; curly dock; field bindweed; Johnson grass; mimosa; tall fescue; Russian-olive; ground ivy; red clover; hairy vetch, among others. The Refuge would employ best management practices (see section VII, B) during planning and application of all herbicide use to avert any adverse impacts to federally listed species and other species of concern. In addition, restoring an invasive species area with native plant species will provide long-term benefits for the foraging habitat of the Ozark big-eared bat, gray bat, and Indiana bat, as well as provide a healthier riparian forest habitat (which filters water and improves quality) for the Ozark cavefish (see benefits above).

The Refuge proposes to provide undisturbed, safe, and protected cave habitat suitable for Ozark big-eared bats, gray bats, Indiana bats, Ozark cavefish and other cave species. This will be accomplished by:

- acquiring lands or entering into agreements with willing sellers for conservation easements (up to 15,000 acres) to protect and/or restore cave habitat and habitat surrounding caves (i.e. riparian habitat, recharge areas, oak-hickory forest, grasslands, etc.)
- working with and educating landowners in implementing programs such as the Service's Partners for Fish & Wildlife Program (see <http://www.fws.gov/partners/>), the NRCS Healthy Forests Reserve Program, and National Speleological Society (NSS) cave management projects to encourage a controlled entry policy to avoid disturbance to cave habitat and its respective species
- working with local cavers, NSS, universities, and other partners to map known caves on- and off-Refuge in order to inform the Refuge staff of overlying landowners and to help identify outreach needs
- coordinating with volunteers, cave and geological experts, NSS, universities, Tribal Nations, and other willing partners to locate additional caves within the Ozark Highlands ecoregion by "ridge walking," which includes walking along faults, contacts, depressions, springs, sinking streams and/or other appropriate geological areas which may lead to potential cave locations
- maintaining confidential information regarding cave locations
- controlling access to Refuge caves susceptible to disturbance by constructing appropriately designed gates that allow air flow and bat-friendly passage

Enhancing opportunities for compatible wildlife-dependent uses including allowing hunting on the Sally Bull Hollow Unit and increasing environmental education programs on the Looney Unit is not anticipated to have any adverse impacts to federally species on the Refuge. In fact, all compatible wildlife-dependent uses should increase public appreciation and awareness of

U.S. Fish & Wildlife Service conservation efforts, including protection and recovery of these threatened and endangered species. For example, all environmental education and interpretation programs highlight the important role of bat species in supporting cave ecosystems. These discussions may influence people to appreciate rather than fear bats as well as understand the need to protect fragile and unique cave ecosystems. In addition, public cave entry will remain prohibited throughout the life of the CCP (according to current guidance in the WNS National Plan); therefore, disturbance to federally-listed cave species as a result of unauthorized human entry into Refuge caves is not anticipated.

Hunting regulations would be coordinated with the Oklahoma Department of Wildlife Conservation (ODWC) to allow walk-in only, open access hunting of species according to State regulations. Once the Unit is surveyed and marked, hunting will take place on the Sally Bull Hollow Unit of the Refuge, located adjacent to the ODWC-managed Ozark Plateau Wildlife Management Area (WMA). Steel cave gates and grills have been constructed at the entrances of caves used by federally-listed species that occur on the Sally Bull Hollow unit to prevent unauthorized human entry and disturbance except for those caves that are remotely located and have no evidence of previous or ongoing unauthorized human entry and vandalism. As an added precautionary measure, hunting would not be allowed within 100 yards from cave entrances. This extra measure will help to ensure the protection of federally-listed cave species and other sensitive and rare fauna. No adverse effects to listed species as a result of this public use is expected; however, the Refuge would continue to inventory and monitor federally listed cave species on the Sally Bull Hollow Unit and inspect caves and their protective features (e.g., cave grills and gates) to identify whether this public use is causing any adverse effects to listed species or adverse impacts to caves. Coordination with the ODWC to modify hunting regulations and the construction of additional cave protection measures would be pursued as deemed necessary to prevent needless impacts to caves and federally-listed cave species.

The Indiana bat currently is not known to occur on the Refuge. This species, therefore, is not anticipated to be affected by any proposed Refuge activities. However, suitable habitat for this species (caves and forested areas) occurs on current Refuge tracts and likely also will occur on many tracts acquired in the future as the Refuge expands. Should this species be discovered on current Refuge lands or on lands acquired in the future, Refuge staff will implement conservation measures to ensure that adverse effects to this species could be avoided, as described below in section VII, B.

Effects on the American burying beetle

Certain activities described in the CCP could adversely affect the American burying beetle should these activities be implemented in an area of suitable habitat and the species occur in the area at the time of implementation. These activities generally include those that would require significant ground disturbance such as the construction of a new headquarters building, other

buildings, roads, and parking areas; the clearing of vegetation; and the grading of land. However, the results of surveys conducted for this species in close proximity to existing Refuge units (i.e., within 5 miles) indicate that occurrence of this species on the Refuge is unlikely. The results of all such presence/absence surveys have been negative (see Section V., 5 – Species habitat occurrence). The American burying beetle likely does not occur on Refuge units or occurs only in very low abundance due to the rocky soils and karst topography (i.e., thin soils over bedrock) of these areas. Therefore, considering that 1) the species is likely absent from most Refuge units or, if present, occurs at only a very low population density, and 2) the likelihood that activities that otherwise may adversely affect this species would be implemented in an area of suitable habitat on the Refuge occupied by American burying beetles is very low, we conclude that implementing the CCP is not likely to adversely affect the American burying beetle. However, to ensure significant adverse effects do not occur to this species on current or future acquired tracts, the Refuge will consider the habitat suitability of areas prior to the implementation of any activities that would result in significant ground disturbance (greater than 1.2 acres) or otherwise have the potential to negatively impact this species, and, if necessary, implement certain conservation measures as described below in Section VII, B.

Effects on the winged mapleleaf, interior least tern, piping plover, and Sprague's pipit

CCP implementation will have no effects on the winged mapleleaf, interior least tern, piping plover, or Sprague's pipit. These species do not occur on current Refuge units and the Refuge does not anticipate acquiring land with suitable habitat for these species.

Effects on the Neosho madtom, Neosho mucket, rabbitsfoot, and Arkansas darter

CCP implementation is not likely to adversely affect the Neosho madtom, Neosho mucket, rabbitsfoot, or Arkansas darter. These species do not occur on current Refuge units. Due to the close association of the habitat types used by these species (Ozark streams and rivers) and habitat types utilized by species the Refuge targets for conservation and recovery efforts of federally-listed cave species and Neotropical migratory birds, it is possible that future Refuge acquisitions may contain areas in which one or more of these species occur. However, there is no certainty regarding whether acquiring lands used by these species would occur. Nonetheless, the goal of Refuge management actions that would impact springs, rivers, streams and associated riparian and upland forests would be to protect, enhance, and/or restore these areas. Therefore, should the Refuge acquire areas used by these species, any effects of Refuge activities as described in the CCP would be expected to be discountable, insignificant, or entirely beneficial.

Overall, no significant adverse effects are expected to occur to any federally-listed species or species that are candidates for federal listing as a result of the management direction proposed in the CCP.

B. Explanation of actions to be implemented to reduce adverse effects:**Prescribed Fire Conservation Measures:**

Prescribed burns would be planned so that factors such as location of caves in relation to prescribed burns, wind direction, and temperature would be considered during the design of the burn plan to prevent smoke from entering caves.

Caves experience minimal air movement when temperatures are around 60°F. To eliminate impact on federally listed cave species, the prescription will call for daytime high temperatures between 45° and 70° in order to time the burn with minimal air movement conditions.

Additionally, excess fuel (e.g., leaf litter, debris, etc.) will be removed from near the cave entrance with leaf blowers or by hand. Ignition will begin by ring firing at least 50 feet from the cave entrance to minimize fire behavior and smoke near the entrance. Excellent mixing heights $\geq 3 < 650$ ft. will be included as a prescription parameter so that smoke will move up and out of the area. Once the fire is established around the cave entrance, the perimeter will be fired quickly to take advantage of peak burn period lifting. With proper ignition, perimeter fire should draw the interior fire away from the cave entrance. In addition, a fire truck will be kept by important caves, where possible, and where caves are inaccessible for a truck, a fire crew will monitor the fire as it passes the entrance in case the fire gets within close proximity of the cave.

As an additional precautionary measure, burning around maternity caves utilized by federally listed bat species during the early maternity season (e.g., May 1- June 30) would not occur so that the potential for smoke to enter a cave that contains non-volant young would be completely avoided. Similarly, burning around hibernacula utilized by federally listed bat species would not occur during the typical winter hibernation period (e.g., November 1 – March 15) to avoid disturbance to hibernating bats.

Invasive Species Removal Conservation Measures

The Refuge would employ best management practices during planning and application of all herbicide use including: application at wind speeds less than 10 mph (but not inversion conditions) - must follow label; calibrate application equipment; field scouting/monitoring before pesticide application; pesticide application buffers around sensitive areas; use lowest effective application rate; and vegetative buffers. The Refuge would not apply chemical herbicides in sensitive groundwater recharge areas or above karst topography that is conducive to filtrating into fragile cave habitat utilized by federally listed cave species.

Indiana bat

Should this species be discovered on current Refuge lands or on lands acquired in the future, Refuge staff will conduct habitat assessments and, if necessary, acoustic bat and mist-netting surveys prior to the implementation of any activity that could adversely affect this species to determine whether Indiana bats are present in the vicinity of the proposed activity. Conservation

measures also would be developed and implemented should Indiana bats be detected/captured during acoustic and/or mist-netting surveys to ensure unnecessary impacts to this species do not occur. If the Refuge discovers an Indiana bat maternity roost site within the forest (they tend to roost in trees), the Refuge would avoid prescribed fire in that particular area during the maternity season. In cases where adverse effects could not be completely avoided, the Refuge would initiate formal intra-Service Section 7 consultation with the Oklahoma Ecological Services Field Office.

American burying beetle

The Refuge will conduct presence/absence surveys for American burying beetles prior to the implementation of any activity that would require significant ground disturbance (greater than 1.2 acres) or otherwise have the potential to negatively affect this species when it is determined, based upon a habitat assessment, that the activity would occur in areas of suitable habitat (a level of detail not currently available). If the species is found during survey efforts, the Refuge will coordinate with the Oklahoma Ecological Services Field Office to develop and incorporate appropriate conservation measures into project plans so that adverse effects could be avoided. In cases where adverse effects could not be completely avoided, the Refuge would initiate formal intra-Service Section 7 consultation with the Oklahoma Ecological Services Field Office (ESFO).

General Conservation Measures

Overall, surveys will be undertaken to determine the presence of listed species potentially occurring on the Refuge in areas planned for prescribed burns, vegetation disturbance, or other wildlife disturbance activities related to actions proposed in this CCP. If listed species are found, the Refuge will change or alter management activities so as not to adversely impact the species, or consult with the Oklahoma ESFO prior to undertaking such actions to determine the appropriate course of action in order to adequately address any listed species concerns. Public use activities, such as hunting, environmental education, interpretation, wood harvesting, and wildlife observation and photography will only be allowed in established pre-designated areas, seasons, and times.

The Refuge is working to develop a thorough updated database of the flora and fauna of the Refuge's biotic communities through baseline surveys. These updates should augment the Refuge's sensitive species mandates to provide timely management and protections if, in the future, additional listed species are documented on the Refuge.

As a working document, modifications to the objectives and strategies are anticipated. If modifications result in changes to the effects analysis, or include actions that are not considered in this document, the Refuge will re-initiate consultation or consult with the Oklahoma ESFO

over a particular action that may affect federally listed species and/or critical habitat.

VIII. Effect determination and response requested:

A. Listed species/designated critical habitat:

Determination

Response Requested

No effect on species/critical habitat
(*Winged mapleleaf, interior least tern, piping plover*) X Concurrence

May affect, but is not likely to adversely affect species
/critical habitat X Concurrence
(*Ozark big-eared bat, gray bat, Indiana bat, American
burying beetle, Ozark cavefish, Neosho madtom*)

May affect, is likely to adversely affect species
/critical habitat _____ Concurrence

B. Proposed species/proposed critical habitat:

Determination

Response Requested

No effect on species/critical habitat
(*rabbitsfoot* [critical habitat only]) X Concurrence

May affect, but is not likely to adversely affect species
/critical habitat X Concurrence
(*Neosho mucket* [species and critical habitat], *rabbitsfoot* [species only])

May affect, is likely to adversely affect species
/critical habitat _____ Concurrence

C. Candidate species:

Determination

Response Requested

No effect on species/critical habitat
(*Sprague's pipit*) X Concurrence

May affect, is likely to adversely affect species
/critical habitat _____ Concurrence

Appendix F: Intra-Service Section 7 Consultation

(Sprague's pipit)

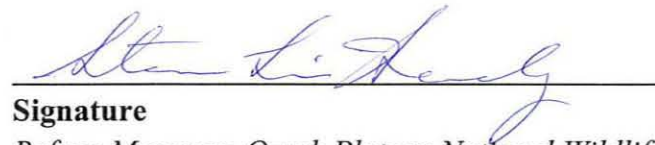
May affect, but is not likely to adversely affect species
/critical habitat

 X Concurrence

(Arkansas darter)

May affect, is likely to adversely affect species
/critical habitat

 Concurrence



Signature

Refuge Manager, Ozark Plateau National Wildlife Refuge

 11-14-12
Date

IX. Reviewing ESO Evaluation:

A. Concurrence ✓ Nonconcurrency _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Orly Porter

Signature

[Title/office of reviewing official]

11-15-12

Date

X. References:

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- U.S. Fish & Wildlife Service and Natural Resources Conservation Service. September 2010. “Programmatic Biological Assessment and Programmatic Biological Opinion for the Natural Resources Conservation Service’s Oklahoma Healthy Forests Reserve Program” . 99pp.

Appendix G: Key Legislation and Service Policies

Management of Ozark Plateau National Wildlife Refuge (Refuge, OPNWR) is dictated, in large part, by the legislation that created the unit and the purposes and goals described in Chapter 1 of this CCP. However, other laws, regulations, and policies also guide the management of the Refuge. This Appendix identifies the acts and policy guidance that are integral in the development of this Comprehensive Conservation Plan (CCP).

Administrative Procedure Act (1966; 5 U.S.C. 551-559, 701-706 and 801-808, as amended):

Contains procedures that Federal agencies must follow, including public information, open meetings, and privacy of information requirements, and provisions for hearings, adjudications, rule making, and judicial and congressional review of Federal agency actions.

Agricultural Credit Act of 1987 (7 U.S.C. 5104; P.L. 100-233): Authorizes the Farmer's Home Administration (FmHA) to transfer land to any Federal or State agency for conservation purposes (e.g., the FmHA can transfer fee-title or assign interests in real estate to the U.S. Fish and Wildlife Service for the protection of floodplains, wetlands, and surrounding uplands).

Americans with Disabilities Act (1992): The Americans with Disabilities Act is the most comprehensive Federal civil-rights statute that prohibits discrimination on the basis of disability in employment, state and local government, public accommodations, commercial facilities, transportation, and telecommunications.

Antiquities Act of 1906 (16 U.S.C. 431-433): First United States law to provide general protection of cultural or natural resources. This act authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974): Requires that Federal agencies provide for “...the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of...any alteration of the terrain caused as a result of any Federal construction project of federally licensed activity or program.”

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-470mm): The Archaeological Resources Protection Act (ARPA) was enacted “...to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals.” The main focus of ARPA is on regulation of legitimate archeological investigation on public lands and the enforcement of penalties against looting or vandalism of

these resources. Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

Appropriate Uses Policy (2006) 603 FW1: Describes procedures for refuge managers to follow when deciding if uses are appropriate on a refuge. Appropriate uses are either proposed or existing uses on a refuge that meet at least one of the following four conditions: 1) the use is a wildlife-dependent recreational use as identified in the 1997 Improvement Act; 2) the use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law; 3) the use involves the take of fish and wildlife under State regulations; or 4) the use has been found to be appropriate as described further in the Appropriate Refuge Uses policy. This policy applies to all proposed and existing uses in the National Wildlife Refuge System only where the Service has jurisdiction over the use. The policy does not apply in: 1) situations where reserved rights or legal mandates provide that the Service must allow the use, and 2) refuge management activities (e.g., fish and wildlife population or habitat management actions including, but not limited to: prescribed burns, water level management, invasive species control, routine scientific monitoring, law enforcement activities, and maintenance of existing refuge facilities).

Architectural Barriers Act (1968): Requires Federally-owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Bald and Golden Eagles Protection of 1940 (16 U.S.C. 668-668d; 54 Statute 250), as amended: Provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds..

Biological Integrity, Diversity, and Environmental Health (2001) 601 FW 3: As part of the comprehensive conservation planning process, this policy provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. It provides refuge managers with an evaluation process to analyze their refuge and recommend the best management direction to prevent further degradation of environmental conditions; and where appropriate and in concert with refuge purposes and Refuge System mission, restore lost or severely degraded components.

Clean Air Act (1970; 42 U.S.C. 7401 et seq.), as amended: A comprehensive Federal law that regulates air emissions from area, stationary, and mobile sources. This law authorizes the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment.

Clean Water Act (1977); Federal Water Pollution Control Act: This is the principal law that governs pollution of the Nation's surface waters. The Clean Water Act employs several regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. Section 404 of the Clean Water Act requires permits (issued by the U.S. Army Corps of Engineers) for the discharge of dredged or fill material into waters of the United States, including wetlands.

Compatibility Policy (2000) 603 FW 2: Incorporates the compatibility provisions of the National Wildlife Refuge System Improvement Act of 1997, that amends the National Wildlife Refuge System Administration Act of 1966. The Compatibility Policy is for determining whether proposed and existing uses, which the Service has jurisdiction over and are occurring on national wildlife refuges, are compatible (i.e., will not detract from or materially interfere) with the purpose(s) of the refuge or with the Refuge System's mission. The policy is to ensure that we (the Service) administer proposed and existing national wildlife refuge uses according to laws, regulations, and policies concerning compatibility, and provides procedures for documentation and periodic review of existing refuge uses.

Comprehensive Conservation Plans (2000) 602 FW 3: As required by the National Wildlife Refuge System Improvement Act of 1997, Comprehensive Conservation Plans (CCPs) describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes; help fulfill the Refuge System mission; maintain and, where appropriate, restore the ecological integrity; as well as to meet other mandates. The purpose of developing the CCP is to provide the refuge manager with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreational uses.

Convention Between the United States of America and the Mexican States for the Protection of Migratory Birds and Game Mammals, 1936 (50 Statute 1311).

Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere, 1940 (56 Statute 1354).

Convention Between the United States and Great Britain (for Canada for the Protection of Migratory Birds). (39 Statute 1702; TS 628), as amended.

Convention on Wetlands of International Importance, Especially as Waterfowl Habitats (I.L.M. 11:963-976, September 1972, Ramsar Convention).

Cooperative Research and Training Units Act (1960; 16 U.S.C. 753a-753b), as amended: Authorizes the Secretary of the Interior to enter into cooperative agreements with colleges and universities, State fish and game agencies, and nonprofit organizations for the purpose of

developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources.

Criminal Code Provisions of 1940 (18 U.S.C. 41), as amended: Provides for fines and penalties for the unlawful taking, disturbing, hunting, trapping, capturing of “...*any bird, fish, or wild animal of any kind whatever, or takes or destroys the eggs or nest of any such bird or fish, on any lands or waters which are set apart or reserved as sanctuaries, refuges or breeding grounds for such birds, fish, or animals under any law of the United States or willfully injures, molests, or destroys any property of the United States on any such lands or waters...*”

Disaster Relief Act of 1974 (42 U.S.C. 5121 et seq.), as amended: Provides authority for Federal agencies to assist State and local governments during Presidentially-declared emergencies.

Economy Act (1932; 31 U.S.C. 1535): Provides authority for Federal agencies to order goods and services from other Federal agencies and to pay the actual costs of those goods and services. The Act was passed to obtain economies of scale and eliminate overlapping activities of the Federal government.

Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901-3932, as amended): The purpose of this act is to promote wetlands conservation for the public benefit and to help fulfill international obligations in various migratory bird treaties and conventions. The Act authorizes the purchase of wetlands from Land and Water Conservation Fund monies. The Act also requires the Secretary of the Interior to establish a National Wetlands Priority Conservation Plan, requires the states to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers funds from import duties on arms and ammunition to the Migratory Bird Conservation Fund.

Endangered Species Act of 1973, as amended: The main purposes of the Endangered Species Act are to: 1) provide a means whereby ecosystems of threatened and endangered species may be conserved; and 2) provide a program for the conservation of threatened and endangered species. The provisions of the Endangered Species Act include, but are limited to, land acquisition, cooperative programs with the States, and interagency cooperation (Section 7). Section 7(a)(1) directs Federal agencies to carry out programs for the conservation of threatened and endangered species.

Environmental Education Act of 1990 (20 U.S.C. 5501-5510): Established the Office of Environmental Education within the Environmental Protection Agency, to develop and administer a Federal environmental education program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

Executive Order 11514; Protection and Enhancement of Environmental Quality (1970):

This directs that the “...*Federal Government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans and programs so as to meet national environmental goals...*”

Executive Order 11644; Use of off-road vehicles on the public lands (1972): Requires that the Service designate areas as open or closed to off-highway vehicles in order to protect refuge resources, promote safety, and minimize conflict among the various refuge users; monitor the effects of these uses once they are allowed; and amend or rescind any area designation as necessary based on the information gathered.

Executive Order 11987; Exotic organisms (1977): Executive agencies shall, to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States.

Executive Order 11988; Floodplain Management (1977): This directs that each Federal agency “...*shall provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains...*,” in carrying out its responsibilities.

Executive Order 11989; Off-Road Vehicles on Public Lands (1977): Requires the Service to close areas to off-highway vehicles when we determine that the use cause or will cause considerable adverse effects on the soil, vegetation, wildlife, habitat, or cultural or historic resources.

Executive Order 11990; Protection of Wetlands (1977): This directs that each Federal agency “...*shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities...*”

Executive Order 12996; Management and General Public Use of the National Wildlife Refuge System (1996): This spells out the mission of the National Wildlife Refuge System along with establishing guiding principles to help insure the long-term enjoyment of the Refuge System for present and future generations. The order directs the Secretary of the Interior to recognize compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation as priority general public uses on the Refuge System (i.e., the big six).

Executive Order 13007; Indian Sacred Sites (1996): Directs Federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites and where appropriate, maintain the confidentiality of sacred sites.

Executive Order 13112; Invasive Species (1999): This order was established to address the growing ecological and economic damage caused by invasive species. Executive Order 13112 requires Federal agencies to: 1) identify actions that might impact the status of invasive species and prevent introductions of invasive species; 2) not authorize, fund, or carry out actions likely to cause the introduction or spread of invasive species; 3) detect and respond rapidly to control invasive species populations; 4) monitor and conduct research on invasive species; 5) restore native species and habitat conditions in ecosystems that have been invaded; and 6) promote public education on invasive species.

Executive Order 13186; Responsibilities of Federal agencies to protect migratory birds (2001): Provides guidance for Service programs relative to the management and conservation of migratory birds. Its purpose is to minimize the potential adverse effects of migratory bird take, with the goal of striving to eliminate take, while implementing our mission. This guidance includes, but is not limited to: 1) integrating migratory bird conservation measures into our activities; 2) restoring and enhancing the habitat of migratory birds; 3) ensuring our actions/plans promote migratory bird conservation; 4) promoting inventory, monitoring, research, management studies and information exchange related to migratory birds; 5) promoting education and outreach related to migratory birds; 6) identifying special migratory bird habitats; and 7) strengthening non-Federal partnerships to further bird conservation.

Executive Order 13514; Federal Leadership in Environmental, Energy, and Economic Performance (2009): Provides guidance for federal agencies to increase energy efficiency; reduce greenhouse gas emissions; design, construct, maintain, and operate high performance sustainable buildings, etc.

Farmland Protection Policy Act (7 U.S.C. 4201 et seq.): Requires Federal agencies to identify and take into account the adverse effects of their programs on the preservation of farmlands.

Federal Aid in Wildlife Restoration Act (1937; 16 U.S.C. 669-669i), as amended: Commonly called the "Pittman-Robertson Act," this provides Federal aid to States for management and restoration of wildlife. Funds from an 11-percent excise tax on sporting arms and ammunition are appropriated to the Secretary of the Interior and apportioned to States on a formula basis for paying up to 75% of the cost-approved projects. Project activities include acquisition and improvement of wildlife habitat, introduction of wildlife into suitable habitat, research into wildlife problems, surveys and inventories of wildlife problems, acquisition and development of

access facilities for public use, and hunter education programs, including construction and operation of public target ranges.

Federal Environmental Pesticide Control Act of 1972 (7 USC 136-136y), as amended: This established, under the Administrator of the EPA, a program for controlling the sale, distribution, and application of pesticides through an administrative registration process. The amendments provided for classifying pesticides for "general" or "restricted" use. "Restricted" pesticides may only be applied by or under the direct supervision of a certified applicator. Amendments to this Act also authorized experimental use permits and provided for administrative review of registered pesticides and for penalties for violations of the statute. States were authorized to regulate the sale or use of any pesticide within a state, provided that such regulation does not permit any sale or use prohibited by the Act. The Federal Environmental Pesticide Control Act of 1972 amended the **1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**. The 1947 statute (FIFRA), prohibited the sale or distribution of "*economic poisons*," provided for the registration of such materials, and authorized penalties for violation of the Act. The Endangered Species Act later amended FIFRA to define imminent hazard to include situations involving *unreasonable hazard to the survival of a species declared by the Secretary of the Interior to be endangered or threatened*.

Federal Fire Prevention and Control Act of 1974 (15 U.S.C. 2201 et seq.), as amended: This authorizes reimbursement to State and local fire services for costs incurred in firefighting on Federal property.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.

Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471-535), as amended: Sets forth requirements for the management and disposal of government property, including excess property (property under the control of any Federal agency, but which it no longer needs) and surplus property (excess property not required for the needs of any Federal agency).

Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l), as amended:

This established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges. The policy emphasizes the commercial fishing industry but also with a direction to administer the Act with regard to the inherent right of every citizen and resident to fish for pleasure, enjoyment, and betterment, and to maintain and increase public opportunities for recreational use of fish and wildlife resources. Among other things, the Act directs a program of continuing research, extension, and information services on fish and wildlife matters, both domestically and internationally. A 1974 amendment to the Fish and Wildlife Act of 1956 abolished the “Bureau of Sport Fisheries and Wildlife” and re-designated it as the “United States Fish and Wildlife Service”(Public Law 93-271). In 1978, the Fish and Wildlife Act was amended to allow the Service to accept donations of both real and personal property. In 1998, the Fish and Wildlife Act of 1956 was further amended to promote volunteer programs and community partnerships for the benefit of national wildlife refuges. This also required the Secretary of the Interior to develop refuge education programs to provide outdoor classroom opportunities for students to promote understanding of the National Wildlife Refuge System and to improve scientific literacy in conjunction with both formal and informal education programs.

Fish and Wildlife Conservation Act of 1980 (“Nongame Act”)(16 U.S.C. 2901-2911), as

amended: Authorizes financial and technical assistance to the States for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife. A 1988 amendment requires the Service to monitor and assess migratory nongame birds, determine the effects of environmental changes and human activities, identify those likely to be candidates for endangered species listing, identify appropriate actions, and report to Congress one year from enactment. It also requires the Service to report at 5 year intervals on actions taken.

Fish and Wildlife Coordination Act (1934), as amended: Authorizes the Secretary of the Interior to assist Federal, State, and other agencies in development, protection, rearing and stocking fish and wildlife on Federal lands and to study effects of pollution on fish and wildlife. The Act also requires consultation with the U.S. Fish & Wildlife Service and the wildlife agency of any State wherein the waters of any stream or other water body are proposed to be impounded, diverted, channelized or otherwise controlled or modified by any Federal agency, or any private agency under Federal permit or license; with a view to preventing loss of, or damage to, wildlife resources in connection with such water resource projects. The Act further authorizes Federal water resource agencies to acquire lands or interests in connection with water use projects specifically for mitigation and enhancement of fish and wildlife.

Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421; 92 Stat. 3110), as amended:

Authorizes the Secretaries of the Interior and Commerce to establish, conduct, and assist with

National training programs for State fish and wildlife law enforcement personnel. It also authorized funding for research and development of new or improved methods to support fish and wildlife law enforcement. The law provides authority to the Secretaries to enter into law enforcement cooperative agreements with State or other Federal agencies, and authorizes the disposal of abandoned or forfeited items under the fish, wildlife, and plant jurisdictions of these Secretaries. It strengthens the law enforcement operational capability of the Service by authorizing the disbursement and use of funds to facilitate various types of investigative efforts.

Flood Control Act of 1944, as amended: This act, supplemented by other flood control acts and river and harbor acts, authorizes various Corps of Engineers water development projects. The Flood Control Act expressed Congressional intent to limit the authorization and construction of navigation, flood control, and other water projects to those having significant benefits for navigation and which could be operated consistent with other river uses. This authorized the construction of numerous dams and modifications to previously existing dams. Several provisions of this act impact the responsibilities of the Service under the **Fish and Wildlife Coordination Act**.

Food Security Act of 1985 “Farm Bill” (99 Stat. 1354), as amended by the Food, Agriculture, Conservation, and Trade Act of 1990: This contains several provisions that contribute to wetland conservation. The “Swampbuster” provisions stated that farmers who produce an agricultural commodity on wetlands converted after enactment are ineligible for most farmer program subsidies. Administration of the program in the Department of Agriculture (USDA), which is required to consult with the U.S. Fish and Wildlife Service on matters relating to wetland identification, determination of exemptions to the wetland conservation provisions, issuance of implementing regulations, mitigation, and restoration of values and functions on converted wetlands. This Act also authorized the Secretary of Agriculture to grant or sell conservation easements, which may include wetlands, to State or local governments or private non-profit organizations for conservation purposes. In addition, the 1985 Act also established a Conservation Reserve program, providing incentives to private landowners (e.g., farmers) to return farmland to permanent vegetative cover and for applying soil conservation prescriptions such as wildlife habitat development. The program was expanded in 1988 by regulation to make cropped wetlands eligible for the program, with the intended result of wetland restoration (i.e., The Wetland Reserve Program).

Freedom of Information Act (1966; 5 U.S.C. 552): Requires all Federal agencies to make available to the public for inspection and copying administrative staff manuals and staff instructions, official, published and unpublished policy statements, final orders deciding case adjudication, and other documents. Special exemptions have been reserved for nine categories of privileged material, including but not limited to confidential matters relating to National defense

or foreign policy, law enforcement records, and trade or commercial secrets. The Act requires the party seeking the information to pay reasonable search and duplication costs.

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461-462, 464-467), as amended.

Also known as the Historic Sites Act, this declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration, and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act. As of January, 1989, 31 national wildlife refuges contained such sites, including Attwater Prairie Chicken NWR.

Lacey Act of 1900 (16 U.S.C. 701), as amended: Makes it unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants taken, possessed, transported, or sold: 1) in violation of U.S. or Indian law, or 2) in interstate or foreign commerce involving any fish, wildlife, or plants taken possessed or sold in violation of State or foreign law. The Lacey Act covers all fish and wildlife and their parts or products, and plants protected by the Convention on International Trade in Endangered Species and those protected by State law. Commercial guiding and outfitting are considered to be a sale under the provisions of the Act. The Act also includes prohibitions on the importation of wild vertebrates and other animals listed in the Act or declared by the Secretary of the Interior to be injurious to man or agriculture, wildlife resources, or otherwise, except under certain circumstances and pursuant to regulations. The Lacey Act includes penalties and fines for violations involving imports or exports or violations of a commercial nature.

Land and Water Conservation Fund Act (1965): Authorizes the use of the receipts from the sale of surplus Federal land, outer continental shelf oil and gas sales, and other sources for land acquisition. Section 7(a)(1) of this Act provides authority to use Land and Water Conservation Fund money for acquisition of refuge areas under paragraph (5) of section 7(a) of the Fish and Wildlife Act of 1956.

Migratory Bird Conservation Act (1929; 16 U.S.C. 715-715d, 715e, 715f-715r), as amended:

This established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended:

The Migratory Bird Treaty Act (MBTA) is one of the earliest Federal wildlife management laws enacted to protect migratory birds, which were rapidly declining from unregulated sport and commercial hunting. Specific provisions in the MBTA include the establishment of a Federal prohibition, unless permitted by regulations, to "*...pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be*

shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention ...for the protection of migratory birds...or any part, nest, or egg of any such bird."

Migratory Bird Hunting and Conservation Stamp Act (1934; 16 U.S.C. 718-718j), as amended: Known as the "Duck Stamp Act," this requires each waterfowl hunter 16 years of age or older to possess a valid Federal hunting stamp. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations. Funds appropriated under the Wetlands Loan Act (16 U.S.C. 715k-3 - 715k-5), as amended, are merged with duck stamp receipts and provided to the Secretary of the Interior for the acquisition of migratory bird refuges under provisions of the Migratory Bird Conservation Act (16 U.S.C. 715 et seq), as amended, and since August 1, 1958, for acquisition of "Waterfowl Production Areas."

National Environmental Policy Act of 1969 (42 U.S.C. 4321-4347), as amended: The National Environmental Policy Act (NEPA) requires that all Federal agencies prepare detailed environmental impact statements for "every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. NEPA stipulates factors to be considered in environmental impact statements, and requires that Federal agencies employ an interdisciplinary approach in related decision-making and develop means to ensure that un-quantified environmental values are given appropriate consideration, along with economic and technical considerations.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n), as amended: Provides for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The Act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in 1976. That Act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of January, 1989, 91 historic sites on national wildlife refuges have been placed on the National Register.

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee. (Refuge Administration Act): Defines the National Wildlife Refuge System and authorizes the Secretary to permit any use of a refuge provided such use is compatible with the purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority

public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of Interior for managing and protecting the System; and requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Wildlife Refuge System Improvement Act (1997): Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System. Clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation); establishes the responsibilities of the Secretary of the Interior for managing and protecting the system; and requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of and repatriate cultural items under their control or possession.

North American Wetlands Conservation Act (1989; 16 U.S.C. 4401-4412), as amended: Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico.

Protection Act (1922; 16 U.S.C. 594): Provides for the Secretary of the Interior to protect and preserve, from fire, disease, or the ravages of beetles or other insects, timber on the public lands owned by the United States.

Reciprocal Fire Protection Act of 1955 (42 U.S.C. 1856), as amended by the Wildfire Suppression Assistance Act of 1989 (102 Stat. 1615): Provides authority for Federal agencies to enter into mutual assistance agreements with foreign, State, and local governments for combating wildfires, and to provide emergency assistance when no agreement exists.

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended: Authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. The Act provides for public use fees and permits, and penalties for violation of regulations. It also authorizes the acceptance of donations of funds and real and personal property to assist in carrying out its purposes. Amendments to the Act authorize acquisition of lands and interests

suitable for: 1) fish and wildlife-oriented recreation, 2) protection of natural resources, 3) conservation of endangered or threatened species, or 4) carrying out two or more of the above. Such lands were required to be adjacent to or within an existing conservation area. Acquisition was not permitted with "duck stamp" receipts for these purposes.

Refuge Revenue Sharing Act of 1935 (16 U.S.C. 715s), as amended: Provides for payments to county governments in lieu of taxes, using revenues derived from the sale of products from refuges. Revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, are required to be deposited in a special Treasury account and net receipts distributed to counties. Remaining monies are required to be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act. The Act was later amended to expand the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as: 1) on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25% of the net receipts produced from the land, and 2) on land withdrawn from the public domain, 25% of net receipts and basic payment, in lieu of taxes on public lands. Amendments to the Act authorized appropriations to make up any difference between the amount in the Revenue Sharing Fund and the amount scheduled for payment in any year. Counties are also required to pass payments along to other units of local government within the county which suffer losses in revenues due to the establishment of Service areas.

Refuge Trespass Act of 1948 (18 U.S.C. 41): This consolidated penalty provisions of various acts from 1905 through 1934, establishing and protecting fish and wildlife areas, and restated the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries and breeding grounds.

Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal government to ensure that anybody can participate in any program.

Secretarial Order No. 3226; Evaluating Climate Change Impacts in Management Planning (2001): Directs each Department of Interior bureau to consider and analyze potential climate change impacts when undertaking long-range planning efforts or multi-year management plans.

Transportation Equity Act for the 21st Century (TEA-21): 23 U.S.C., as amended: In part, this established the Refuge Roads Program and requires that all projects funded under the Refuge Roads Program be consistent with the Service's CCP plans and step-down management plans.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948 (16 U.S.C. 667b-d), as amended: This Act provides that, upon a determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.

Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4601 et seq.), as amended: Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.

Volunteer and Partnership Enhancement Act (1998): This amended the Fish and Wildlife Act of 1956 to promote volunteer programs and community partnerships for the benefit of national wildlife refuges, and for other purposes.

Waterfowl Depredations Prevention Act (1956; 7 U.S.C. 442-445), as amended: This Act authorizes the Secretary of the Interior to use surplus grain owned by Commodity Credit Corporation in feeding waterfowl to prevent crop damage. Findings regarding possible crop damage are to be made by the Secretary of the Interior and grain is to be used to lure waterfowl away from crops while not exposing them to shooting over areas to which they have been lured. Such grain may be made available to Federal, State or local governments or private organizations or individuals. Appropriations are authorized to reimburse the Corporation for packaging and transporting such grain.

Water Resources Planning Act (1965), as amended: This established a Water Resources Council to be composed of Cabinet representatives, including the Secretary of the Interior. The Council was empowered to maintain a continuing assessment of the adequacy of water supplies in each region of the U.S. In addition, the Council was mandated to establish principles and standards for Federal participants in the preparation of river basin plans and in evaluating Federal water projects. Upon receipt of a river basin plan, the Council was required to review the plan with respect to agricultural, urban, energy, industrial, recreational, and fish and wildlife needs. This also established a grant program to assist States in participating in the development of related comprehensive water and land use plans.

Wetlands Reserve Program: The Wetlands Reserve Program (WRP) is a voluntary program. It provides technical and financial assistance to eligible landowners to address wetland, wildlife habitat, soil, water, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner. The program provides an opportunity for landowners to receive financial incentives to restore, protect, and enhance wetlands in exchange for retiring marginal land from agriculture. There are three enrollment options for landowners: 1) permanent

easement, 2) 30-year easement, and 3) a restoration cost-share agreement. The WRP was re-authorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill). The Natural Resources Conservation Service administers the program (*See Also: Food Security Act of 1985*).

Wilderness Act of 1964 (16 U.S.C. 1131): The purpose of this act is to preserve and protect wild lands in their natural condition “...to secure for the American people of present and future generations the benefits of an enduring resource of wilderness.” This directed Federal agencies such as the U.S. Fish and Wildlife Service to survey their roadless lands for possible wilderness designation. Wilderness areas are protected from development and the operation of motorized equipment. A Wilderness Area is defined as an area with at least 5,000 acres of undisturbed, undeveloped land affected by the forces of nature and may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

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Appendix H: Glossary

accessible facilities: structures accessible for most people with disabilities without assistance; facilities that meet UFAS standards; ADA-accessible

adaptive management: a management style in which the effectiveness of management actions is monitored and evaluated, and future management is modified as needed, based on the results of this evaluation or other relevant information that becomes available

alternatives: Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. A reasonable way to fix an identified problem or satisfy a stated need [40 CFR 1500.2 (cf. “management alternative”)]

appropriate use: A proposed or existing use on a refuge that is a wildlife-dependent recreational use as identified in the 1997 Refuge System Improvement Act (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) or the use contributes to the fulfillment of refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997.

approved acquisition boundary: a project boundary that the Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved acquisition boundary only designates those lands which the Service has authority to acquire or manage through various agreements. The approval of an acquisition boundary does not grant the Service jurisdiction or control over lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the System until the Service buys them or they are placed under an agreement that provides for their management as part of the System.

best management practices: land management practices that produce desired results [n.b. usually describing forestry or agricultural practices effective in reducing non-point source pollution, like not storing manure in flood plain. In their broader sense, practices that benefit target species.]

biological diversity: The variety of life and its processes, including the variety of living organisms, the genetic differences among them and communities and ecosystems in which they occur.

biological integrity: Biotic composition, structure and functioning at genetic, organism and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms and communities.

biotic community: A set of plants, animals and microorganisms occupying an area interacting directly or indirectly with each other and their physical environment.

breeding habitat: habitat used by migratory birds or other animals during the breeding season

candidate species: species for which we have sufficient information on file about their biological vulnerability and threats to propose listing them

cave: naturally occurring void/recess below the Earth

compatible use: A wildlife-dependent recreational use, or any other proposed or existing use on a refuge that will not materially interfere with or detract from the purposes of the refuge or the National Wildlife Refuge System mission.

Comprehensive Conservation Plan: A document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge; helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

concern: cf. “issue”

connectivity: community occurrences and reserves have permeable boundaries and thus are subject to inflows and outflows from the surrounding landscape. Connectivity in the selection and design of nature reserves relates to the ability of species to move across the landscape to meet basic habitat requirements. Natural connecting features within the ecoregion may include river channels, riparian corridors, ridgelines, or migratory pathways.

conservation: managing natural resources to prevent loss or waste [N.b. Management actions may include preservation, restoration, and enhancement.]

conservation easement: a non-possessory interest in real property owned by another imposing limitations or affirmative obligations with the purpose of returning or protecting the property’s conservation values.

conservation status: assessment of the status of ecological processes and of the viability of species or populations in an ecoregion.

cooperative agreement: a usually long-term habitat protection action, which can be modified by either party, in which no property rights are acquired. Lands under a cooperative agreement do not necessarily become part of the National Wildlife Refuge System

coyote mentoring: Ozark Plateau NWR's EE programs are based on this philosophy, as highlighted in *Coyote's Guide to Connecting with Nature* (Young, et. al., 2010), which is the art of guiding people to have a deep nature-connection by mentoring and facilitating an edge-walking experience, as coyote does, between the ancient, primitive world of the wilderness and instinct, and the modern, civilized world of science and technology

cultural resources: The remains of meaningful sites, structures, or objects used by people in the past.

deep nature-connection: a strong kinship between students and their environment through a quality of awareness and a quality of connection to a place and all its living things (Young et. al., 2010)

delineate: to indicate the exact position or boundaries of something

desired future condition: the qualities of an ecosystem or its components that an organization seeks to develop through its decisions and actions.

disturbance: any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment

ecological integrity: The relative intactness of biotic and abiotic components and their interrelated structure and function within a given ecosystem.

ecoregion: a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.

ecosystem: Dynamic and interrelating complex of plant and animal communities and their associated non-living environment.

ecosystem approach: A strategy or plan to protect and/or restore the natural function, structure and species composition of an ecosystem, recognizing that all components are interrelated.

ecosystem management: Management of an ecosystem that includes all ecological, social, and economic components, which make up and/or that affect the whole of the system.

endangered species: A plant or animal species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

environmental assessment: A systematic analysis to determine if proposed Federal actions would result in a “significant effect on the quality of the human environment” thereby requiring either the preparation of an environmental impact statement (EIS) or a determination of a “Finding of No Significant Impact.”

environmental education: curriculum-based education aimed at producing a citizenry that is knowledgeable about the biophysical environment and its associated problems, aware of how to help solve those problems, and motivated to work toward solving them

exotic: A non-native plant or animal species to the ecosystem under consideration introduced intentionally or unintentionally.

extinction: the termination of any lineage of organisms, from subspecies to species and higher taxonomic categories from genera to phyla. Extinction can be local, in which one or more populations of a species or other unit vanish but others survive elsewhere, or total (global), in which all the populations vanish (Wilson 1992)

fauna: all animal life associated with a given habitat, country, area or period

federal land: public land owned by the Federal Government, including national forests, national parks, and national wildlife refuges

federally listed species: a species listed either as endangered, threatened, or a species at risk (formerly, a “candidate species”) under the Endangered Species Act of 1973, as amended

federal trust species: Important fish and wildlife resources that the U.S. Fish and Wildlife Service is specifically mandated to protect including migratory birds, threatened species, endangered species, inter-jurisdictional fish, marine mammals, and other species of concern.

fee-title acquisition: the acquisition of most or all of the rights to a tract of land; a total transfer of property rights with the formal conveyance of a title. While a fee-title acquisition involves most rights to a property, certain rights may be reserved or not purchased, including water rights, mineral rights, or use reservation (e.g., the ability to continue using the land for a specified time period, such as the remainder of the owner’s life).

Finding of No Significant Impact (FONSI): supported by an environmental assessment, a document that briefly presents why a Federal action will have no significant effect on the human

environment, and for which an environmental impact statement, therefore, will not be prepared [40 CFR 1508.13]

firebreak: A firebreak is a permanent or temporary strip of bare or vegetated land planned to retard fire. Firebreaks shall consist of bare ground, roads, or fire-resistant vegetation. Firebreaks will be of sufficient width and length to contain the expected fire. They will be located and constructed in areas to minimize risk (detrimental effects) to the target species.

fire regime: the characteristic frequency, intensity, and spatial distribution of natural fires within a given ecoregion or habitat

flora: all the plants found in a particular place

flyway: any one of several established migration routes of birds

fragmentation: the disruption of extensive habitats into isolated and small patches. Fragmentation has two negative components for biota: the loss of total habitat area; and, the creation of smaller, more isolated patches of habitat remaining.

geographic information system (GIS): a computerized system to compile, store, analyze and display geographically referenced information [E.g., GIS can overlay multiple sets of information on the distribution of a variety of biological and physical features.]

goal: Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not defined measurable units.

habitat fragmentation: the breaking up of a specific habitat into smaller, unconnected areas [N.b. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.]

habitat conservation: protecting an animal or plant habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced

habitat: The place or type of site where species and species assemblages are typically found and/or successfully reproduce. [N.b. An organism's habitat must provide all of the basic requirements for life, and should be free of harmful contaminants.]

historic conditions: the composition, structure and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human-related changes to the landscape

hydrology: the science of waters of the earth: their occurrences, distributions, and circulations; their physical and chemical properties; and their reactions with the environment, including living beings

interpretive facilities: structures that provide information about an event, place, or thing by a variety of means, including printed, audiovisual, or multimedia materials [E.g., kiosks that offer printed materials and audiovisuals, signs, and trail heads.]

interpretive materials: any tool used to provide or clarify information, explain events or things, or increase awareness and understanding of the events or things [E.g., printed materials like brochures, maps or curriculum materials; audio/visual materials like video and audio tapes, films, or slides; and, interactive multimedia materials, CD-ROM or other computer technology.]

invasive plant species: A non-native plant to the ecosystem under consideration that lacks natural controls and tends to aggressively dominate the plant community, often forming extensive mono-cultures. Invasive species generally reduce the diversity and health of ecosystems when they become dominant.

Issue: Any unsettled matter that requires management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition.

karst environment: a landscape that is marked by caves, sinkholes, springs, and other features and has special drainage characteristics due to the greater solubility of certain rocks

Land Protection Plan (LPP): a document that identifies and prioritizes lands for potential Service acquisition from a willing seller, and describes other methods of providing protection. Landowners within project boundaries will find this document, which is released with environmental assessments, most useful.

limiting factor: an environmental limitation that prevents further population growth

losing stream: a stream with a bed that allows water to flow directly to the groundwater system

mission statement: a succinct statement of the purpose for which the unit was established; its reason for being

mitigation: actions to compensate for the negative effects of a particular project [E.g., wetland mitigation usually restores or enhances a previously damaged wetland or creates a new wetland.]

National Environmental Policy Act (of 1969): (NEPA) requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in planning and implementing environmental actions [Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision-making (cf. 40 CFR 1500).]

national wildlife refuge: A designated area of land or water or an interest in land or water within the Refuge System, such as refuges, wildlife management areas, waterfowl production areas and other areas under Service jurisdiction for the protection and conservation of fish and wildlife and plant resources. A complete listing of all units of the Refuge System may be found in the current “Annual Report of Lands under Control of the U.S. Fish and Wildlife Service.”

National Wildlife Refuge System: All lands, waters and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas and other areas for the protection and conservation of fish, wildlife and plant resources.

native: a species that, other than as a result of an introduction, historically occurred or currently occurs in a particular ecosystem

native plant: a plant that has grown in the region since the last glaciation, and occurred before European settlement

natural disturbance event: any natural event that significantly alters the structure, composition, or dynamics of a natural community: e.g., floods, fires, and storms

Notice of Intent: (NOI) an announcement we publish in the Federal Register that we will prepare and review an environmental impact statement [40 CFR 1508.22]

objective: A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measureable.

partnership: a committed, long-term relationship between institutions with a common objective, allowing each side to dedicate time, money, knowledge, and/or personnel to the partnership to accomplish a certain conservation task that neither institution could do alone (Smith, 2005)

philopatry: the behavior of remaining in, or returning to, an individual's birthplace. More specifically, in ecology philopatry is the behavior of elder offspring sharing the parental burden in the upbringing of their siblings, a classic example of kin selection.

population: an interbreeding group of plants or animals. The entire group of organisms of one species.

prairie: an extensive area of flat or rolling grassland.

prescribed fire: Prescribed burning is the application of controlled fire on a pre-determined area of land. It will be used at Ozark Plateau NWR to promote the development of historic plant communities in oak/hickory forests while also reducing hardwood understory density for the targeted species. Use of prescribed burning will restore, enhance, or maintain desirable habitat. Burning should be managed with consideration for targeted species needs, particularly smoke management near cave entrances. A prescribed burn plan is required prior to the implementation of the burn. A trained and qualified individual will formulate this plan considering overall ecological restoration, smoke management, required safety equipment, special precaution areas, and techniques.

priority public use: Wildlife-dependent recreational uses involving hunting, fishing wildlife observation and photography, and environmental education and interpretation are the priority general public uses of the system and shall receive priority consideration in refuge planning and management.

priority species: Wildlife or plant species that include Federal trust species such as migratory birds, threatened species, endangered species, inter-jurisdictional fish, marine mammals, and other species of concern. Priority species also include rare, declining, or species of management concern that are on lists maintained by natural heritage programs, State wildlife agencies, other Federal agencies, or professional, academic, and scientific societies, and those mentioned in landscape-level or other conservation plans.

private land: land owned by a private individual or group or non-government organization

public involvement: offering an opportunity to interested individuals and organizations whom our actions or policies may affect to become informed; soliciting their opinions. We thoroughly study public input, and give it thoughtful consideration in shaping decisions about managing refuges.

public uses: Normally refers to the six priority public uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation), but may include other permitted special uses.

purposes of the refuge: “The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit.”

refuge lands: lands in which the Service holds full interest in fee title or partial interest like an easement

Refuge Operating Needs System (RONS): The Refuge Operating Needs System is a national database that contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

representative species: a species that is indicative of particular conditions in a system (ranging from natural to degraded) and used as a surrogate measure for other species of particular conditions. An element of biodiversity selected as a focus for conservation planning or action. The two principal types of targets in Conservancy planning projects are species and ecological communities.

restoration: management of a disturbed or degraded habitat that results in the recovery of its original state [E.g., restoration may involve planting native grasses and forbs, removing shrubs, prescribed burning, or reestablishing habitat for native plants and animals on degraded grassland.]

riparian: Of or relating to land lying immediately adjacent to a water body and having specific characteristics of that area, such as riparian vegetation. A stream bank is an example of a riparian area.

scoping: A process for identifying the “scope of issues” to be addressed by a CCP. Involved in the scoping process are Federal, State, local agencies, private organizations, and individuals.

species: the basic category of biological classification intended to designate a single kind of animal or plant. Any variation among the individuals may be regarded as not affecting the essential sameness which distinguishes them from all other organisms.

stakeholders: Those agencies, organizations, groups and individuals of the public, having an interest or stake in an organization’s program and that affects or that may be affected by its implementation.

step-down management plan: A plan that provides specific guidance on management subjects (e.g. habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

strategy: A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.

threatened species: A plant or animal species listed under the Endangered Species Act that is likely to become endangered within the foreseeable future.

trust species: (*See Federal Trust Species*).

wetland: Areas such as lakes, marshes, ponds, swamps, or streams that are inundated by surface or groundwater that is enough to support plants and animals that require saturated or seasonally saturated soils.

white-nose syndrome: a disease caused by the fungus *Geomyces destructans*, which is responsible for unprecedented mortality in cave-hibernating bats in the northeastern and central U.S and eastern Canada (Lorch et al, 2011). This previously unknown disease has spread very rapidly since its discovery in January 2007, and poses a considerable threat to cave-hibernating bats throughout North America. More than 5 million hibernating bats have died since 2007 (Froschauer, 2012).

wildfire: unplanned ignition of a wildland fire (such as a fire caused by lightning, volcanoes, unauthorized and accidental human-caused fires) and escaped prescribed fires.

wildland fire: every wildland fire is either a wildfire or a prescribed fire [FWS Manual 621 FW 1.3]. A general term describing any non-structure fire that occurs in the wildland.

wildlife-dependent recreational use: “A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.” These are the six priority public uses of the Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence.

wildlife management: manipulating wildlife populations, either directly by regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors

vision statement: A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates.

ABBREVIATIONS AND ACRONYMS

| | |
|--------------|--|
| ADA | Americans with Disabilities Act |
| ARPA | Archeological Resources Protection Act |
| BCI | Bat Conservation International |
| BSA | Boy Scouts of America |
| CAFO | Confined Animal Feeding Operation |
| CCP | Comprehensive Conservation Plan |
| CDs | Compatibility Determinations |
| DEQ | Department of Environmental Quality |
| EA | Environmental Assessment |
| EE | Environmental Education |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| ES | Ecological Services |
| FMP | Fire Management Plan |
| FONSI | Finding of No Significant Impact |
| FR | Federal Register |
| FRWC | Fossil Rim Wildlife Center |
| FWS | U.S. Fish & Wildlife Service |
| GRDA | Grand River Dam Authority |
| GS | General Schedule (pay rate schedule for certain Federal positions) |
| GSA | Girl Scouts of America |
| HMP | Habitat Management Plan |

Appendix H: Glossary

| | |
|----------------------|---|
| I&M | Inventorying & Monitoring |
| IPCC | International Panel on Climate Change |
| ITA | Indian Trust Asset |
| LCC | Landscape Conservation Cooperative |
| LE | Law Enforcement |
| MMLERC | Mary & Murray Looney Education & Research Center |
| MOU | Memorandum of Understanding (Agreements) |
| NEPA | National Environmental Policy Act |
| NGOs | Non-governmental Organizations |
| NNL | National Natural Landmark |
| NRCS | Natural Resources Conservation Service (U.S. Department of Agriculture) |
| NSS | National Speleological Society |
| NSU | Northeastern State University |
| NVCS | National Vegetation Classification System |
| NWR | National Wildlife Refuge |
| O&M | Operation & Maintenance |
| ODWC | Oklahoma Department of Wildlife Conservation |
| OPNWR | Ozark Plateau National Wildlife Refuge |
| OSU | Oklahoma State University |
| OTS | Ozark Tracker Society |
| OU | University of Oklahoma |
| PIF | Partners in Flight |
| Plan | Comprehensive Conservation Plan |
| Refuge System | National Wildlife Refuge System |
| RNA | Research Natural Area |
| RONs | Refuge Operating Needs System |
| RRP | Refuge Roads Program |
| RSU | Rogers State University |
| SAMMS | Service Asset Maintenance Management System |

| | |
|----------------|---|
| SCA | Student Conservation Association |
| SCEP | Student Career Experience Program |
| SHC | Strategic Habitat Conservation |
| Service | U.S. Fish & Wildlife Service |
| SUP | Special Use Permit |
| System | National Wildlife Refuge System |
| T&E | Threatened and Endangered Species |
| TCPP | Texas City Prairie Preserve |
| TNC | The Nature Conservancy |
| TPWD | Texas Parks and Wildlife Department |
| UA | University of Arkansas |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |
| USFWS | U.S. Fish & Wildlife Service |
| WG | Wage Grade Schedule (pay rate schedule for certain Federal positions) |
| WMA | Wildlife Management Area |
| WNS | White-nose Syndrome |

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Appendix J: List of Preparers

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Appendix K: Response to Public Comments

This appendix identifies public comments received on the Ozark Plateau National Wildlife Refuge (NWR; Refuge) Draft Comprehensive Conservation Plan (Draft CCP) and Environmental Assessment (EA) and the U.S. Fish and Wildlife Service's response to those comments.

The public was notified of the release of the Draft CCP and EA with a Notice of Availability published in the *Federal Register*, Vol. 78, No. 27, on February 8, 2013 ([FWS–R2–R–2012–N277] FR00001273), as well as mailing a postcard notifying everyone on the Refuge mailing list of the Draft CCP/EA public review process. In addition, the Refuge also advertised in various media outlets (local newspapers and local and national social media sites) and by posting fliers at local community centers. The public comment period was open for 30 days, closing on March 8, 2013. The Ozark Plateau NWR hosted three public meetings (see Table K-1) during the Draft CCP public review period to engage locals in discussions regarding Refuge management and get feedback on what was being proposed in the Draft CCP.

Table K-1. Location, Attendance, and Dates of Public Meetings during Draft CCP Public Review Period.

| Meeting Location | Attendance | Meeting Date |
|--|------------|-----------------------------|
| Delaware County Library. Jay, OK | 9 | Monday, February 25, 2013 |
| Stilwell Community Center. Stilwell, OK | 13 | Tuesday, February 26, 2013 |
| Cherokee Nation Headquarters Community Ballroom. Tahlequah, OK | 14 | Thursday, February 28, 2013 |

The Service received 64 total responses that included a combination of letters, emails, and comments submitted (orally and via comment forms) during the public meetings. All responses were analyzed using a process called content analysis. Content analysis organizes and groups comments made during the public comment period to reflect different resource issues. A number of issues were identified in the public's response to the Draft CCP/EA. Respondents were self-selected (i.e., they voluntarily provided comments); therefore their comments do not necessarily represent the sentiments of the public as a whole.

Geographic Representation

Table K-2. Geographic representation was tracked for each respondent.

| State/Native Nation | Number of Respondents |
|---------------------|-----------------------|
| Oklahoma | 30 |
| Arkansas | 11 |
| Texas | 1 |
| Washington, DC | 1 |
| Unspecified | 21 |
| Total | 64 |

Organization Affiliation

Responses were received from various organizations and unaffiliated individuals. Organization types were tracked for each comment received. Organization Types, and the number of respondents in each category, are identified in Table 2.

Table K-3. Number of Responses by Organizational Affiliation

| Organization Type | Number of Respondents |
|----------------------------------|-----------------------|
| General Public | 45 |
| Non-Governmental Organization | 5 |
| Local Government (City/County) | 1 |
| University/Education Institution | 5 |
| State Agency | 7 |
| Tribal Nation | 1 |
| Federal Agency | 0 |
| Total | 64 |

Response to Public Comments

The Service's response to public comments is displayed below under the following topics:

- Comprehensive Conservation Plan/EA – General
- Partnerships
- Land Acquisition
- Scientific Research
- Habitat Management

- Wildlife Management
- Hunting
- Environmental Education/Interpretation

Some of the Service's response to public comments did not warrant changes to the Final CCP while others did. The comment portion of this table is mostly verbatim of the comments we received. However, some may contain a clarified version of the actual comment submitted, especially if there were spelling errors, etc. All comments are on file in the Ozark Plateau National Wildlife Refuge Comprehensive Conservation Plan administrative file located in the Southwest Regional Office.

Topic: COMPREHENSIVE CONSERVATION PLAN/EA – GENERAL

Comment (ODWC): In general, the Ozark Plateau NWR CCP is a very thoughtful and well-written plan of action and it address the known conservation issues in the Oklahoma Ozarks and articulates the needs of the Refuge very well. It contains an impressive level of detail with respect to the Ozark Region's geology, biological communities, hydrology, invasive species issues and economic setting...

We also appreciate your incorporation of information from Oklahoma Comprehensive Wildlife Conservation Strategy (CWCS) into multiple sections of the CPP including Section 1.3.3, Section 3.3 regarding the biological environment of the refuge, and Appendix C. We believe that the Oklahoma CWCS contains a complete summary of the conservation issues affecting the Ozark region and identifies the species that are in greatest need of conservation action in association with the habitats upon which they depend. It appears that the Refuge's CCP and the Oklahoma CWCS have identified many of the same conservation issues and have recommended many of the same conservation strategies to address these.

Response: We appreciate the State of Oklahoma's ODWC for taking the time to review our Draft Comprehensive Conservation Plan and provide thorough comments to us. We are glad to hear that ODWC supports what Ozark Plateau NWR outlines in its CCP – especially to address our State's common conservation issues at the landscape-level. We would also like to mention that the Oklahoma Comprehensive Wildlife Conservation Strategy was a great resource for us in the development of this CCP. Thank you.

Comment (ODWC): Section 3.4.1 Population (page 3-37): The caption under the photo should read Bentonville AR instead of Bentonville AK.

Response: Thank you for your attention to this detail. We have made the appropriate change, as suggested.

Appendix K: Response to Public Comments

| |
|--|
| Comment: Many thanks for the opportunity to comment on the OPNWR Draft Comprehensive Conservation Plan. I fully support Alternative B, the Proposed Future Management of OPNWR. |
| Comment: I'm genuinely heartened by all past and proposed work. I support partnerships, increasing land acquisition, education and outreach, increased science and monitoring, and habitat management (including prescribed fires) fully. Allowing hunting makes good PR sense. I also appreciated the opportunity tonight [at the Tahlequah public meeting] to learn more about the OPNWR's work and the history of white-nose syndrome. |
| Comment: My input is that this is a very good idea. All life deserves to live! My only input is to conserve and keep conserving! I love it, thank you so much you guys! |
| Comment: I am pleased to see the amount of focus on education and involvement of our youth. I feel that this CCP encompasses the best possible scenarios possible with both public involvement and preservation of our natural resources. |
| Comment: Thank you for your commitment to preserve and protect the bats and associated terrestrial/aquatic environments in the Ozark Plateau. Your approach is right on! It's a worthwhile undertaking! Future generations will benefit... Again thank you... |
| Comment: Did cave gate welding the past 30 years, one or two caves a year. These guys (refuge managers) are doing a good job and the funding needs to be continued for their work in the Ozark areas. |
| Comment: I am with The Nature Conservancy. We have been partnering with the Refuge for a long time to protect caves and bats. We have also been through a planning process for a long time and we have come to the same conclusions! To address our conservation issues, we need: to form partnerships; make decisions based on good science; perform public outreach and education – and work with private landowners. I agree with everything the Refuge proposes. You are on the right track... Mostly for habitats in Oklahoma beyond TNC boundaries. |
| Response: Thank you all for taking the time to comment. We truly appreciate your support. |

| |
|--|
| Comment: ...An EA is a cheap unsubstantial way to environmentally evaluate an area and an EIS should be completed per NEPA... Please remember that the refuge is paid for by 325 million people all over this nation and is not simply a local site for locals people. It belongs to the entire nation. We need to watch our wildlife since bats are sick, moose are sick, deer are sick, rabies is rampant. It is clear that living outdoors is becoming more and more unhealthy for wildlife in America... They are given tax exemption for that reason - to give back to all of us... This comment is for the public record. |
| Response: Thank you for taking the time to share your thoughts and comments. An Environmental Assessment (EA) was performed for the implementation of the Ozark Plateau NWR Comprehensive Conservation Plan in order to determine if the actions outlined would have significant impacts. As described throughout Chapter 4 of the EA, no significant impacts were identified as a result of either of the alternatives. Therefore, an Environmental Impact Statement (EIS) is not required, as per the National Environmental Policy Act. Please see |

<http://www.fws.gov/habitatconservation/nepa.pdf> for more information.

Comment: On page 3-13, 2nd paragraph, change 1977 to 1972 regarding the enactment of the Clean Water Act.

Response: Thank you for your attention to this detail. We have referenced the Clean Water Act of 1977 because this includes major amendments to the Federal Water Pollution Control Act of 1972. The 1977 Act bolstered the Environmental Protection Agency's authority to eliminate toxic pollutants by: (1) requiring industry to meet best available technology standards for specified toxic pollutants by July 1, 1984, and (2) mandating compliance with best available technology standards for newly listed toxins within three years. Three new categories of pollutants were created under this law: conventional, non-conventional, and toxic pollutants.

Topic: PARTNERSHIPS

Comment: Continue and improve the relationship between Cherokee Nation and USFWS as a whole. Cherokee Nation and USFWS employees already work well with each other, but need to improve the government to government relationship. The Ozark Plateau NWR employees are doing a great job.

Response: Thank you for sharing your insight and comments with us. We are sympathetic to your concerns. The U.S. Fish and Wildlife Service is working to improve the government to government relationship and communication with its fellow Tribal Nations, including the Cherokee Nation.

As outlined throughout the Final CCP, Ozark Plateau NWR plans to continue working with the Cherokee Nation as well as other Tribal Nation neighbors to address common conservation issues at the larger landscape-level and with respect to Native American Nations. As described in Chapter 4, Goal 1, Objective 1 of the Final CCP, “continuously building relationships with a variety of landscape-level stakeholders remains to be essential in order for the Refuge to acquire and conserve lands and conservation easements from willing sellers, monitor and research, protect and restore habitat, share information about resources, conduct environmental education, and reduce Ozark habitat loss and fragmentation”. We will not be able to accomplish our CCP’s objectives if we do not work with our Tribal Nations.

Comment: I am the 2013 chairman of the Tulsa Regional OK Grotto, (TROG). My group represents the NE Oklahoma chapter of the National Speleological Society (NSS). Our organization has been partnered with the Ozarks Plateau National Wildlife Refuge in Eastern and Northeastern Oklahoma for many years. In Response to the mail correspondence I received outlining the planning options for the future of this refuge, I would like to take this opportunity to express our groups utmost gratitude, and admiration for the OPNWR, it's resources, it's staff,

and the steps taken by many over the years to preserve and keep it for the enjoyment of future generations.

This refuge is the fruit of the combined efforts of several cave management agencies in our state, who have come together for a common goal. To preserve and protect the fragile cave ecosystems of the OPNWR, and the fascinating wildlife within. To preserve high quality forest habitat above ground, and water resources both above and below ground. Together, we help each other by providing resources in our own area of expertise. And our efforts are paying off tremendously. This congruency of ideas, has inspired, and continues to inspire improvements to refuge preservation activities along with educational opportunities for volunteers such as our group, and the general public. Perhaps most of all... the refuge provides an outstanding opportunity for a connection with the pristine beauty of nature for anyone with a passion for the outdoors.

It is our hope, that during this time of financial distress, that our nation's great natural resources such as this refuge and other like it continue to receive much needed funding, equipment, staff, and other resources to continue doing the outstanding job that they do. Let's continue something that our great grandchildren will thank us for. After all, the land is certain outlive each of us. May we be good stewards of it while we are here, and leave it in as good if not better shape than we found it.

Thank you for this opportunity to express our gratitude and great appreciation for the OPNWR and all of those who continue to make a dream of many into reality.

Response: Thank you. We could not have accomplished many of our cave protection and monitoring projects without your numerous volunteer hours. We appreciate your support and look forward to continue working together in the future to achieve our common conservation goals.

Comment: Make sure that any alleged "partners" such as non-profits that come knocking at your door are not there to get on the government payroll and be paid by taxes. Such groups need to exist on donations, not stick their hands into the taxpayers wallets. Unfortunately, they have turned into lobbyists for taxpayers cash from government agencies...

Response: Thank you for sharing your concerns. We are very attentive to funding sources and allocation when operating the Refuge, including when working with non-governmental organization partners. We do and will continue to abide by all laws and regulations regarding how federal dollars are spent.

Topic: LAND ACQUISITION

Comment (ODWC): Section 4.1.3 (pages 4-8 and 4-9): It is not clear whether this Refuge objective is the expansion of the refuge’s approved acquisition boundary or the expansion of its authorized acquisition acreage. This should be more carefully explained. If the goal is to increase the acreage authorized for acquisition, then other justifications could be cited that include the need to conserve habitat within the recharge areas of refuge caves, the need to conserve forested foraging habitat for the endangered bats inhabiting refuge caves and a desire to maintain buffers of undeveloped land surrounding refuge units.

Response: Thank you for your comment. We agree that this objective needed some clarification. We have modified the title and objective itself to read,

“4.1.3 Objective 3: Acquire Lands within Approved Acquisition Area.”

“Within the length of this CCP, take a Strategic Habitat Conservation approach to prioritize land acquisition within the approved acquisition boundary of up to a total of 15,000 acres of Refuge land utilizing fee title acquisition, conservation easements and/or agreements from willing sellers with private landowners, conservation organizations, state agencies, Tribal Nations, and other federal agencies to address Ozark habitat loss, fragmentation and to accomplish the Refuge goals at a landscape-level.”

Therefore, this objective focuses on acquire lands within our already approved acquisition boundary and acreage limitation of 15,000 acres within the length of this CCP. We have also modified the final strategy of this objective to read, “Once 15,000-acre limit has been acquired within the approved acquisition area, explore the feasibility and need to expand into other areas and/or to acquire additional acreage (a Land Protection Plan would need to be developed)”.

Comment: My husband and I attended the meeting at Tahlequah, OK, Thursday, February 28, concerning the Ozark Plateau NWR. Thank you for the work you have already began. We are for protecting and managing the area, with the ownership of the land remaining in private hands. We are not for our government buying more land. I believe we have enough land closed to the public. We liked the lease agreement for protection of the bats with private landowners. Thank you for accepting our comments.

Response: Thank you for sharing your comments with us. We have been approved, since 2005, to expand Ozark Plateau NWR to up to 15,000 acres total within northeastern Oklahoma. Working with private landowners via conservation easements and/or agreements (where the ownership remains in private hands) is a key strategy to help us accomplish our conservation objectives. These conservation easements and/or agreements with private landowners will be used to help us achieve our goal of acquiring up to 15,000 acres. In addition, when fee title is utilized, portions of these Refuge lands will be open to the public for educational and recreational purposes, including scientific research, environmental education, interpretation, wildlife photography/observation, and hunting.

Comment: I'm interested in learning more about conservation easements and the Healthy Forest Reserve Program.

Response: The Healthy Forest Reserve Program is administered by the Natural Resource Conservation Service (NRCS). For more information about HFRP, please contact your local U.S. Department of Agriculture - NRCS Service Center or visit: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/ok/programs/easements/forests/>. The purpose of the HFRP is to assist landowners, on a voluntary basis, in restoring, enhancing and protecting forestland resources on private lands through conservation easements, 30-year contracts and 10-year cost-share agreements. The program is being offered in five counties in northeastern Oklahoma: Adair, Cherokee, Delaware, Sequoyah, and Ottawa counties. The federally-listed species that are being targeted for habitat and population recovery activities include the gray bat, the Ozark big-eared bat, and the Ozark cavefish.

Topic: HABITAT MANAGEMENT

Comment (ODWC): Section 4.2.1 (page 4-19): This Section describes some of the forest land conditions in the Ozark Region. In the fourth sentence of the first paragraph in the Rationale section, it states that the region has an abundance of uneven age stands. In actuality, the Ozarks Region is comprised of many even-aged forest stands as a result of historic commercial logging. Uneven-aged forest stands typically support greater wildlife diversity and abundance because they have a more diverse canopy structure and a greater abundance of understory vegetation.

Response: We agree that the Ozarks Region currently is comprised of many even-aged forest stands due to factors such as historic commercial logging. This paragraph has been modified to more accurately describe current and desired forest land conditions in the Ozarks region. Please see modified objective and rationale below (changes highlighted in italics):

4.2.1 Objective 1: Protect, Enhance, and/or Restore Forested Habitat.

Over the lifetime of this CCP, protect, enhance, and/or restore approximately 4,038 acres (and up to 15,000 acres of approved acquired land) of upland and riparian forested habitat to conditions believed to exist prior to European settlement on- and off- Refuge in order to improve the overall health of the forest ecosystem, enhance opportunities for foraging, provide movement corridors, and offer watershed protection for the benefit of migratory birds, bats, and other cave species. *Desired forest conditions include a moderately-stocked, healthy forest that is able to naturally regenerate, with a well-developed understory dominated by native grasses and forbs, with a small shrub and woody component.*

Rationale: Early descriptions of the Ozark region of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants (Heikens, 1999). *However, since European settlement, suppression*

of the natural fire regime has led to overcrowded forest conditions. In addition, many fragments of forest were cut for commercial logging. As a result, today's remaining forest areas mostly consist of exceedingly high densities of even-aged stands with an excessive fuel load and a lack of well-developed understory. Current conditions not only lead to unnatural and uncontrollable wildfires, but they are also not ideal for native vegetation and wildlife to thrive as they once had. Forest habitat restoration measures (such as prescribed fire, thinning, native planting, etc.) that mimic the historic fire regime and maintain a natural mosaic of plant communities representative of the ecosystem will reduce the risk of unplanned, high-intensity wildfires while also supporting a greater diversity of native flora and fauna.

Comment: We own private lands adjacent to the Refuge. We are concerned that you will regulate our pesticide use on our private property.

Response: Thank you for your comment. The Ozark Plateau NWR does not have regulatory authority over the use of pesticides on private lands. However, all pesticide use should be conducted in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136 et seq), and all label instructions and requirements. The Federal Insecticide, Fungicide, and Rodenticide Act requires that the Environmental Protection Agency (EPA) evaluate pesticides before they can be sold and used in the United States. The EPA's Office of Pesticide Programs is responsible for ensuring that a pesticide will not pose unreasonable adverse effects to human health and the environment. In addition, the EPA must ensure that use of pesticides it registers will not result in harm to species listed as endangered or threatened under the federal Endangered Species Act of 1973, as amended. To prevent and minimize the impacts of pesticides on fish, wildlife, and plants, the Service provides technical assistance and consults with the EPA during the registration and reregistration of pesticides. If pesticide use in a certain geographic area may affect a federally listed species, EPA may place limitations on its use.

Comment: I really would like to see this land managed with burning and to have the boundaries marked. This would allow law enforcement to patrol this area, allowing more management of the wildlife and resources.

Response: Thank you for your comments and support. As outlined throughout Chapter 4 of the Final CCP, we do plan to enhance habitat with prescribed burns (see Goal 2, Objective 1: Protect, Enhance, and/or Restore Forested Habitat), survey and mark Refuge boundaries (see Goal 3, Objective 9: Survey and Mark Refuge Boundaries) and increase law enforcement to patrol and monitor Refuge Units (see Chapter 5, Table 5-2 [0.3 FTE Law Enforcement Officer]).

Comment: I am interested in coordinating with the FWS on a controlled burn on my property.

Response: Ozark Plateau NWR can assist private landowners in managing their properties adjacent to the Refuge with prescribed fire for the benefit of fish and wildlife resources. For more information, contact the Refuge at (918) 326-0156; 16602 County Road 465, Colcord, OK 74338; or email shea_hammond@fws.gov or richard_stark@fws.gov. In addition, the Service's

Partners for Fish and Wildlife Program provides technical and financial assistance for restoration and enhancement of fish and wildlife habitat on private lands, in partnership with other state and federal agencies and non-governmental organizations. For more information, please visit: <http://www.fws.gov/southwest/es/oklahoma/pwp.htm>.

Comment: Prescribed burns kill fellow American citizens. You release both mercury and fine particulate matter when you burn. You pollute the air but can't see it because it is microscopic. You cause lung cancer, heart attacks, strokes, pneumonia, allergies and asthma a horrible health consequence of vegetation burning. That dirty air goes eastward poisoning along the way. Stop it now. We need clean air.

Response: Thank you for sharing your concerns about the use of prescribed fire as a management tool. Early descriptions of the Ozark regions of Oklahoma described the presence of grass-covered savannahs and open woodlands with an abundant understory of grasses, wildflowers, and other herbaceous plants – all of which cyclical fires played a major role in creating (Heikens, 1999). Since settlement, however, suppression of the natural fire regime has resulted in overcrowded forest conditions. Restoring habitat (including use of prescribed fire) on and surrounding the Refuge to conditions that promote a more open, and regenerating, mature forest condition (e.g., basal area of 50-60) is anticipated to provide an enhanced foraging environment and abundant food source for the federally listed Ozark big-eared bat, and protect important flight corridors for gray bats. Mimicking the natural fire regime would benefit these species as well as migratory interior forest nesting birds.

As described in Chapter 4 of the Environmental Assessment (Appendix A), prescribed fire would have minor adverse impacts that are short-term in duration at the local scale due to smoke from burning vegetation. Prescribed fires could produce smoke that could drift into residential communities and cause breathing and eye irritation and inconvenience during times of unpredicted inversions. There are also short-term adverse impacts on visibility, which is in conflict with the Class 1 Airshed designation. However, carefully planned prescribed fire gives refuge managers the flexibility and increased control to burn under the right conditions, more effectively managing fire effects and smoke to benefit natural resources while keeping firefighters and the public safe. These actions help reduce the risk of devastating wildfires that can threaten people, fish, wildlife and plants.

The benefits of using prescribed fire as a management tool far outweigh these minor adverse effects described above. The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) study suggests that prescribed burning could reduce CO₂ and other emissions from fires in dry forest types by 52-68%. This equates to overall fire emission reduction in the western U.S. of 18-25%, and as much as 35% at the state level (<http://www.forestthreats.org/>). In addition, the Refuge proposes to acquire and restore up to 15,000 acres of, at minimum, 80% mature oak-hickory forest which would ultimately benefit air

quality because the trees would:

- Help to settle out, trap and hold particle pollutants (dust, ash, pollen and smoke) that can damage human lungs.
- Absorb CO₂ and other dangerous gasses and, in turn, replenish the atmosphere with oxygen.
- Produce enough oxygen for people and wildlife to breathe.
- Absorb enough CO₂ on each acre, over a year's time, to equal the amount one produces driving a standard car over 20,000 miles. Trees remove gaseous pollutants by absorbing them through the pores in the leaf surface. Particulates are trapped and filtered by leaves, stems and twigs, and washed to the ground by rainfall (www.dnr.state.md.us).

Comment: Taxpayers say no new roads.

Response: Thank you for providing your comment. The Refuge agrees that it would rather refrain from developing any new roads. The Refuge prides itself on maintaining its units as natural as possible, with very limited access. However, there is a possibility that the Refuge will acquire a new tract of land that may require access to an important site(s) by Refuge staff or the public. Therefore, as outlined in Chapter 4 of the Final CCP, we plan to “keep construction to a minimum of any new roads or infrastructure on all Refuge Units, unless necessary”.

Comment: We support you prohibiting 4-wheeling on Refuge lands.

Response: Thank you for your support.

Topic: WILDLIFE MANAGEMENT

Comment (ODWC): Section 4.1.2 (page 4-6): This Section lists the existing recovery plans and their completion dates for all federally listed species. It lists the Ozark Cavefish Recovery Plan date as 2010; however we believe that the first edition of this recovery plan was printed in 1986 and has not been updated since that time.

Response: The Ozark Cavefish Recovery Plan was finalized on January 1986 and revised on November 19, 1989 (U. S. Fish and Wildlife Service. 1989. Ozark Cavefish Recovery Plan. U. S. Fish and Wildlife Service. Atlanta, Georgia. 15 pp.). You may download this revision here: <http://www.fws.gov/southwest/es/Documents/R2ES/OzarkCavefish.pdf>

Comment (ODWC): Section 4.2.10 (page 4-41): The last sentence within the rationale section describes cavefish and cave crayfish as “precious” aquatic species. This is probably not the best word to use in this situation and we recommend an alternate adjective such as “unique” or “rare.”

Response: Thank you for your suggestion. We have omitted an adjective altogether (“precious”).

Comment (ODWC): Appendix C: There have been two recent taxonomic changes since the Refuge conducted its initial herpetofaunal surveys:

The Oklahoma Salamander (*Eurycea tynerensis*) and the Gray-bellied Salamander (*Eurycea multiplicata griseogaster*) are not considered to be the same species which goes by the name Oklahoma Salamander (*Eurycea tynerensis*) because that taxon was described first. The Oklahoma Salamander is a variable species in terms of the physical size of animals in different populations and the life history traits of different populations. Some populations are paedomorphic and consist of individuals that remain aquatic as both juveniles and as adults. Other populations are comprised of metamorphic individuals that have an aquatic juvenile stage and a terrestrial adult stage. The name Oklahoma Salamander was former used to describe paedomorphic populations of the salamander while the name Gray-bellied Salamander was used to describe metamorphic populations.

The Grotto Salamander (*Typhlotriton spelaeus*) has been assigned to the genus *Eurycea* and is now *Eurycea spelaeus*. Since the initial herpetofaunal surveys on the Refuge, believe that the Grotto Salamander has been documented in January-Stansberry Cave on the Looney Unit of the Refuge.

Response: Thank you for so carefully reviewing our species list survey. We have updated the Appendix C, Table C-1: Salamanders section to reflect these recent taxonomic changes.

Comment: Leave feral cats alone since you cannot tell the difference between an owned cat and a feral cat. And they have a right to live.

Response: Thank you for your comment. The Refuge acknowledges that this may be a common concern, especially among cat owners. The Refuge has no intention of interfering with domestic cats. Feral cats (a descendent of a domesticated cat that has become a wild cat), however, are currently found on most Refuge units and management recognizes that they may be a threat to the bat and migratory bird species the Refuge was established to protect and recover. Therefore, the Refuge plans to work with landowners, NGOs, cities, universities, states, Tribal Nations, and federal agencies to identify (survey), document, and monitor all non-native wildlife species occurring on and near the Refuge including feral cats, while also assessing their impacts on native wildlife, before taking any action. If these studies demonstrate that feral cats indeed cause a great negative impact to native species, such as T&E and non-T&E bats and migratory birds, the Refuge may develop and implement population control strategies (within an Integrated Pest Management Plan) in order to meet Refuge objectives. See page 4-40, Goal 2, Objective 10 for more information.

Comment: The draft documents suggest that the Service and Refuge employees may have to manage invasive fauna (feral hogs and feral cats) in the near future. Safari Club International recommends that, when the time comes, the Service partner with local hunters to manage feral

hogs through hunting. Experienced hunters have proven to be a valuable resource for wildlife population control and should be used in Ozark Plateau NWR as well.

Response: Thank you for your recommendation. If and when our invasive fauna species studies show the need for population control, we will consider providing local hunters with the opportunity of managing these species, according to the Refuge's hunt plan.

Topic: SCIENTIFIC RESEARCH

Comment (ODWC): Section 4.1.4 (page 4-11 and 4-46): We recommend that the USFWS investigate potential collaboration with the Oklahoma Mesonet program to develop one or more permanent weather stations on or near the Refuge if they are interested in additional monitoring sites in this region. Additionally, the word "herpatofauna" should be replaced with "herpetofauna" in the fifth strategy listed in this Section.

Response: Thank you for your suggestion. We will look into this potential partnership. We have also edited "herpetofauna", as per your comment.

Comment: I wanted to take a minute and comment on the importance of the Ozark Plateau NWR. I have been using these tracts of land in my research of subterranean species (biology, ecology, and conservation) for an excess of 12 years. In particular, I have spent much time at the Looney Unit and working in January-Stansberry Cave. During many bioinventory efforts in the region with which I have been involved, I have used the cabin on the Looney Unit as a base from which to work. The facility is ideally positioned and provides critically important resources to aid in cave research. In particular, when we have a group of cave biologists that converge from several corners of the United States to work in the western Ozarks, the cabin accommodates all of us and gives us a place to sort specimens, take measurements, etc. The cave on the property has been a place of considerable scientific study, including all of my Masters work. Several scientific publications have resulted as well as inclusion of said data in *The Cave Life of Oklahoma and Arkansas*, which two collaborators and myself published through the University of Oklahoma Press. Should you require a list of publications that have resulted from these efforts, I can provide one.

The personnel at the Ozark Plateau NWR have been fantastic in assisting our academic work. Before he retired, Steve Hensley assisted with many of our projects and has been instrumental in a number of our publications. Shea Hammond has been helpful in the same ways. In particular, a study of a blind cave silverfish has advanced owing to his assistance. Richard Stark has been of considerable assistance in cave crayfish counts, in accessing particular localities, and with other research. I simply can not say enough positive things with regard to the dedication by these individuals to the conservation of subterranean ecosystems and species across the years.

I hope that the Ozark Plateau NWR continues to support research in subterranean systems and threatened subterranean species. The NWR has been critically important in this field across the past 15 plus years. The western Ozarks is a hotspot for subterranean biodiversity and the Ozark Plateau NWR, in particular the Looney Unit and its personnel, have supported the study of the subject. The number of publications that have resulted from this support, and the upcoming publications, represent a considerable advancement in our knowledge base for the regional subterranean biodiversity, including a number of threatened and endangered species. Please continue to support these valuable resources.

Response: Thank you for sharing your experience and support. We are very grateful for your bioinventory and other scientific research contributions to us and to the whole scientific community. As proposed throughout Chapter 4 of the Final CCP, we will continue protecting and conserving the natural resources of the Ozark Plateau, especially to advance scientific knowledge regarding subterranean ecosystems and biodiversity. Throughout Chapter 4 of the Final CCP, we plan to accomplish the following objectives related to scientific research of cave habitats and species within the next 15 years:

- Goal 2, Objective 3: Provide Undisturbed, Safe, and Protected Cave Habitat;
- Goal 2, Objective 4: Locate Additional Caves;
- Goal 2, Objective 5: Delineate Recharge Area of Cavefish and Crayfish Caves;
- Goal 2, Objective 6: Inventory & Monitor to Advance Scientific Knowledge Regarding Federally Listed Cave Species and Species of Concern; and
- Goal 2, Objective 7: Inventory & Monitor to Advance Scientific Knowledge Regarding Migratory and Resident Non-T&E Species, among others.

We look forward to continue working with the scientific community in the future on these efforts.

Comment: In recent years I have been able to use the OPNWR in a couple of different ways, for some of my professional research through my university job, and through the environmental education opportunities offered at the refuge. In my job as a researcher/teacher at the Oklahoma Museum of Natural History of the University of Oklahoma, a few years ago I was granted a permit for paleontological work studying ice-age vertebrate fossils. The permit allowed recovery of Pleistocene fossils in one of the OPNWR caves. These fossils are currently under study by a graduate student and myself. My fossil research at other caves in the Ozarks was suspended when white-nose syndrome became a potential problem in Ozark caves and I became concerned for the survival of the bats, but the identification of fossils and lab analysis phase of this particular project continues at the museum. This kind of study might provide some time depth to inform the conservation and adaptive management of living species as climate changes. In the meanwhile, given the potential lethality of white-nose syndrome to the refuge's bats, I support continued monitoring and protection of the OPNWR caves from unnecessary human disturbance and potential transmittal of the disease-causing fungus...

Response: Thank you for sharing your experience and comments. We appreciate your fossil research contributions to the scientific advancement of understanding the Ozark Plateau’s natural history and ecology.

We also appreciate your understanding and support for our closed-caves policy in light of the dire threat of white-nose syndrome to Ozark cave species and ecosystems. White-nose syndrome is an extremely important issue for us and we are doing all that we can to prevent it from occurring and/or spreading to Refuge and surrounding caves.

Comment: ...Similarly for the sake of other native wildlife and plants, including other cave species, I also strongly encourage you to do all possible to protect surface and groundwater quality in the area, and to protect the land from ever-increasing human impacts that cause habitat loss or fragmentation.

Response: Thank you for sharing your concern. We too, are concerned with protecting surface- and groundwater quality and mitigating habitat loss and fragmentation. As discussed in Chapter 4 of the Final CCP, one of our objectives is: “Over the lifetime of this CCP, through outreach efforts, stronger partnerships and implementation of watershed and groundwater recharge area management practices, protect, enhance, and/or restore surface and subterranean aquatic habitats, on- and off-Refuge, used by federally listed cavefish, and species of concern cave crayfish, and other aquatic species in order to achieve sustainable population trends of these species”. We also propose to address human impacts that cause habitat loss and fragmentation by using “[Strategic Habitat Conservation] planning to establish wildlife corridors to connect tracts of forests, springs, gravel bottom streams, rivers, wetlands, etc. with other habitat types such as caves or other protected lands (National forests, State wildlife management areas, tribal lands, etc.) through land acquisition and entering into conservation easements and/or agreements with willing sellers”, among many other partnership strategies described throughout Chapter 4.

Topic: HUNTING

Comment (ODWC): I also would like to take this opportunity to express my appreciation to the Service and to the staff of the Refuges Division for your interest and past cooperation with the Oklahoma Department of Wildlife Conservation to increase hunting opportunities on national wildlife refuges within the state. We have discussed our desire to see walk-in hunting access on the Sally Bull Hollow Unit with the Ozark Plateau NWR staff and we would like to reiterate that here. We were very encouraged to see that our interest in opening the Sally Bull Hollow unit for walk-in hunting was cited several times within the CCP. The Oklahoma Department of Wildlife Conservation owns fee title to a 98-acre tract in the SW/4 of Section 26, T15N, R26E, which is land-locked within the Sally Bull Hollow Unit. We have a strong interest in providing access to the ODWC-owned tract, as well as the Sally Bull Hollow Unit of the Refuge as a whole, to the

Appendix K: Response to Public Comments

sportsmen and women of Oklahoma. At the present time, our constituents cannot access the ODWC property because of the Refuge's current management plan. But, we know from constituent contacts within the community and from our visitors to the adjacent Ozark Plateau WMA that there is a substantial interest in having walk-in access to the area to provide hunting opportunities. We understand that the Service's compatibility analysis for hunting activities determined that hunting is a compatible use on the Refuge, with some stipulations. We understand that this will require the development of a hunting plan for the area, a completed survey of the Unit's boundaries and signage. We appreciate your preparation of Section 4.3.6, Objective 6: "Collaborate with ODWC to Provide Hunting Opportunities" in the Refuge's CCP (pages 4-53 through 4-54). We strongly support this objective and are eager to work with you on its implementation.

Response: We appreciate your support and look forward to working with the ODWC on the development of this hunt plan at the Sally Bull Hollow Unit of the Refuge.

Comment: Protecting the water is very important. For that reason, no hunting with lead shot should be allowed anywhere within this national refuge. Do not allow any baiting of any wildlife in this site and ban all hunting... No trapping should be allowed, this site is for protection of wildlife, not facilitating their death... The other more peaceful activities are not at all "compatible" with allowing a ton of wacko wildlife murderers in this site, which is called a "refuge".

Response: Hunting is identified by the 1997 Refuge System Improvement Act as a priority wildlife-dependent recreational use of national wildlife refuges and is needed as a management tool for some Refuge wildlife populations such as deer. Through the development of a compatibility determination (see Appendix B), we have determined that these programs are determined to be compatible with the establishment purposes of the Refuge and the mission of the National Wildlife Refuge System. The awareness, enjoyment and education gained from these activities are expected to outweigh their associated impacts. Ozark Plateau National Wildlife Refuge has determined that hunting, in accordance with the stipulations provided above, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the Refuge. Instead, providing opportunities for hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving habitat, thereby further contributing to the overall mission of the National Wildlife Refuge System. In addition, all hunting on the Refuge would abide by existing non-toxic shot regulations (for more information, see <http://www.fws.gov/migratorybirds/CurrentBirdIssues/nontoxic.htm>).

Comment: As District 2 Wildlife Commissioner for the ODWC and portions of the Refuge being in my District, I very much support the opening of the Sally Bull Hollow Unit of the Refuge to Hunting. As time passes, it becomes increasingly difficult for our sportsmen to locate properties on which to hunt. Many of the privately owned properties in this day and time are

leased for hunting, so it becomes very difficult for our sportsmen to find properties to hunt. This is especially difficult for our younger sportsmen, as many of them do not have the wherewithal to pay any type of lease price for hunting. The Sport of Hunting is rich in tradition in the State of Oklahoma. We are but one of a handful of states throughout this Nation that continues to attract our citizenry to the Sport of Hunting. Our Department continues to purchase properties for our sportsmen as our funding becomes available.

As a representative of the sportsmen in my District and our Department, I would very much appreciate your consideration to the opening of the Bull Hollow Unit for Hunting.

Comment: I and ODWC's Wildlife Division are very much in favor of the Fish and Wildlife Service opening the Sally Bull Hollow Unit to public use and hunting. This acreage, along with our 2,000 plus –acre Ozark Plateau WMA would provide the public with a great area to recreate and hunt.

Comment: I am from Oklahoma and I am in favor of opening these lands for hunting. Hunting is a tradition and way of life in Oklahoma, it is also part of our culture.

Comment: I think [you] should allow walk in hunting in the Sally Bull Hollow Unit of the refuge to help keep the population of some of the animals down. So there would be enough food for other animals.

Comment: As a hunter, I would love to see and would certainly utilize the Sally Bull [Hollow Unit] portion of the NWR if open for hunting. Several of my friends already use the ODWC portion and would also love to see Sally Bull [Hollow Unit] opened.

Comment: Safari Club International (“SCI”) appreciates the opportunity to provide our comments on the draft Comprehensive Conservation Plan (“CCP”) and Environmental Assessment (“EA”) for the Ozark Plateau National Wildlife Refuge. In particular, SCI supports the Service’s recognition of hunting as an appropriate and compatible use of the unit.

Safari Club International, a nonprofit IRC § 501(c)(4) corporation, has approximately 51,000 members worldwide, many of whom hunt on refuges throughout the National Wildlife Refuge system. SCI’s missions include the conservation of wildlife, protection of the hunter, and education of the public concerning hunting and its use as a conservation tool. SCI is an active supporter of hunting opportunities on National Wildlife Refuges. SCI participated as a Defendant-Intervenor in the almost decade-long litigation concerning the U.S. Fish and Wildlife Service’s compliance with National Environmental Policy Act requirements regarding the opening of hunting opportunities on National Wildlife Refuge system lands.

Among other reasons, SCI supports hunting in National Wildlife Refuges across the United States because it is beneficial to the refuges. The Service has recognized the value of hunting in previous planning documents for other refuges:

the cumulative effect of closing refuges to hunting may result in decline in social and financial support for wildlife conservation, as hunters have provided, through purchases of hunting licenses

and migratory bird conservation stamps, and taxes levied on purchases of hunting equipment, a steady stream of revenue to build the National Wildlife Refuge System, and to restore upland and wetland habitats on millions of acres of public and private lands across the country. (USFWS 2000). These habitat projects also benefit migratory songbirds and other wildlife. Conversely, the cumulative effect of closing refuges to hunting may result in decline in duck stamp and hunting license sales, leading to a decline in funds for conservation. The cumulative effect on closing refuges to hunting may be reduced conservation of wildlife habitats if the above revenues are not replaced by another source. (Draft Environmental Assessment for Moosehorn National Wildlife Refuge 2007).

SCI commends the Service and the Refuge personnel specifically for the efficient and comprehensive manner with which they have examined and reported the possible effects and benefits of hunting on the Refuge. The purposes for which Ozark Plateau NWR was established include (1) “to reduce the need for future listing of species of concern in the Ozarks”; and (2) “to provide important environmental educational opportunities identifying the need for protecting fish and wildlife and other karst resources of the Ozarks.” The draft CCP/EA make clear that hunting both is compatible with and actually helps the Service fulfill these purposes.

SCI appreciates that the Service and Refuge personnel will be collaborating with the Oklahoma Department of Wildlife Conservation (“ODWC”) to produce an effective Hunt Plan for the Sally Bull Hollow Unit of the Refuge. While we understand that the development of the plan may take some time, we encourage and suggest that all parties involved work to open the unit to hunting as soon as possible. We also suggest that the Service and ODWC work together to allow hunting on other areas of the Refuge as lands are acquired. Opening the Sally Bull Hollow Unit to hunting and allowing hunting on future units of the Refuge is in accord with Oklahoma’s appreciation of the rights of hunters reflected in Article 2, Section 36 of Oklahoma’s Constitution.

The draft documents correctly note that hunting can play a valuable role in managing the environment that exists within the Refuge. The planning documents aptly explain how allowing more public use opportunities, including hunting, will improve relationships with the public, local landowners, Tribal Nations, and the State. Public use opportunities will heighten awareness of the Ozark Plateau NWR’s purposes, provide support from people to benefit the lands and species in the long-term, and possibly create future conservationists for the Refuge. Compatible wildlife-dependent uses, including hunting, increase public appreciation and awareness of conservation efforts, including protection and recovery of the threatened and endangered cave species on the Refuge.

The National Wildlife Refuge System Improvement Act of 1997 defines a unifying mission for the Wildlife Refuge System, establishes the Service’s obligation to give priority to six priority wildlife-dependent recreation activities, including hunting, and identifies a formal process for determining the compatibility of the six recreation activities in each refuge. The compatibility determination for hunting does an excellent job of explaining the benefits of allowing hunting on

the Refuge. Hunting is an important wildlife management tool used to control populations of some species that may exceed the carrying capacity of their habitat or threaten the sustainability of other native wildlife species. The compatibility determination correctly notes that allowing hunting can benefit many species by controlling populations so that long-term sustainability is attainable and so that there is no over-abundance of any one species on the Refuge. It also points out that hunting is an important cultural, recreational and even spiritual experience for many people, and hunting provides opportunities to observe nature and enjoy local, natural food.

Response: Thank you all for taking the time to share your insights and show your support for our CCP's hunting objective which states, "Within 5 years of the approval of this CCP, collaborate with the Oklahoma Department of Wildlife Conservation (ODWC) to allow walk-in, open-access hunting, according to state regulations, adjacent to the state Ozark Plateau Wildlife Management Area (WMA) on the Sally Bull Hollow Unit of the Refuge". We look forward to having people like you enjoy the rich Oklahoma and Native American culture of hunting on Refuge land. As soon as we can get funding to survey and mark the boundaries of Sally Bull Hollow Unit, we will work with ODWC to develop a hunt plan and keep those on our mailing list informed of available public use opportunities.

Comment: If/when the 2000-acre block gets opened to hunting, it would be greatly beneficial to Law Enforcement if the USFWS restrictions could be enforced at the State/District Court level. Otherwise, only State laws would be enforced by State Game Wardens.

Response: USFWS restrictions can be enforced at the State/District Court level by State Game Wardens as long as the hunting regulations are added under Title 800 (http://www.wildlifedepartment.com/laws_regs.htm). We will coordinate with the ODWC in developing our hunt plan, which will include hunting regulations and details regarding law enforcement.

Comment: I am a lifetime resident of Oklahoma and a lifetime holder of an Oklahoma hunting license. I live in Claremore, OK and would greatly benefit from being able to hunt on the refuge near Vian, Ok.

Response: Thank you for taking the time to provide your comments. Ozark Plateau NWR proposes to open the Sally Bull Hollow Unit to hunting, which is approximately 95 miles from Claremore, OK. We are approved to acquire additional lands within seven counties of northeastern Oklahoma, including Sequoyah County, where Vian is located. We will assess the feasibility and necessity of opening any newly acquired Refuge Units to hunting, as they are acquired, as long as they are compatible with our purposes of establishment. Additionally, the Sequoyah National Wildlife Refuge, located in Vian, permits waterfowl and upland game hunting in designated areas, including Sandtown Bottom, Webbers Bottom, and Girty Bottom. Contact Refuge headquarters at (918) 773-5251; Route 1, Box 18-A, Vian, Oklahoma 74962; or email chad_ford@fws.gov before hunting for current hunting regulations and maps.

Topic: ENVIRONMENTAL EDUCATION/INTERPRETATION

Comment (x 5): I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge.

Comment: I am married and have 2 daughters. We started doing the Ozark Nature Connection Series. This became an important thing we did together as a family. We now take what we learned there back home to the farm. My kids have been soo motivated to continue going and to show even adults what they have learned, such as starting a primitive fire. FWS has had such a positive impact on our family, even on that little 100 acres where they hold their programs. You don't need a \$2 million visitor center to enjoy and learn. Thank you from my family to the federal government.

Comment: My family has taken advantage of the Looney programs. We have incorporated what we have learned into homeschooling and extended this knowledge and methods into our family life. I believe that these programs have actually shaped my son's identity.

Comment: I like this public interaction you are having on the Refuge. Back in the 70's and 80's you didn't tell the public where they caves were. Now, its nice that you allow and teach people about this stuff.

Comment: ... For about the last three years I have also been privileged to participate in several of the OPNWR environmental education workshops held at the MMLERC. These have included programs on deep nature connection, mentoring in nature, edible and medicinal plants, and various other outdoor and survival skills. In my opinion, these environmental education workshops provide outstanding hands-on "interactive" educational opportunities in nature in a safe, natural setting, and at low cost. They are multigenerational, completely experiential workshops that represent a very wise use of public lands and an excellent collaboration with NGOs such as the Ozark Tracker Society, tribes, and others. To me the OPNWR environmental education workshops are tax dollars extremely wisely spent. I strongly encourage you to continue partnering with the Ozark Tracker Society. If more children and adults from surrounding communities could participate in this kind of beneficial educational experiences, they would gain a much better appreciation for the natural world, the ultimate provider of every resource that we need, as well as becoming well-grounded caretakers of the earth. This ultimately would make conservation, sustainability, and caretaking of wildlife refuges and the entire landscape much more of a priority among the public. The children participating in the EE program could easily become conservation and environmental leaders in the future.

Comment: Please continue USFWS support for programs provided by the Ozark Tracker Society at the Ozark Plateau NWR. I have observed first-hand the life-changing impact of these low-cost Deep Nature Connection outreach programs, and hope these opportunities will be available in years to come for my children and grandchildren.

Comment: As an affiliate and long-time participant with Ozark Tracker Society along with

dozens of other friends and colleagues, I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. This is so vitally important in today's world of nature disconnect. I have personally seen numerous program participants immediately begin teaching and mentoring people of all ages in deep nature connection.

Comment: As an active member of Central Arkansas Taskforce 1 and Lonoke County Search and Rescue, as well as many years of experience with other SAR efforts and teams in the state, I have had the pleasure to receive multiple hours of training in both SAR related skills and nature awareness and appreciation through the Ozark Tracker Society. The combined knowledge of the members of the [OTS] is immense and immeasurable in value for a state such as Arkansas that prides itself in it's abundance of natural beauty. I sincerely hope that any and all efforts to continue funding of the [OTS] and the Ozark Plateau National Wildlife Refuge will continue.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. I feel that the programs taking place are a very good way to get people reacquainted with nature. I, for one, am very thankful for the ability to go to these programs, meet like-minded people, and get a better and deeper understanding of our natural connection. Please continue to support these programs.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. My son Alex and I have continued to learn and love these programs. Please make more like these.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. My young daughter and I recently attended an OTS course, and it was invaluable. Giving children an opportunity to immerse themselves in the natural world is a rare gift.

Comment: I am an employee of the Oklahoma Conservation Commission. I work specifically in a program called "Blue Thumb", which involves citizens in water quality monitoring and educating the public about stream and river protection. The Blue Thumb Program supports the Ozark Plateau National Wildlife Refuge and the Ozark Tracker Society in their efforts to protect wildlife and wild places.

Specifically, Blue Thumb shares an important philosophy with the Ozark Tracker Society, and with the reasoning behind creating wildlife refuges. I believe we all agree that the earth is a richer, healthier, and more wonderful place when species beyond humans can have their needs met. This requires not only educating the public about the natural world, it also requires providing experiences and guidance to help people develop a relationship with nature. I can see many ways that the Blue Thumb Program can work with both the Ozark Plateau NWR and the Ozark Tracker Society. In fact, collaboration has begun. Thank you for this opportunity.

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Please continue to provide support to the Ozark Tracker Society (OTS) for their wonderful nature programs in the Ozarks region. They help preserve our beautiful and valuable natural resources by educating people about the ecosystem. Thank you.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. Thank you for supporting Nature Connection programming in Federal reserve's.

Comment: Thanks for your past and continued support of the partnership between the Ozark Plateau NWR and the Ozark Tracker Society – especially with regard to their Deep Nature Connection Programs on the Refuge! These low-cost outreach programs meet a crucial need.

Comment: I hope the Ozark Tracker Society can continue to partner with the Fish and Wildlife Service at their wildlife refuges to offer educational programs to the public. In particular, I would like to see a foraging/wildcrafting workshop series come to the Deep Fork NWR.

Comment: Greetings from Fayetteville, Arkansas!... The Deep Nature Connection programs designed and implemented by Sarah and her associates are going far to extend environmental awareness and education on multiple levels - individual, familial, and community-wide. Their impact is already apparent and I am profoundly encouraged by their prospects for continued success and public engagement.

As an educator with commitment to human-nature connections, I wish to offer approbation and support for the ongoing partnerships between the Ozark Plateau National Wildlife Refuge, US Fish and Wildlife Service, and the Ozark Tracker Society. These, I believe, can continue to enrich the lives of many in ways that are compelling, productive, generative, and rewarding.

Comment: I am writing to show support for and would like to see continued support for The Ozark Tracker Society in it's affordable programs such as Deep nature connections on the Ozark Plateau National Wildlife Reserve as well as Support for the Reserve itself. I have attended several activities and have learned a lot that I would not have otherwise. The Tracker Society offers nature classes with skills and care that make learning fun and useful.

Comment: I attended one of the Ozark Tracker Society's nature connectedness workshops and it changed my life. I learned so much about mentoring, nature and why it is important to our lives. I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. Thank you!

Comment: Nothing is more important than our nature refuges and conservation efforts. Mentoring and educating at and about nature is imperative to our existence not to mention they are a lot of fun. I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge.

Comment: Please keep supporting Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. The Deep Nature Connection programs are extremely helpful to me in my volunteer work with school children and scouts.

Comment: My husband, two daughters (ages 12 & 9) and I have participated in several Ozark Tracker Society Deep Nature Connection weekends at the Ozark Plateau NWR. Big parts of my childhood were canoeing in the boundary waters between Minnesota & Canada and backpacking in Wyoming. We greatly appreciate that our daughters are able to have these deep nature connections without having to travel so far. Plus, I think we are learning far more than I did as a child. (I know I never laid down in a place where deer had been laying while it was still warm. My 12 year old did at Ozark Plateau NWR!) So, thank you for the OTS experiences we've had at Ozark Plateau NWR, and please continue the opportunities!

Comment: I am a strong supporter, and know many more who are as well, of the Ozark Plateau NWR and the Ozark Tracker Society. They are working together locally to provide strong nature-based education programs that are growing in popularity. The chance for the local community to experience place-based education of this high quality is invaluable.

Comment: I have been to several Nature Connection Workshops with the Ozark Tracker Society in conjunction with the FWS. Each time has been an incredibly rewarding experience. There are so many layers upon layers of lessons learned that we carry into our daily lives. I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. They are an invaluable tool to bring a renewed and greater respect and understanding of the natural world.

Comment: My children and I have so greatly benefitted from the low cost, deep nature connection programs the Ozark Plateau Wildlife Refuge and the Ozark Tracker Society have put on. Over the last several years, not only my family, but many of my patients and community have come to anticipate and enjoy the wonderful benefits of these great programs. As a psychiatrist who is very concerned with the effects of nature connection on our youth and communities, I strongly urge the continued support of these programs. Thanks so much to the U.S. Fish and Wildlife Service for such great programs!

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. I've had an opportunity to take advantage of the programming there through the OTS. It was an amazing and life changing experience. Furthermore, in my capacity as a teacher I've passed down these lessons to my students. Connecting people with nature is the best way to help people understand and therefore solve the problems facing our world today and OTS' programming at the refuge is the best nature connection programming that I've been a part of. Thank you for your consideration.

Comment: I was recently allowed to participate in a Coyote Mentoring Workshop, presented by the Ozark Track Society [and the U.S. Fish and Wildlife Service], at Lake Ft. Smith State Park. This workshop focused on "Bird Language" the premise of the weekend was to open ourselves up to the experience. Focus on taking in all that nature had to offer us. Traditionally cultures have been far more connected to the land. People spent more time outdoors hunting and growing their own food. Now days, people get their food from a store and don't recreate in the out of doors on a regular basis. In general, people have lost their connection to nature. This weekend

was all about rebuilding that connection. By listening to what goes on in the forest we can learn a lot about not only birds, animal behavior and habits, but ourselves too. The workshop was all about getting out and experiencing nature in a more primal way. Instead of marching out to a spot and sitting in the woods, wander quietly until you find just the right spot. Take notice of what you see, hear, and feel as you do so. The workshop also had us taking note of how we felt throughout the process, the more relaxed and open we were the more we could see. When we were done in the woods, we returned to the group and shared our experiences. The workshop focuses on our oneness with nature.

We did a lot of what is called “sit spots” you find a spot in the woods and you sit and take notes of what you see, hear, and feel. Friday afternoon, was our first “sit” I was a little hesitant, anxious even, the setup of the workshop was not what I have become accustomed to. As I sat in the woods there wasn’t much activity. I could hear a few birds way off in the distance, all and all, kind of a disappointing “sit”. Saturday we got to wander and sit. We took off and wandered through the woods until we found a place that suited us. We were to sit until dark. I walked until I found a bird nest up in a tree. I climbed up a hill and found a large boulder and settled in. I felt very relaxed and comfortable. I had a hawk fly in about 30 feet in front of me. There were woodpeckers working over trees around me and off in the distance a Barred Owl began to call. There was also a lot of human noise, distant repeated gunshots, cars, dogs, all muffling what I wanted to hear. I began to get frustrated. The woodpecker silenced and so did the owl. I continued to sit and calm. I could hear something climbing on a tree. I looked and I saw two gray squirrels sitting on a knot up in a tree about 40 feet in front of me. They survey the area and one comes down the tree and hops down the drainage that in to my right. I continue to watch the tree and another head pops out of a cavity on the opposite side of the tree. They continue to pop out and sit on the knot to survey the area, until all 6 of the squirrels are out of the tree. They all disperse through the forest. As I sit I begin to hear leaves rustle and at first I thought it was the squirrels, but after getting a good listen I know it is not. Four deer walk over the hill and out in front of me about 30 feet out. One doe and one yearling walk across in front of me grazing. The other doe and yearling aren’t as confident, the yearling walking right in front of me and grazes, but the doe isn’t too sure. I can hear more rustling but I can’t see the other deer. Then the first doe and yearling come back, closer this time, about 20 feet in front of me and the doe stops right in front of me and stares at me. I look right back into her eyes and she slowly walks away and they all move off down the hill. They never spooked. After the deer had walked away two of the gray squirrels climbed down from trees behind me, I didn’t want to turn and scare them to see exactly where they were, but one was very near me gnawing on something, it was quite loud and very near my head. As it was almost dark I gathered my pack and headed down the hill myself, moving slowly and quietly and taking time to listen between steps. As I was leaving I could hear the deer coming towards me once more, not running scared, just walking back my direction. It was an amazing evening.

This workshop for me was a lot of common sense sort of stuff, I have always gone out in nature to gather my thoughts and center myself. But it did show me that the way I enter nature, how I feel and move, has a huge effect on what I see and experience. I gathered a lot of ideas for programs and camps. The workshop not only showed me new activities and games, it also reminded me that the birds can tell you a lot if you listen. They have more than one call, and some are for mates, some for marking territory, and others for alarms; if you take the time to listen you will learn to recognize when something isn't right. The Coyote Mentoring Workshop was a fun and interesting journey. I learned a lot and will continue to learn more as I implement more of the activities and build stronger nature connections. I am very glad the department allowed me to participate in this workshop. I think this workshop would be beneficial to any park interpreter interested in looking at things from a different perspective.

These workshops are a great experience and very educational. The grant program that allow these workshops to be at such low costs are wonderful, and I hope they continue in the future.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. Their programs have given us a better appreciation of nature. They are well planned and carried out.

Comment: I attended the Tahlequah meeting, but wanted to formally state that I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. These programs have been invaluable to my family and friends. Their idea of deep nature connection beyond a simple hike is revolutionary, and to allow time in wild protected space is crucial. Please consider continuing to support this outstanding partnership that helps to ensure the protection of ecosystems in the midwest.

Comment: I would greatly appreciate future funding support for the Ozark Plateau NWR and the Ozark Tracker Society so that they can continue to provide low cost outreach programs in Deep Nature Connection on the refuge. The Grant money has allowed me to be able to attend and participate in these wonderful and educational programs. I would have otherwise missed the opportunity to experience such a unique learning process. So please continue the funding!!!

Comment: I hope this finds you in good health and spirits. I've attended several weekend workshops facilitated by the Ozark Tracker Society at the Ozark Plateau NWR at the Looney Center. These truly enhanced my connection with nature, and that neck of the woods in particular, and were attended by a diverse demographic of the region. I'd love to see continued support for these affordable programs that utilize the NWR so well.

Comment: Having been in education for over 30 years and having been the recipient of, participated in, and observed many Federal programs over the years, I have seen no other more significant, cost effective, and positive environmental impacting effort than that with the Ozark Tracker Society and the Deep Nature Connection programs. This refuge is a model of what Federal refuges should be: engaging, teaching and inspiring the public to care for our Earth in

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community. It is my hope that not only is this effort recognized and continued here in the Ozark Plateau, but also that it is replicated wherever possible nationwide. With great admiration for the refuge and strong support of its 15-year plan.

Comment: I would like to see continued support for the Ozark Plateau NWR and the Ozark Tracker Society in providing low-cost outreach programs in Deep Nature Connection on the refuge. I had an amazing experience attending one of the weekend programs that I wouldn't have been able to go to if it weren't low cost. I hope this can keep reaching more and more people by making it affordable and easy to participate in.

Response: Thank you for your support and sharing your personal insights regarding how our nature connection programs have impacted you. We are very moved to hear that these programs are having such a positive impact on individuals, families, and communities. As proposed in Chapter 4, Goal 3, Objective 3, we plan to continue collaborating with Ozark Tracker Society, among other partners, to increase program opportunities for environmental education. Although educational funding is a challenge for us year to year, we will also do our best to maintain these programs at a low cost. We appreciate your support and look forward to having you join us again for more programs in the future.

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Looking out from January-Stansberry Cave / Richard Stark / USFWS
Stansberry Cave Entrance / Richard Stark / USFWS
Ozark Big-eared Bats / Richard Stark / USFWS
Twin Crayfish / Steve Hensley / USFWS
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Ozark Plateau Overview / USFWS Photograph

September 2013

