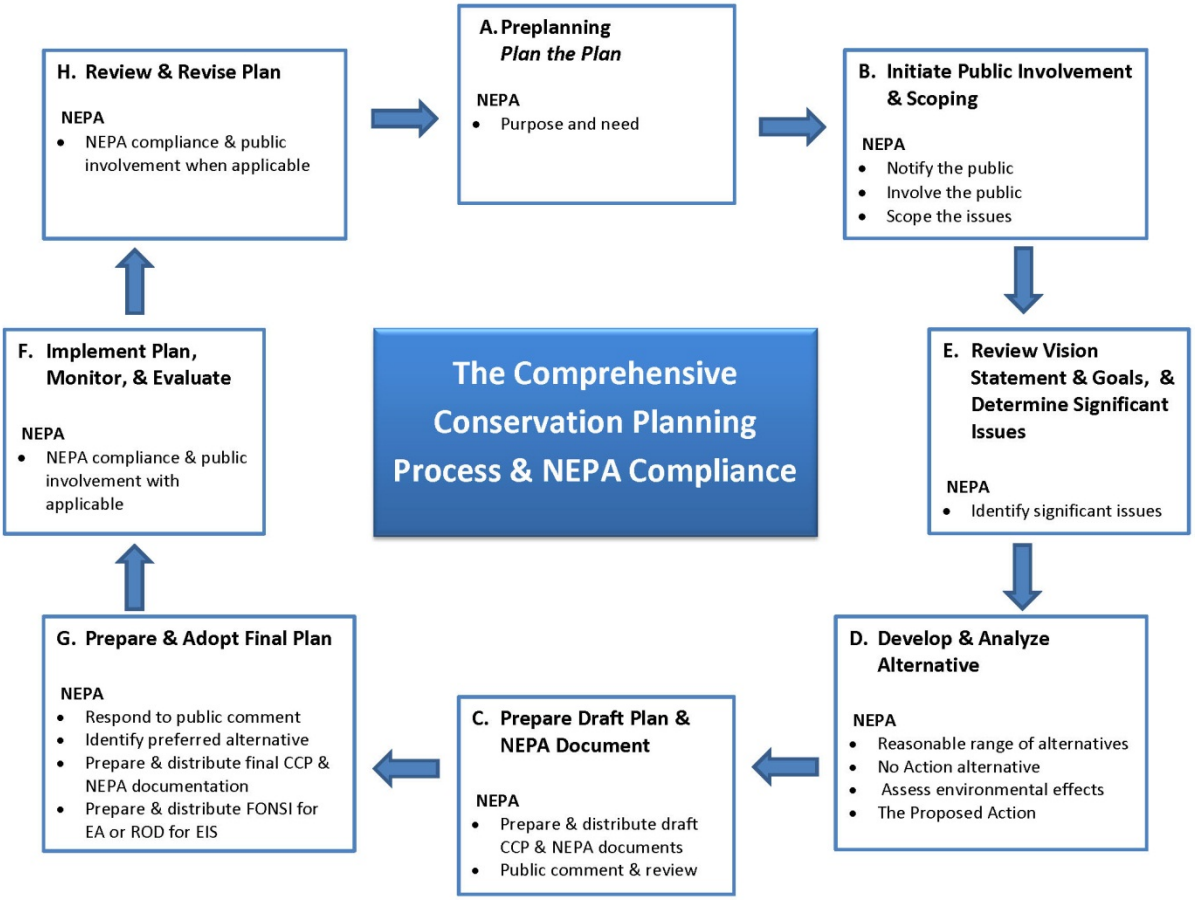
Chapter 2: The Planning Process

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
- habitat management
- wildlife management
- public use opportunities
- cultural resources
- facilities & infrastructure
- 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.

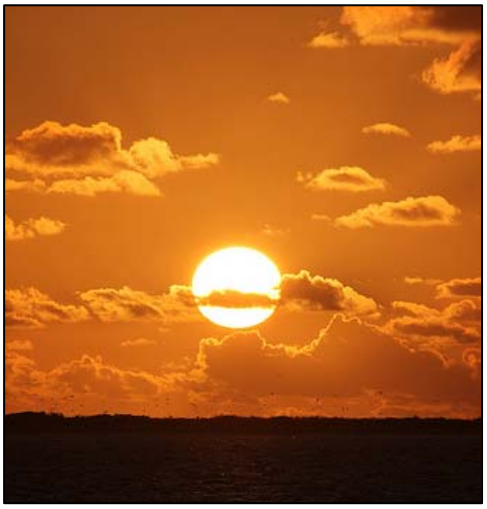
Aerial view shows three North Tulsa projects. (Credit: Tulsa City-County Library) (Photo: Austin Hellwig, 1987)

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 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.



Climate change on the horizon. (Credit: USFWS)

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)

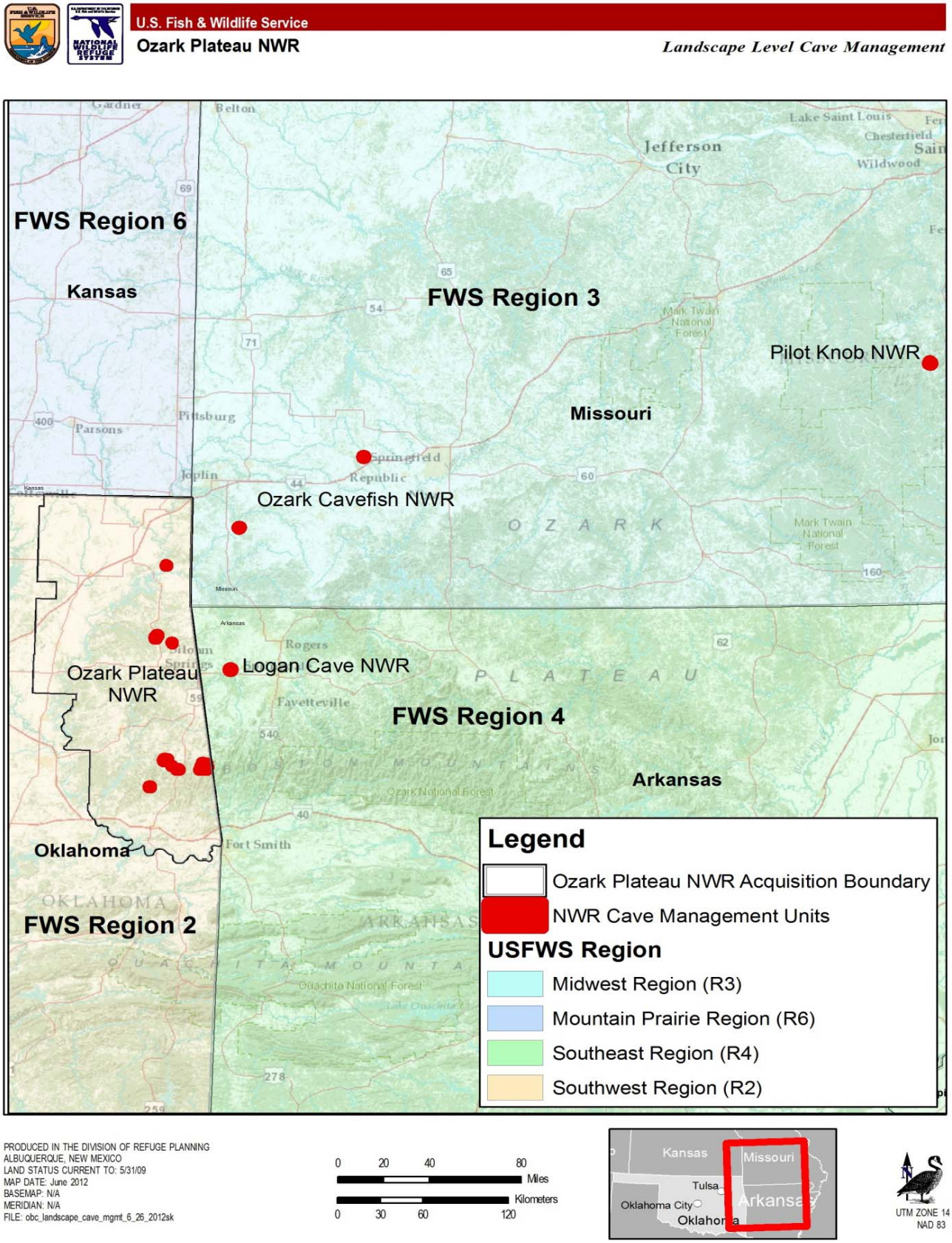
Species Cross Political and Regional Boundaries

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

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

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.

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; USWFS, 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 gat 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 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).

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

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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