

Environmental Assessment

**White-Tailed Deer, Squirrel, Rabbit, and Feral Hog Hunt Plan for
Sequoyah National Wildlife Refuge**

August 2016

DRAFT

Prepared by:

**Dustin Taylor & Chad Ford
Sequoyah National Wildlife Refuge
Vian, OK**

[Page Left Blank Intentionally]

Contents

1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION	iv
1.1 Introduction.....	1
1.2 Location	1
1.3 Background:	3
1.4 Purpose of Proposed Action:	3
1.5 Need for Action:	4
1.5 Decision to be Made:	5
1.6 Regulatory Compliance:	5
1.7 Scoping/Public Involvement and Issues Identified:.....	8
2.0 ALTERNATIVES; INCLUDING THE PROPOSED ACTION.....	9
2.1 Alternative A - No Action Alternative (Current Management).....	9
2.2 Alternative B - Open 7 new units to deer hunting and 3 new units to upland game hunting, with the incidental take of feral hogs during those seasons (Proposed Action).	10
2.3 Alternative C- Open the refuge hunt units to white-tailed deer, upland game, and feral hog hunting in accordance with State regulations (with some restrictions).	11
2.4 Alternative Considered But Dismissed From Detailed Analysis.....	12
3.0 AFFECTED ENVIRONMENT	12
3.1 Physical Environment:	13
3.1.1 Air Quality:	13
3.1.2 Water Quality:.....	13
3.1.3 Soils.....	13
3.2 Biological Environment.....	14
3.2.1 Vegetative Communities:.....	14
3.2.2 Wildlife:	15
3.2.3 Threatened and Endangered Species and Other Special Status Species:.....	19
3.3 Human Environment.....	21
3.3.1 Socioeconomic Resources:	21
3.3.2 Public Use/Recreation:.....	22
3.3.3 Cultural Resources:.....	22
4.0 ENVIRONMENTAL CONSEQUENCES	23

4.1 Effects Common to All Alternatives.....	23
4.1.1. Environmental Justice:.....	23
4.1.2. Climate Change:.....	23
4.2 Physical Environment	24
4.2.1 Impacts on Air Quality:	24
4.2.2 Impacts on Water Quality:	24
4.2.3 Impacts on Soils:.....	25
4.3 Biological Environment:.....	26
4.3.1 Impacts on Habitat:	26
4.3.2 Impacts on Wildlife:	26
4.3.4 Impacts on Threatened and Endangered Species and Special Status Species:	28
4.4 Human Environment:.....	29
4.4.1 Impacts on Socioeconomics:.....	29
4.4.2 Impacts on Visitor Services/Activities:	30
4.4.3 Cultural Resources:.....	31
4.4.4 Impacts on Public Health and Safety	32
4.4.5 Impacts on Refuge Facilities.....	32
4.4.6 Humaneness and Animal Welfare Concerns:	33
4.5 Assessment of Cumulative Impacts	33
4.3.1 Anticipated Direct and Indirect Impacts of Proposed Hunt on Wildlife Species:	34
4.3.2 Anticipated Direct and Indirect Impacts of Proposed Action on Refuge Programs, Facilities, and Cultural Resources:	37
4.3.3 Anticipated Impacts of Proposed Hunt on Refuge Environment and Community:.....	38
4.5.4 Other Past, Present, Proposed, and Reasonably Foreseeable Hunts and Activities) Anticipated Impacts:	38
4.3.5 Anticipated Impacts if Individual Hunts are Allowed to Accumulate:.....	40
4.3.6 Summary of Cumulative Effects.....	40
4.4 Indian Trust Assets:	41
4.5 Unavoidable Adverse Effects:	41
4.6 Irreversible and Irretrievable Commitment of Resources:.....	42

5.0 CONSULTATION, COORDINATION, AND DOCUMENT PREPARATION: 44
 5.2 References:..... 44
Appendix A..... 47
 DEFINITION OF TERMS 47

DRAFT

[Page Left Blank Intentionally]

DRAFT

1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION

1.1 Introduction

The United States Fish and Wildlife Service (Service), is proposing to increase hunting opportunities at Sequoyah National Wildlife Refuge by opening new hunt units in areas currently closed to upland and/or big game hunting. These would include Vian Creeks, Webbers, Hisaw/Shelby, Girty, Possum Hollow, Delta Islands and Haskell units. In addition, these new units and currently open units would be open to incidental take of feral hog during all upland and big game hunts.

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, three alternatives are described and environmental consequences of each alternative are analyzed.

1.2 Location

The Sequoyah National Wildlife Refuge (SNWR or refuge) is an overlay project of the U.S. Army Corps of Engineers (USACE) established on the 42,000 acre Robert S. Kerr Reservoir by Cooperative Agreement No. DACW56-3-71 on December 11, 1970, to "...be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon..." 16 U.S.C. 664 (Fish and Wildlife Coordination Act). Migratory waterfowl are the main management thrust of the refuge. Wading birds, shorebirds, white-tailed deer, and other resident wildlife species thrive on the refuge as well.

Sequoyah NWR is located in Sequoyah, Haskell, and Muskogee counties of Oklahoma, a few miles south of Vian, OK. Strategically situated at the confluence of the Canadian and Arkansas Rivers, the refuge is a valuable sanctuary containing rich river-bottomland forests with numerous ponds and sloughs that provide food and cover for migratory and resident wildlife species. The distinct landscape, diversity of biological communities, and secluded location are inherent characteristics that contribute to the area's value as a natural preserve. The refuge provides a variety of protected habitats for wildlife, open space, and wildlife dependent recreational activities for the public.

This eastern section of Oklahoma has historically been a prime waterfowl migration and use area. The Arkansas River and surrounding lands provided ample water, food, and habitat that attracted thousands of migrating waterfowl each year. Today, the refuge continues to offer sanctuary to migratory waterfowl in the fall, winter, and spring. The value of these lands that were dedicated to providing waterfowl habitat also benefits other migratory bird species and resident wildlife species throughout the year. The refuge's land and water restoration activities are designed and implemented to improve waterfowl habitat, and to benefit more than 272

species of birds, 46 species of mammals, 94 species of reptiles and amphibians, and 73 species of fish. While the primary challenges on the refuge have centered on conservation and management of habitat for migrating birds and other native wildlife species, the refuge also conserves and manages habitat for federally listed threatened and endangered species, and several species of concern, including the American burying beetle (*Nicrophorus germanicus*) and interior least tern (*Sterna antillarum*).

Located in the heart of a rural community, the refuge receives increasing influences from the nearby urban areas of Muskogee, Tulsa and Oklahoma City to the west and Ft. Smith and Little Rock to the east. The refuge was established on the upper end of the Robert S. Kerr Reservoir in eastern Oklahoma and overlaps the junction of Sequoyah, Muskogee and Haskell counties. The refuge headquarters is located 3 miles south of the Vian exit on Interstate 40 (I-40), 35 miles west of Fort Smith, Arkansas, and approximately 150 miles east of Oklahoma City, Oklahoma. Other refuges in proximity to the Refuge include Ozark Plateau NWR, approximately 45 miles to the north, Deep Fork NWR, approximately 70 miles to the west, and Little River NWR, approximately 120 miles to the south.

The target area for this big game, upland game, and feral hog hunt plan is the hunt units as shown on the refuge (Figure 1). The species listed in this plan may be hunted within the different units that are described in section 2.2.

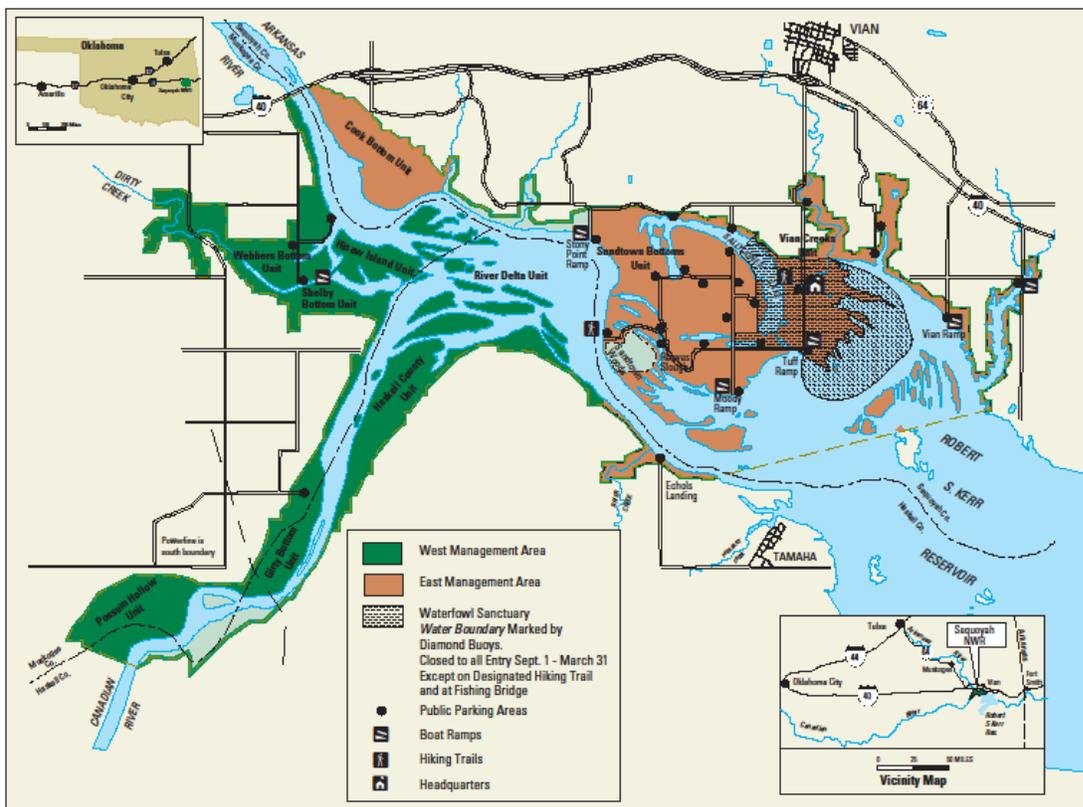


Figure 1. Map of Sequoyah National Wildlife Refuge

1.3 Background:

Sequoyah National Wildlife Refuge opened to hunting soon after its establishment date of December 11, 1970. The refuge operated under an Interim Plan in 1971 with revisions in 1972. The species hunted at that time included bobwhite quail, coots, squirrel, rabbit, goose, and duck. A comprehensive hunt plan was written in April 1973. A fur management plan was issued in 1976 with a targeted species of beaver. A revised hunt plan was issued in May 1988 to restrict the hunting days to Saturdays, Sundays, Mondays, and Tuesdays. An opening package with a hunt plan for white-tailed deer was completed in May 1996. In 2010, the refuge manager decided to stop quail hunting on the refuge due to low population numbers. In 2014 a feral hog management plan was implemented that allows the refuge to use staff and other agencies to conduct control efforts, but public hunting was not considered at that time. Hunts on the refuge have operated under the hunt plans completed in 1973, 1988, and 1996.

The controlled deer hunts have been a vital tool in the management of the deer herd population on the refuge. These hunts help stabilize the deer population and reduce impacts on habitats and croplands on the refuge. Deer hunting is also a very popular activity among people across the United States and is an important legacy that is passed between generations of families. The deer hunts at Sequoyah NWR provide an avenue for friends and families to participate in this activity. Many hunters take advantage of the unique opportunity that is offered and use the time at the refuge to bond with their fellow hunters.

Feral hog populations have been discovered on every land tract in SNWR; the newest populations are found on the Sandtown Bottoms Management Area (on the N side of Arkansas River). The activities of feral hogs have resulted in substantial damages to the natural resources on SNWR. The detrimental effects of free-ranging feral hogs can be found throughout major portions of the refuge and threatens the entire refuge as population numbers have increased without control measures. Impacts on refuge habitat occur in the form of vegetation destruction, rooting and digging activities, and by changes in plant successional patterns, soil properties, and water infiltration rates. The refuge has conducted feral hog management techniques such as trapping and shooting by refuge staff and aerial shooting conducted by USDA staff. There has also been an increase in hunters expressing their desire to harvest feral hogs while they are participating in other hunting activities on the refuge.

1.4 Purpose of Proposed Action:

The purpose of the Environmental Assessment is to evaluate the potential impacts of adding new units to hunt big game (white-tailed deer), feral hog, and upland game (cottontail rabbit, swamp rabbit, gray squirrel, fox squirrel) on Sequoyah NWR, in Oklahoma. The purposes of the proposed action are: 1) to provide additional compatible, wildlife-oriented recreation opportunities on the refuge; 2) to provide another tool for managing invasive feral hog populations; 3) to preserve biological diversity by reducing or eliminating the negative environmental impacts associated with feral hogs and white-tailed deer overpopulation; and 4) to improve deer herd health.

1.5 Need for Action:

There is a need to manage the deer population to preserve habitat diversity. The deer hunts on the refuge are an excellent way for the refuge to properly manage the deer herd. Deer herd health is often measured by maintaining either a desired sex or age ratio. Deer transect surveys or camera surveys will be utilized to assess deer populations at a minimum of every 5 years (Sequoyah Inventory and Monitoring Plan, 2015). The focus of most of our hunts will be to stabilize the deer herd population and will focus on controlled doe hunts. Limited buck hunting may occur in certain areas if the desired doe to buck ratio is met. These hunts are currently the only tool available to the refuge for the management of the deer herd. There are units on the refuge that are currently not in the deer hunting program. By adding new units to the current hunting program it will broaden the refuge's ability to manage the deer herd. This hunting program also offers an excellent platform for the incidental harvest of feral hogs as well.

The upland game hunting program is comprised of cottontail rabbit, swamp rabbit, gray squirrel, and fox squirrel. This program has been very stable and has not experienced dramatic changes in the number of hunters or the numbers of species harvested. The numbers of these species harvested on the refuge are extremely small. These new areas will be enjoyed by the hunters and provides more opportunities to participate in a wildlife dependent recreational opportunity. A reduction in the feral hog populations is necessary on the refuge. Feral hog rooting and digging is causing disturbance and harm to native wildlife and plants. The feral hog hunt is being proposed to: (1) help reduce the number of hogs and the destruction caused by their foraging behavior, and (2) provide additional opportunities for priority, wildlife dependent recreation on Sequoyah NWR. A reduction in feral hog numbers will reduce negative impacts caused by feral hogs and help maintain the integrity of refuge habitats.

The new units will provide additional wildlife-oriented recreation opportunities. There has been a desire expressed by hunters to harvest feral hogs. Providing additional acreage for upland game and big game hunting would help meet a growing demand for low-cost public hunting land in Oklahoma. Providing additional land for hunting would provide additional opportunities for priority, wildlife-oriented recreation on the refuge and to fulfill the Refuge System hunting goals described below.

The guiding principles of the Refuge System's hunting programs as outlined in the U.S. Fish & Wildlife Manual (605 FW 2) are to:

- Manage wildlife populations consistent with Refuge System-specific management plans approved after 1997 and, to the extent practicable, State fish and wildlife conservation plans;
- Promote visitor understanding of and increase visitor appreciation for America's natural resources;
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6;
- Encourage participation in this deeply-rooted tradition in America's natural heritage and conservation history.

1.5 Decision to be Made:

The Service's Regional Director will review the recommendations assessed in this EA and select one of the three Alternatives presented. The Regional Director will also determine whether this EA is adequate to support a Finding of No Significant Impact (FONSI) or whether an Environmental Impact Statement will need to be prepared.

To initiate or expand hunting programs, the Service must publish in the Federal Register any proposed and final refuge-specific regulations pertaining to that use prior to implementing them. The regulations are only one element of a complete opening package, which is comprised of the following documents: hunting plan; compatibility determination; documentation pursuant to compliance with the National Environmental Policy Act of 1969, as amended (NEPA) and appropriate NEPA decision document; Endangered Species Act section 7 evaluation; copies of letters requesting State involvement and the results of the request; outreach plan; and the draft refuge-specific regulations.

This EA serves as the NEPA document which analyzes the impacts on environmental, cultural, and historical resources of continuing to provide hunting opportunities on Sequoyah NWR. The hunt plan is presented in this document as the preferred alternative. Proposed uses within this plan have been determined to be appropriate and compatible with the mission of the Refuge System and purpose for which the refuge was established.

1.6 Regulatory Compliance:

Sequoyah NWR is an overlay project of the U.S. Army Corps of Engineers (USACE) established on the 42,000 acre Robert S. Kerr Reservoir by Cooperative Agreement No. DACW56-3-71 on December 11, 1970, to "...be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon,..." 16 U.S.C. 664 (Fish and Wildlife Coordination Act).

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 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.

The NWRS Improvement Act of 1997 provides guidelines and directives for the administration and management of all areas in the NWRS. It states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use "... will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuges." In addition, "wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety." The act also recognized that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, environmental education and interpretation, when determined to be compatible with the mission of the System and purposes of the refuges, are legitimate and appropriate public uses of the NWRS and they shall receive priority consideration in planning and management. This EA was prepared by the Service and represents compliance with applicable Federal statutes, regulations, Executive Orders, and other compliance documents, including the following:

- Administrative Procedures Act (5 U.S.C. 551-559, 701-706, and 801-808) as Amended
- American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)
- Antiquities Act of 1906 (16 U.S.C. 431-433)
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470)
- Bald Eagle Protection Act (16 U.S.C. 668-668d) as amended
- Clean Air Act of 1972, as amended (42 U.S.C. 7401 et seq.)
- Clean Water Act of 1972, as amended (33 U.S.C. 1251 et seq.)
- Endangered Species Act of 1973, (ESA) as amended (16 U.S.C. 1531 et seq.)

- Executive Order 12898, Federal Action Alternatives to Address Environmental Justice in Minority Populations and Low Income Populations, 1994.
- Executive Order 13112, Invasive Species (issued in February 1999)
- Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. 661 et seq.)
- Fish and Wildlife Improvement Act of 1978 (16 U.S.C. 7421)
- Floodplain Management (Executive Order 11988)
- Migratory Bird Treaty Act (16 U.S.C. 703-712) as amended
- National Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) as amended
- National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 et seq.)
- Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500 et seq.)
- National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.)
- Protection and Enhancement of the Cultural Environment (Executive Order 11593)
- Protection of Wetlands (Executive Order 11990)
- National Pollutant Discharge Elimination System, as amended (33 U.S.C. 1251 et seq.)
- Soil and Water Conservation Act of 1977 (16 U.S.C. 2001-2009) as amended

Refuge Manual (7RM14), Pest Control.

The policy of the Service is to engage in the necessary control of wildlife within the National Wildlife Refuge System to assure balance of wildlife and fish populations consistent with the optimum management of refuge habitat. All control methods will be accomplished by the most humane manner and in accordance with Service directives and Refuge Manual.

Title 50 CFR Part 30, Section 11 – Control of feral animals.

Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized Federal or State personnel or by private persons operating under permit in accordance with applicable provisions of Federal or State law or regulations.

Title 50 CFR Part 30, Section 12 – Disposition of feral animals.

Feral animals taken on wildlife refuges may be disposed of by sale on the open market, gift or loan to public or private institutions for specific purposes, and as otherwise provided in section 401 of the act to June 15, 1935 (49 Stat. 383, 16 U.S.C. 715s).

Title 50 CFR Part 31, Section 14 – Official animal control operations.

(a) Animal species which are surplus or detrimental to the management program of a wildlife refuge area may be taken in accordance with Federal and State laws and regulations by Federal or State personnel or by permit issued to private individuals. (b) Animal species which are damaging or destroying Federal property within a wildlife refuge area may be taken or destroyed by Federal personnel.

Executive Order 13112 - Invasive Species

Issued in February, 1999, this Executive Order instructs Federal Agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm, or harm to human health.

Title 50 CFR Part 32, Section 1 – Opening of Wildlife Refuge Areas to Hunting

The opening of a wildlife refuge area to hunting will be dependent upon the provisions of law applicable to the area and upon a determination by the Secretary that the opening of the area to the hunting of migratory game birds, upland game, or big game will be compatible with the principles of sound wildlife management and will otherwise be in the public interest. The opening or closing of wildlife refuge areas to hunting shall be in accordance with the rulemaking requirements of the Administrative Procedure Act (5 U.S.C. 553). Lands acquired pursuant to the Act of May 18, 1948 (62 Stat. 238, 16 U.S.C. 695) will be opened to hunting only after it has been determined that the major portion of the crops in the vicinity of the area involved have been harvested, that the period of susceptibility of such crops to wildfowl depredation has passed, or that the possibility of these crops being damaged by waterfowl is minor. Lands acquired as “waterfowl production areas” shall annually be open to the hunting of migratory game birds, upland game, and big game subject to the provisions of State law and regulations and the pertinent provisions of parts 25 through 31 of this subchapter: Provided, that all forms of hunting or entry on all or any part of individual areas may be temporarily suspended by posting upon occasions of unusual or critical conditions of, or affecting land, water, vegetation, or wildlife populations.

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 with the Oklahoma Ecological Services office will be completed as part of this process.

1.7 Scoping/Public Involvement and Issues Identified:

The Service has, and will continue to, encourage public participation throughout the NEPA process. On October 1, 2015, the Service announced its intent to prepare an Environmental Assessment for white-tailed deer, rabbit, squirrel, and feral hog at Sequoyah NWR. A 16-day scoping period from October 1st, 2015, to October 16th, 2015 was established under that notice. The Service drafted a letter for the Oklahoma Department of Wildlife Conservation (ODWC), requesting comments about the development of the EA. At the onset of the scoping period the Service posted the announcement at the office and at several locations throughout Vian, Sallisaw, and Gore, Oklahoma. Only one comment from the public was received. Internal scoping of refuge staff was also conducted to identify issues, concerns, and opportunities. Based on internal and external scoping, the following concerns were identified and considered in the development of alternative in this EA:

- There is interest in expanding hunting opportunities on the refuge.
- An interest in hunting feral hogs was expressed; with a desire to be able to carry something other than upland game load during upland game hunts.

- There is a concern with habitat impacts that result from feral hogs and deer overpopulation.
- The public will have an opportunity to review and comment on the Draft Hunt Plan and EA.

2.0 ALTERNATIVES; INCLUDING THE PROPOSED ACTION

This chapter discusses the alternatives considered for expanding hunting opportunities on the refuge.

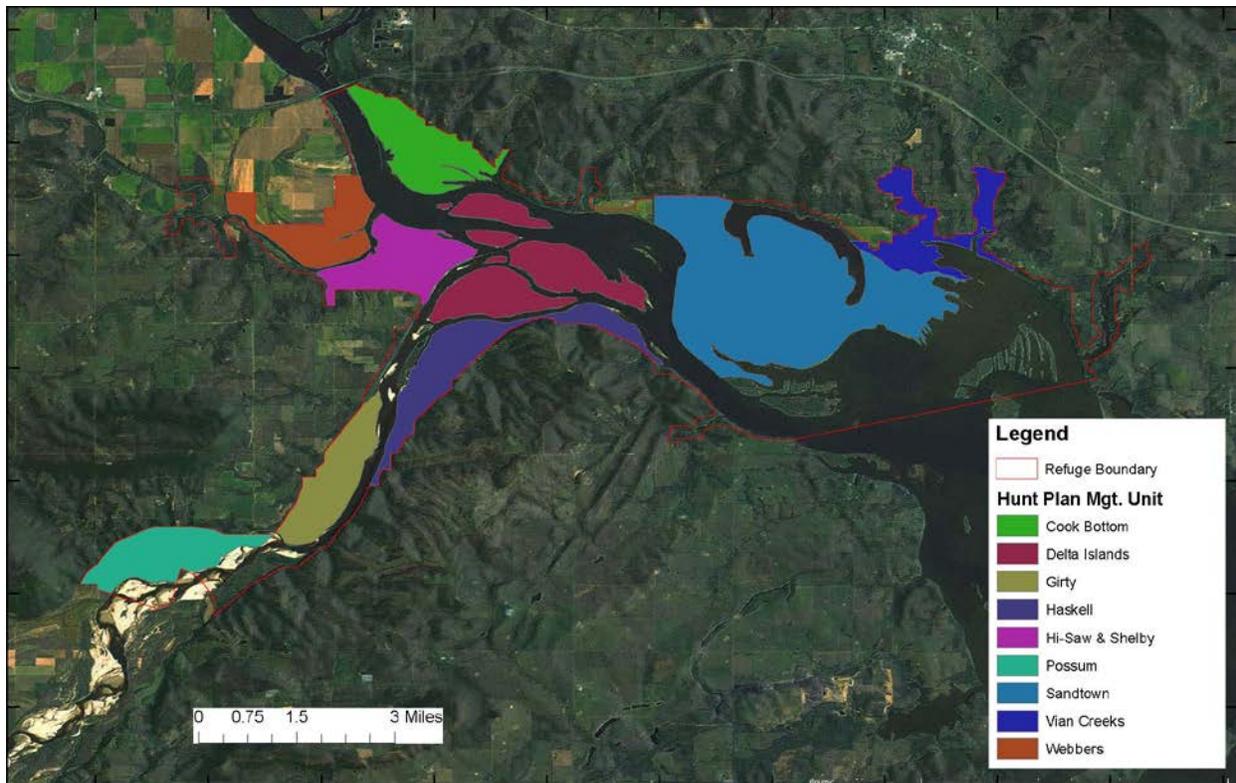


Figure 2. Hunt Plan Management Units for white-tailed deer hunt at Sequoyah NWR.

2.1 Alternative A - No Action Alternative (Current Management)

Under the No Action Alternative, current management direction would continue. The refuge currently allows hunting of white-tailed deer (*Odocoileus virginianus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*S. niger*), swamp rabbit (*Sylvilagus aquaticus*), and eastern cottontail rabbit (*S. floridanus*). Vehicles are confined to public access roads and designated parking areas. The Arkansas River separates two management areas on the refuge. Currently, hunting (waterfowl, upland game and big game) primarily occurs on East side of the Arkansas River, but the West side also has some upland game and waterfowl hunting. There is a waterfowl sanctuary area within a portion of the Sandtown bottom unit, which is closed to all public entry (except for the five controlled deer hunts) from September 1 to March 31 of each year. Upland game hunting on the Sandtown, Vian Creeks, Webbers, and Girty units would continue. The refuge estimates (based on traffic counters) that there are approximately 215 visits/year for upland game hunting. Based on hunter harvest information, it appears that hunter density is

relatively low. Rabbit, gray squirrel, and fox squirrel are the species that are hunted. These species are open to hunting on Saturdays, Sundays, Mondays, and Tuesdays in accordance with the State of Oklahoma season dates from September 1st through January 31st. Hunters may only use plugged shotguns capable of holding no more than three shells in the magazine and chamber combined. Only legal non-toxic shot is allowed on the refuge. No incidental take of feral hogs is currently allowed.

The deer hunts are conducted with the State of Oklahoma performing the draw and the refuge serving as host for the event. Hunters wishing to participate in one of the special draw hunts for deer must apply through the Oklahoma Department of Wildlife Conservation (ODWC) website (www.wildlifedepartment.com). The ODWC is responsible for handling all applications and conducting the draws. Hunters are notified by ODWC that they have been selected for one of the hunts and a complete package with permits and instructions are sent to the hunters.

A total of 30 permits per hunt are issued for four adult hunts (muzzle loader and/or archery) and 25 permits per hunt issued for one youth hunt. There are a total of four adult hunts and one youth hunt. Currently, the units of the refuge that are hunted are Sandtown Bottom Unit and Cook Bottom Unit. The adult hunts will continue to give hunters the option of harvesting up to two antlerless deer. If deer populations exceed desired levels (0.33 buck to doe ratio, SNWR White-tailed Deer Management Plan, 1996) the hunters will be allowed to harvest antlered deer. The youth hunt will give hunters an option of harvesting up to two deer as well. One deer is antlerless and the other deer is an option of antlered or antlerless, regardless of the buck to doe ratio. The Sandtown Bottom Unit is closed to public entry (except vehicles on the tour loop and deer hunters) beyond Tuff Boat Ramp during the special deer muzzleloader hunts. Deer hunts are allowed in the waterfowl sanctuary hunt area as a population control measure. The maximum number of days the unit may be closed to other public entry during any calendar year is 11 days. There will be no take of feral hog performed by any hunter during the upland game or white-tailed deer hunts. Habitat conditions would continue to be negatively impacted by the destructive nature of invasive feral hogs. The current hunt program costs the refuge approximately \$6,500 annually (staff salaries, brochures, fuel/miscellaneous, and road/parking lot rehab). There would be no additional cost to the Refuge under this alternative.

2.2 Alternative B - Open 7 new units to deer hunting and 3 new units to upland game hunting, with the incidental take of feral hogs during those seasons (Proposed Action).

Under this alternative hunting will be conducted the same as Alternative A, except for the following changes. The refuge would also allow feral hog hunting on existing units where big game and upland game hunts already occur. In addition, one new unit (Possum Hollow) will be opened to upland game hunting. The refuge's hunt season for upland game will be shortened to December through January (Saturday thru Tuesday) to reduce public use conflicts with deer hunts. This would be more restrictive than the State season.

Seven new units (Girty, Webber, Vian Creek, Possum Hollow, Shelby, Delta Island and Haskell) would be opened to big game (white-tailed deer & feral hog) hunting. The deer hunts (adult and youth) will continue to be conducted in the same fashion as Alternative A, with the State of Oklahoma conducting the draw and the refuge serving as host for the event. Of the nine hunt units included in the hunt plan, the refuge will typically only hunt six units within a given year, and hunts will typically not occur simultaneously on both the east and west sides of the river. However, if deer populations become overabundant in more than six units as determined by population surveys, browse lines, and deer herd health assessment etc. more than six units may be hunted in a given year. The amount and type of permits that are issued each year will be based on a combination of camera surveys, transect surveys, browse-line observations, and staff observations, and may adaptively change each year depending on available information.

A maximum of 80 and 54 permits may be issued for the East management area (Cook, Sandtown, and Vian Creeks hunt units) and the West management area (Possum, Girty, Hi-Saw/Shelby, Webbers, Delta Islands and Haskell hunt units), respectively. For population control, the refuge typically utilizes antlerless deer hunts. Proposed harvest levels will be based on distance sampling surveys, camera trap surveys, as well as observation of habitat conditions. Opportunities for persons with disabilities will be offered during at least one of the designated muzzleloader hunts. One or more youth hunts will also be offered. There would be a maximum of two separate archery hunts per management area each season. Muzzleloader hunts may occur simultaneously within hunt units and will be limited to no more than 4 total hunts per management area each season. Under this alternative the Sandtown Bottom Unit (beyond Tuff Boat Ramp) could be closed to public entry (except deer hunters) for a maximum of 20 days. There are no hunting programs specifically for taking feral hogs. This plan only provides for the take of feral hogs by the general public incidentally during established hunting seasons for other species (e.g. deer, upland game). This incidental take will provide a control measure that is complimentary to control measures described in SNWR's Feral Hog Management Plan (Sequoyah National Wildlife Refuge 2013), which includes the take of hogs by refuge staff, state/federal wildlife officers, volunteers, and contractors using a variety of control methods (e.g. trapping, limited use of hog baying dogs, shooting, aerial control). The estimated cost of implementing the proposed action is \$10,400.

2.3 Alternative C- Open the refuge hunt units to white-tailed deer, upland game, and feral hog hunting in accordance with State regulations (with some restrictions).

Under this alternative, the current and proposed hunt units would be open to white-tailed deer and feral hog hunting in accordance with State of Oklahoma hunting regulations and seasons with some restrictions. The restrictions would include limiting the days of the week that could be hunted (to minimize conflicts with waterfowl hunting) and limiting the method of take to muzzleloader and archery. This alternative would cause a large upswing in the amount of hunters and the times available for them to hunt. As with alternate A, vehicles are confined to public access roads and designated parking areas. The hunting seasons for all the species listed in the document would overlap. These seasons would also occur at the same time as waterfowl season. The refuge would no longer be more restrictive than other public hunting lands in Oklahoma. All other public uses of the refuge would be impacted as described below. The refuge would have no control over the number of permits issued to hunters, but there would be a restriction on the days hunting is allowed. Deer hunting would begin with the state archery season in October and end during the month of January (as identified by the State regulations).

The muzzleloader season would begin in October and end in November (as identified by the State regulations). During these two seasons, muzzleloader hunting would be open from Wednesday through Friday. Hunting would not be allowed in the waterfowl sanctuary. For safety reasons, the refuge would be required to close the hunt units to other public entry during this time (Wednesday through Friday during the State muzzleloader season). There would be no rifle season on the refuge. Any hunter possessing a legal Oklahoma hunting license would be allowed to participate in this activity.

The upland game hunting would continue to be open Saturday through Tuesday, with longer seasons (as identified by the State regulations). The statewide season allows this activity May through January (versus September through January under alternatives A and B). Rabbit season would occur throughout the State season (from October through March) instead of current refuge season (October through January). Squirrel season would occur from May 15th through January 31st, compared to the refuge season, which is September 1st through January 31st. The waterfowl sanctuary would continue to be closed to upland game hunting.

Feral hogs could be taken during any established hunting season with methods authorized by the ODWC for that hunting season. The only exception to this would be that during any open deer season, only appropriate methods, hunting hours, and weapons for that deer season would be authorized for taking or pursuing feral hogs.

This alternative may have less administrative costs; however, road and facility maintenance and law enforcement costs would likely increase.

2.4 Alternative Considered But Dismissed From Detailed Analysis

The Service considered opening the entire refuge (including the waterfowl sanctuary) to upland game and big game hunting in accordance with state regulations without restrictions. This alternative was considered but dismissed from detailed analysis because it was found to be infeasible due to an unacceptable level of disturbance in the waterfowl sanctuary, impacts on other recreational uses, and safety issues. In addition, the cost to operate a hunting program of that size would be considerably more than current hunting program costs. This cost would include additional law enforcement officers, printing of additional hunting brochures, and maintaining roads, parking lots and signs. The refuge currently does not have the staff or funding to administer this type of a hunt program.

The refuge also considered a comment received from the public, which expressed a desire to be able to carry something other than upland game load during upland game hunts to hunt feral hogs. The method of take is restricted by State regulations and the Service has no authority to change these regulations.

3.0 AFFECTED ENVIRONMENT

Sequoyah NWR is an overlay project of the U.S. Army Corps of Engineers (USACE) established on the 42,000 acre Robert S. Kerr Reservoir by Cooperative Agreement No. DACW56-3-71 on December 11, 1970. The Refuge supports a variety of wetland and upland vegetation within the

20,800 acres managed for resident and migratory fish and wildlife species. Current and proposed hunting areas are located across the breadth of the refuge. The following resources are not discussed in this EA because the proposed hunting activities are not expected to have any impacts on them: physiography, geology, minerals, water quantity, visual resources, and wilderness. The resources described below are those that will have hunting activity occurring in them and could be impacted (directly or indirectly) by the alternatives discussed in this document.

3.1 Physical Environment:

The physical environment consists of climate, air quality, water resources (quality and quantity) geology, soils, and minerals. The physical resources that may be impacted by the proposed action are described below.

3.1.1 Air Quality:

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 ambient air quality within the boundaries of the Refuge does not vary considerably. The Sequoyah NWR in Oklahoma has not recorded ambient criteria pollutant concentrations that approach the maximum concentration permitted by the NAAQS. It has met and continues to meet air quality standards for all six pollutants (U.S. Environmental Protection Agency 2013).

3.1.2 Water Quality:

The Arkansas River is the major river that flows through the refuge. Most of the freshwater withdrawn from the alluvial and terrace deposits along the Arkansas River is used for agricultural and manufacturing purposes. Between the Canadian River junction and the Arkansas State line, the alluvium and alluvial terraces along the Arkansas river consists mostly of sand and gravel about 40 feet thick (U.S. Geological Service 1996).

Development, agriculture, navigation, and flood control measures have all negatively impacted water quality on the Arkansas and Canadian Rivers, which flow through the refuge. On the refuge’s wetlands and moist soil units, sedimentation is also a concern since it may impact natural wetland function and, as a result, may alter the ability of the wetland to provide habitat for a variety of wetland-dependent species. Nutrients, pesticides and runoff from farming operations may also degrade the quality of water on the refuge.

3.1.3 Soils

The soils of the refuge consist predominantly of sandy loams and silty loams (e.g. Coughatta silt loam) that are typical of the river alluvial deposits in the area. These soils consist of deep, well-drained, moderately slowly permeable soils that formed in calcareous, loamy alluvium and occur on natural levees along rivers. These types of soils can be agriculturally productive and provide excellent woodland habitat if flood events and inundation periods are not too extensive in length.

3.2 Biological Environment

3.2.1 Vegetative Communities:

South-Central Interior Large Floodplain

This is likely the most prevalent habitat type found on the refuge, and typifies the habitat commonly referred to as floodplain forest, or sometimes bottomland hardwood forest. This habitat type has dramatically declined in the last century due to the waterway alterations of the Arkansas and Canadian Rivers. Very little floodplain forest habitat remains in Oklahoma, making those found on the refuge vital for wildlife use.

This habitat type occurs along large rivers or streams where topography and alluvial processes have resulted in a well-developed floodplain. A single occurrence may extend from river's edge across the outermost extent of the floodplain or to where it meets a wet meadow or upland system. Many examples of this system will contain well-drained levees, terraces, and stabilized bars, and some will include herbaceous sloughs and shrub wetlands resulting, in part, from beaver activity. A variety of soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. A variety of substrate types combined with a dynamic flooding regime creates a mosaic of vegetation. The peak of the hydrological cycle within this habitat is in the spring, as a majority of the habitat is flooded for at least some point each spring; microtopography determines how long the various habitats are inundated.

Vegetation varies quite widely, encompassing shrubby and herbaceous communities, as well as forested communities with a wide array of canopy types. Although vegetation is quite variable in this broadly defined system, examples may include Silver maple (*Acer saccharinum*), American sycamore (*Platanus occidentalis*), elm (*Ulmus* spp.), pecan (*Carya illinoensis*), green ash (*Fraxinus pennsylvanica*), hackberry (*Celtis occidentalis*), eastern cottonwood (*Populus deltoides*), willow (*Salix* spp.) and oak (*Quercus* spp.) species. Understory species are mixed, but include shrubs such as giant cane (*Arundinaria gigantea*), sedge, and smartweed (*Polygonum* spp.) species. Annual flooding events are confined to the main channel or lowlands bordering the river. However, floods occurring every 5-100 years typically overflow the banks, leaving residual water in back swamps, pools, sloughs, oxbows, and depressions (Jones 1996). These peak flood events scour bottomland habitat creating a disturbance regime, providing a variety of successional states. Inundation by reservoirs, a stabilized hydrological regime, and agricultural conversion are the primary threats to this system.

Ozark-Ouachita Riparian

This system is found along streams and small rivers within the Ozark and Ouachita regions. In contrast to larger floodplain systems, this system has little to no floodplain development and often contains cobble bars and steep banks. Flooding and scouring strongly influence this system and prevent the floodplain development found on larger rivers. It is traditionally higher gradient than larger floodplains and experiences periodic, strong flooding. It is often characterized by a cobble bar with forest immediately adjacent with little to no marsh development. This habitat type exists along many of the tributaries to the Arkansas and Canadian river systems. Canopy cover can vary within examples of this system, but typical tree species include American sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), maple (*Acer* spp.), and oak (*Quercus* spp.) species. The richness of the herbaceous layer can vary significantly, ranging from species-

rich to species-poor. These areas are typically dominated by primarily wetland obligate species of sedge, fern, and other herbaceous species. Flooding and scouring strongly influence this system and prevent the floodplain development found on larger rivers.

Sand Bars

There are approximately 900 acres of sandbars located primarily in river habitat on the western portions of the Refuge. The periodic fluctuations in reservoir levels and flood events have a significant effect on the quantity and type of vegetation on the sandbars. Typically, the succession of vegetation on the sandbars begins with emergent vegetation, sedges (*Carex* spp.), and horsetails (*Equisetum arvense*) followed by invasion of salt cedar (*Tamarix ramosissima*), cattails (*Typha* spp.), and willows (*Salix* spp.).

Agriculture - Cultivated Crops

Sequoyah NWR utilizes a cooperative farming program to supplement the energetic and nutritional needs of wintering waterfowl. The refuge contains approximately 2,746 acres of cultivated farmland, of which a portion of the standing crop (of either corn, milo, or millet) is cultivated for wildlife use. An additional portion of the total cultivated acreage is cultivated as winter wheat. For example in 2011, approximately 1,456 and 1,099 acres of soybeans and corn were farmed, respectively. Historically, alfalfa, harvest wheat, mungbeans, and hull peas were also cultivated in the cooperative farming program.

3.2.2 Wildlife:

The refuge supports a diversity of wildlife species of eastern Oklahoma, including game and nongame species, reptiles, amphibians, and invertebrates, which are important contributors to the overall biodiversity on the Refuge. Many species of waterfowl, game birds, and endangered species have been Service priorities since the 1930s. Conservation of migratory birds is often considered the focal point of the Refuge System throughout the United States. The refuge was established primarily for the conservation and management of migratory birds and to serve as a stopover and resting place for waterfowl during their spring and fall migrations. Species that depend on the refuge, especially during the winter or as migratory bird stopover habitats include the mallard (*Anas platyrhynchos*), gadwall (*A. strepera*), northern shoveler (*A. clypeata*), northern pintail (*A. acuta*), blue-winged teal (*A. discors*), green-winged teal (*A. crecca*), American wigeon (*A. americana*), canvasback (*Aythya valisineria*), and redhead (*A. americana*). The refuge has documented 272 species of birds, 46 species of mammals, 94 species of reptiles and amphibians, and 73 species of fish. Management of many of these species remains a collaborative effort with the Oklahoma Department of Wildlife Conservation (ODWC). The refuge's rich mixture of bottomland hardwood forests, open lakes and wetland habitats also support other rare and declining migratory birds, particularly neotropical songbirds and federally listed species such as the interior least tern.

White-tailed deer

The white-tailed deer population at SNWR has grown rapidly since the 1980's. White-tailed deer were nearly eliminated from Oklahoma in the early 1900's, and the SNWR population remained low through the 1980s. Spotlight surveys conducted at SNWR give a glimpse into general deer population trends at the refuge. The spotlight surveys at SNWR in the early 1980's averaged about 17 deer, by the late 1990's; spotlight surveys averaged greater than 200 deer per survey. Following the increase in deer numbers, refuge staff started to notice significant browse lines, bedding sites, and deer trails throughout the refuge (SNWR White-Tailed Deer Management

Plan, 1996). As a result, the deer management objectives shifted from protection in the 1980s to population control in the late 1990s. Current spotlight surveys appear to indicate that the population has consistently averaged about 200 individuals per survey. Although browse lines and deer trails remain present at SNWR, it appears that control methods have at least stabilized deer populations on the Cook and Sandtown Management Units. The use of hunting as a herd management tool has not occurred in areas west of the Arkansas River. As a result, the Webbers Falls and the Shelby/Hi-Saw Management Units boast some of the greatest concentrations of deer on the refuge. The refuge will use an adaptive management plan to manage the deer populations, and hunt control methods will be implemented to meet desired goals.

Eastern gray and fox squirrel

The gray squirrel and fox squirrel are both arboreal species that require mature forest for shelter and food. They spend the majority of their time in native hardwood trees such as oaks and hickories, and occasionally in pines. They require mid- to late-succession forests, however, they will forage in some early successional stages such forest openings, or croplands. Both species can be found in bottomlands, on bluffs, and along rivers. Suitable habitat must contain food sources through all seasons. Food is provided by fruit- and nut-producing hardwoods, fungi, confers, agricultural crops, and the buds, flowers, an inner bark of some trees and shrubs. The most productive habitats have a variety of tree species. Both of these species are common on the refuge.

Squirrel populations will not be impacted by refuge hunting because of their prolific breeding capabilities and more than adequate refuge habitat. Eastern gray squirrels breed twice a year and normally have two to six young in each litter, but this number can be as high as eight. Eastern gray squirrels can start breeding as early as 5 -1/2 months old (Lawniczak 2002). Fox squirrels can produce two litters in a year. Average litter size is 2-3, but litters range between one and seven. Sexual maturity is attained at eight months for females (Fahey 2001). Since the establishment of the refuge, squirrel hunting has occurred on the refuge. The estimated number of squirrels taken on Sequoyah NWR over a two year period was less than 30. The limit set by the State for 2015 for individual hunters is 10 squirrels per day. Additionally, the refuge's 76 day short season was much more restrictive than the 262 days the State allows.

Eastern cottontail and swamp rabbit

The eastern cottontail is found throughout Oklahoma, while the swamp rabbit is restricted to central, northeast, and southeast Oklahoma. Cottontails are widely distributed throughout Oklahoma from bottomlands and marshes to uplands. Habitat requirements can be met in a variety of diverse areas, as no single plant community type describes habitat for the rabbit. Optimum habitat for the cottontail is composed of early successional stages with low structure, transitional zones, and disturbed areas. This includes moderately grazed, weedy pastures with native grasses and low, dense clumps of trees and shrubs. The presence of perennial bunch-type grasses and a variety of forbs is common to good rabbit habitat in a variety of plant community types. Escape cover is essential and can be provided by dense underbrush, low growing vines, thorny vines and bushes, and woody perennials.. Cottontails are rarely found in dense, mature forests or highly-stocked, pole-sized stands. The swamp rabbit, however, can be found in greater numbers than cottontails in areas that have been selectively logged and also in mature forests. Swamp rabbits are generally associated with habitat types such as bottomlands, floodplains,

wooded swamps and marshes, estuaries and tributaries of rivers and streams, and canebrakes. Preferred habitat for the swamp rabbit is a system of low ridges, small sloughs, and marshes that are grass-dominated. Grain fields can also be utilized by the swamp rabbit in times of flooding as a source of food and cover. The swamp rabbit usually ranges no farther than 1.2 miles from a major water source.

Both of these species are common on the refuge. Rabbit populations will not be impacted by refuge hunting because of their prolific breeding capabilities and more than adequate refuge habitat. Swamp rabbits (*S. aquaticus*) have litter sizes from one to six, and produce two to five litters per year while eastern cottontail rabbits (*S. floridanus*) can have one to seven litters of 1 to 12 young per year (Chapman and Ceballos 1990). Since the refuge was established rabbit hunting has occurred on the refuge. A total of 10 rabbits are estimated to have been harvested during the two previous hunting seasons. Low harvest numbers of rabbits can be an indication of a few things such as a low number of rabbit hunters; rabbits tend to hide and stay motionless compared to squirrels.

Feral hogs

Feral hog populations have been discovered on every land tract within the refuge; the newest populations are found on the Sandtown Bottoms Management Area (on the N side of Arkansas River). The activities of feral hogs have resulted in substantial damages to the refuges natural resources. The detrimental effects of free-ranging feral hogs can be found throughout major portions of the refuge and threatens the entire refuge as population numbers have increased without control measures. Feral hogs are highly adaptable, have high reproductive capabilities, and can be found in a wide range of habitat types. Impacts on refuge habitat occur in the take of vegetation as food, indirect impacts in response to rooting and digging activities, and by changes in plant successional patterns, soil properties, and water infiltration rates.

Feral hogs have been very successful in expanding their range and increasing their numbers. The success can be attributed to introduction and reintroduction by hunters, water development in arid areas, improved range condition, and an ability to reproduce rapidly. Feral hog home ranges can vary from 0.4-19 square miles depending on availability of food and water (Stevens 1996). Males have larger home ranges than females, especially during the breeding season (Stevens 1996). Unless accompanied by a receptive sow, boars are generally solitary when traveling and feeding. Groups of hogs normally seen throughout the Refuge consist of sows and their offspring. Sows normally begin breeding at 6 months of age and have an average of 2 litters per year with 4-10 offspring per litter (Stevens 1996). Hog populations can potentially double in 4 months (Barrett and Birmingham 1994). The feral hog breeding season on the refuge appears to be year-round as sows with their offspring are observed throughout the year. Hog populations have also benefited from the increased disease control in domestic livestock. Feral hogs compete with native wildlife for food, cover, water and space. They also negatively impact lands and vegetative communities as a result of feeding and/or rooting. Rooting, if severe enough, can alter plant community successional sequences. The effect these activities have on vegetation varies from positive to negative depending on the area and type of vegetation. Negative effects may include soil erosion, consumption of native seed crops, and consumption of threatened or endangered species, altered plant succession into monocultures or native rangeland and reduction of overall species diversity (West et al. 2009; Stevens 1996).

Rooting and digging activities are the first indicators of feral hog presence. Feral hogs have been

found damaging row crops, food plots, impoundments, fences, and forest regeneration sites within the refuge. These activities are in pursuit of roots, tubers, mast, and invertebrate food resources. Tate (1984), viewed rooting as disruptive to vegetative communities and successional patterns, and the activity altered the forest floor habitat and nutrient cycling. Singer et al. (1984) found rooting activities mixed soil horizons, reduced ground vegetative cover and leaf litter, accelerated decomposition of organic matter, accelerated leaching of certain minerals, and altered ecosystem nitrogen transformation processes. Rooting and digging around riparian areas can increase siltation that degrades streams and affects fish and other aquatic life.

Feral hogs seem to prefer moist bottomland, and are probably most common along riparian areas with dense vegetation (Stevens 1996). Feral hogs on the refuge are most commonly observed feeding in the emergent vegetation surrounding the marsh and within agricultural fields, while traversing along their extensive network of trails. Feral hogs are persistent in their rooting behavior and because they attack at the root level, they can disrupt natural regeneration of bottomland forest, decrease survivability of some plant species, and create environmental conditions that favor invader plant species that are less desirable in habitat management for wildlife (West et al. 2009).

Adult hogs in east central Oklahoma do not seem to have any natural predators other than humans. Smaller offspring may be taken by coyotes and bobcats; however, this predation is countered by large litter sizes and does not seem to have an effect on hog populations. Competitive interaction between feral hogs and game and non-game wildlife species presents a major concern. Feral hogs are omnivorous (Stevens 1996) and the diet includes oak mast, soft mast, succulent grasses, forbs, fungi, roots and tubers, and animal matter. Many of the food items utilized by feral hogs are staple items for native wildlife species. Feral hogs are highly adaptable when competing for food resources and have the ability to utilize different components of the habitat, and thus have an advantage over other species with a narrow tolerance of food items in the diet.

Wood and Roark (1980) found oak mast to be one of the more important seasonal food items for feral hogs. Tate (1984) indicated that feral hogs compete with deer, turkeys, squirrels, waterfowl, and other wildlife species for this food resource. Yarrow and Kroll (1989) found that during years of low mast availability, deer populations might be seriously impacted by competition with feral hogs. Feral hogs have a distinct advantage over deer and turkeys in utilizing oak mast in their diet. Deer and turkeys feed primarily by sight and are limited to what is visible, whereas feral hogs use their keen sense of smell to locate the fallen crop. This gives feral hogs the ability to thoroughly deplete an area of the mast that would be utilized by wildlife species (Ray 1988). Feral hogs also have the potential to impact ground-nesting species, particularly quail and turkeys, through nest destruction and predation.

Like all wild or domestic animals, feral hogs are susceptible to a wide range of infectious and parasitic diseases (Davis 1993). As hog populations increase and expand, there is a greater chance they may transmit diseases to other wildlife, domestic animals, and humans. Currently, the two most serious diseases found in feral hogs are swine brucellosis and pseudorabies (United States Dept. of Agriculture 1991).

3.2.3 Threatened and Endangered Species and Other Special Status Species:

Interior Least Terns – Interior Least Tern colonies are known to nest along the Canadian and Arkansas River Systems adjacent to SNWR, during the months of May-August. The colonies along the Canadian River utilize un-vegetated sandbars, usually created by high water events regulated by the US Army Corps of Engineers. Within the Arkansas River System, sandbars created by excess dredge material have been created in order to provide additional nesting habitat for Least Terns. Tern nesting is limited to these unique locations due to favorable conditions (i.e. sandbar islands, clear shallow water). Additionally, Interior Least Terns have occasionally been observed foraging within large, shallow wetlands scattered throughout SNWR. While interior least tern may occur in the units that are hunted, no hunting occurs during nesting season.

American Burying Beetle –American Burying Beetles (ABBs) are known to inhabit a range of habitats, including: oak-hickory and coniferous forests on lowlands, slopes, and ridge-tops, to deciduous riparian corridors and pasture lands (U.S. Fish and Wildlife Service 1991, Creighton et al. 1993). ABB's will utilize a variety of habitat types particularly when feeding (Creighton and Schnell 1998, Creighton, et al. 1993, U.S. Fish and Wildlife Service 1991), and will travel up to 2+ miles to utilize carrion. In 1992 at SNWR, census surveys were conducted within the Sandtown Bottoms Management Units yielding three ABBs captured among grassland/brush habitats bordering intermittent woodlands, southwest of the refuge headquarters. A survey conducted in 2015 revealed two beetles in Cook Bottom and one beetle in Sandtown Bottom. ABBs tend to use areas with level topography and a well formed detrital layer at the ground surface (U.S. Fish and Wildlife Service 1991). Very xeric, saturated, or loose sandy soils are not suitable for carcass burial (Ratcliff 1996), and therefore ABBs are less likely to occur in these areas. Roadways, areas that are permanently or frequently flooded, or agricultural areas are not considered suitable habitat for the ABB. ABBs bury themselves in soil to overwinter when temperatures are below 15 °C (60 °F). When night-time temperatures are above 15 °C (60 °F) ABBs emerge from the soil and begin mating and reproduction processes (U.S. Fish and Wildlife Service 1991). In Oklahoma, the primary time ABBs are active is between May 20th and September 20th in Oklahoma.

Northern Long-Eared Bat - The northern long-eared bat (NLEB) was listed as a threatened species under the Endangered Species Act in April 2015 with an interim 4(d) rule due to drastic population declines caused by white-nose syndrome. The Service published a final 4(d) rule in January 2016 that focuses protections to sensitive life stages of the bat (pup season and hibernation) in areas affected by white-nose syndrome while providing flexibility and minimizing regulatory requirements for landowners, land managers, government agencies, and others with the species range.. At this time no critical habitat has been proposed for the NLEB.

The northern long-eared bat is known to occur in seven counties along the eastern edge of Oklahoma, including Sequoyah County (Stevenson 1986). There are no known suitable hibernacula within the SNWR boundary, and therefore, no winter use is expected. Suitable summer habitat may occur at SNWR, however the NLEB has not been documented on the refuge. Certain tree species (e.g., black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), silver maple (*Acer saccharinum*), black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), sourwood (*Oxydendrum arboreum*), and shortleaf pine (*Pinus echinata*) (Mumford and Cope 1964; Clark et al. 1987; Sasse and Pekins 1996; Foster and Kurta 1999; Lacki and Schwierjohann 2001; Owen et al. 2002; Carter and

Feldhamer 2005; Perry and Thill 2007; Timpone et al. 2010)) will form suitable cavities or retain bark suitable (including live trees and snags) for their summer roosting sites (Foster and Kurta 1999). In tree roosts, NLEBs typically prefer: loose bark and crevices (e.g. Foster and Kurta 1999) areas below the canopy (e.g. Foster and Kurta 1999); canopy coverage ranging from 56-84 % (Timpone et al. 2010, Perry and Thill 2007, Sasse and Pekins 1996, Lacki and Schwierjohann 2001); tall, large diameter trees (Sasse and Pekins 1996); and the upper and middle of slopes (Lacki and Schwierjohann 2001). NLEB typically switches roosts every 2-3 days (e.g. Foster and Kurta 1999). The mean distance traveled between roost trees was 0.67 km (range 0.05–3.9 km) in Missouri (Timpone et al. 2010) and 0.22 km in the Ouachita Mountains or Arkansas (Perry and Thill 2007). Breeding typically occurs in late summer to early fall (e.g. Amelon and Burhans 2006). Maternity colonies generally range from 30-60 individuals (Caceres and Barclay 2000). Female roost site selection, in terms of canopy cover and tree height, changes depending on reproductive stage; relative to pre and post-lactation periods (w/ a greater number using sites pre-lactation), lactating NLEBs has been shown to roost higher in tall trees situated in areas of relatively less canopy cover and tree density (Garroway and Broders 2008). Birthing generally: occurs in May or early June (but may occur in July); tends to be synchronous (Krochmal and Sparks 2007). Juvenile flight occurs between 18-21 days after birth (Krochmal and Sparks 2007).

The most common insects found in the diets of NLEB are lepidopterans (moths) and coleopterans (beetles) (Brack and Whitaker 2001) with arachnids (spiders) also being a common prey item. However, diet may also include: flies, leafhoppers, and caddisflies (Nagorsen and Brigham 1993; Brack and Whitaker 2001; Griffith and Gates 1985). Emerging at dusk, most hunting occurs: above the understory; 1 to 3 m above the ground; under the canopy (Nagorsen and Brigham 1993); on forested hillsides and ridges (as opposed to along riparian areas) (e.g. Brack and Whitaker 2001), and in mature forests (Caceres and Pybus 1998). Occasional foraging also takes place over forest clearings and water and along roads (Van Zyll de Jong 1985).

Gray Bat - The Gray bat occurs in the limestone cave areas of the southeastern United States. Major populations are found in Alabama, Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations occur in surrounding states including Oklahoma. Gray bats 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 1976; 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. Large maternity colonies (around 5,000 bats or more) are known from caves in Adair, Cherokee, Delaware, and Ottawa counties. A few individuals also are located within caves in Sequoyah County from time to time. Although a few individuals also may be found in Oklahoma caves during the winter, most gray bats that summer in Oklahoma migrate to northern Arkansas and southern Missouri for the winter. No hibernating colonies are known from Oklahoma. Further, there are no known suitable hibernacula within the SNWR boundary, and therefore, no winter use is expected. Gray bats are known to travel up to 35 km 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 1976). 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). In Northeast Oklahoma, Gray bats typically: begin to arrive at caves during mid to late-April; a single offspring typically is born in late May or early June; young begin to fly 20-25 days after

birth; and the maternity colony typically leaves the cave by August. In 2014, a few Gray bats were detected near wetland and stream areas at SNWR using Anabat survey equipment (BCID and Kaleidoscope software packages were in agreement for 4 individual detections). This is the first evidence that Gray bats may seasonally forage at SNWR. However, due to the distance to the nearest known roosting cave it is unlikely that more than a few individuals utilize the refuge. Further, it is possible (and perhaps likely) that the software packages misidentified the species. *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 dbh. Indiana bats forage for insects along forest edges, in or beneath forest canopy, over ponds, and along streams (USFWS 2007).

In Oklahoma, Indiana bats are known from a single hibernaculum on the Ouachita National Forest, LeFlore County, Oklahoma. The Indiana Bat has never been documented on the refuge or on any counties located within the refuge. In 2014, a few Indiana bats were detected within riparian areas using Anabat survey equipment (BCID and Kaleidoscope software packages were in agreement for 6 individual detections). This is the first evidence that Indiana bat may seasonally utilize SNWR. However, *Myotis* spp are notoriously difficult to detect using Anabat survey equipment, and it is possible (and perhaps likely) that the software packages misidentified the species. Because, SNWR is on the far western portion of the species range and because there are no other known detections of Indiana Bats on refuge or in surrounding counties; if Indiana Bats were present it is unlikely that more than a few individuals utilize the refuge.

3.3 Human Environment

3.3.1 Socioeconomic Resources:

The refuge is located in three counties, with the majority of the refuge in Sequoyah County and smaller portions of the refuge in Haskell and Muskogee Counties. The socioeconomic impact of refuge operations is mainly in the neighboring communities of Vian (population 1,538) and Sallisaw (population 8,812), Oklahoma and Ft. Smith (population 85,544), Arkansas (Onboard Informatics 2010). The majority of the refuge's annual budget is recycled into the local economy through refuge staff spending, purchases from local stores for supplies, and service contracts. Youth and other cooperative programs provide occasional employment to members of the community.

The refuge's cooperative farming program yields an annual return to the cooperative farmers. The refuge provides various wildlife-dependent recreational opportunities with fishing being the most popular, followed by hunting and photography. According to traffic counts, the refuge receives over 70,000 visitors a year. The majority of visitors are from nearby locations, though proximity to the larger cities of Muskogee, Tulsa, and Oklahoma City allows for visitors from foreign countries to tour the refuge.

As required by the Refuge Revenue Sharing Act of 1978, Public Law 95-469, the Service annually compensates counties for Service lands taken off county tax rolls. The revenue sharing payment is calculated using a formula taking into account the land's appraised value and money available under the program. However, since refuge lands are considered the property of the USACE, Sequoyah, Haskell, and Muskogee Counties do not receive a payment from the Service but from the USACE who makes a payment to the individual counties in lieu of taxes. The economic area for the refuge is Sequoyah, Haskell, and Muskogee Counties in Oklahoma. It is assumed that visitor expenditures occur primarily within these counties. Total expenditures were \$2.6 million with non-residents accounting for \$1.5 million or 56 percent of total expenditures. Expenditures on hunting activities accounted for 39 percent of all expenditures, followed by non-consumptive activities and fishing at 34 and 27 percent respectively (Banking on Nature 2006).

3.3.2 Public Use/Recreation:

The refuge has been open to public use activities such as hunting, fishing, wildlife observation, and wildlife photography since its establishment in 1970. In 2015, total visitation was estimated to be 73,058 people. This includes approximately 23,471 visits for fishing, with catfish, largemouth bass, white bass, crappie, and striped bass being the more popular game fish that are sought after on the refuge. Hunting is open to migratory birds (coot, snipe, mourning dove, and woodcock), upland game (rabbit, gray squirrel, and fox squirrel), all waterfowl species (ducks, geese, and mergansers) and big game (white-tailed deer) allowed by the Oklahoma hunting regulations. Total visitation for hunting in 2015 was approximately 3,984 visits, with 101 for migratory bird hunting, 215 for upland game hunting, 3,381 for waterfowl hunting, and 287 for deer hunting. Other public uses include a total of 63,041 visits for wildlife observation, environmental education, interpretation and photography. In 2015, there were approximately 56,863 visits for wildlife observation, 5,192 for photography, 856 for environmental education and 130 for interpretation.

Public use areas and access points on the refuge, including 28 parking lots, three fully developed boat ramps with courtesy docks, six other less developed to primitive boat ramps, six fishing/observation decks, two photography/observation platforms, and two 1-mile one long paved hiking trails. Refuge hunting and fishing brochures complete with maps and regulations are available to the public at distribution boxes throughout the refuge and on the refuge website.

3.3.3 Cultural Resources:

Approximately 43 archaeological sites are presently recorded within or partially within the boundary of the refuge. Many of the sites were documented during surveys conducted for the USACE on land within and around the Robert S. Kerr Reservoir; the rest were recorded during other contracted surveys or by avocational archaeologists (Sisson 2000). Sites on the refuge and surrounding area have yielded artifacts from all recognized prehistoric periods, burial mounds and village sites, 19th century trade goods (knives, ceramics, kitchen utensils, etc.), and early 20th century homesteads and cemeteries. National Register of Historic Places (NRHP) are identified on the refuge. Very little excavating has been done on the refuge. Known or suspected sites are protected from disturbance.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter analyzes and discusses the potential environmental effects or consequences that can reasonably be expected by the implementation of the alternative described in Chapter 2 of this EA. An analysis of the effects of management actions has been conducted on the physical environment (air quality, water quality, and soils); biological environment (vegetation, wildlife, and threatened and endangered species); and socioeconomic environment (socioeconomic features including public use/recreation, cultural resources).

It has been determined that none of the Alternatives will have impacts on hydrology, water quality or quantity, geology, mineral resources and visual/aesthetic resources; therefore there will be no further discussion of these resources in the analysis. Potential impacts on physical, biological, and socioeconomic resources are addressed in the sections below. Potential impacts are described in terms of type, duration, intensity, and context (scale). General definitions of terms used in this analysis can be found in Appendix A.

4.1 Effects Common to All Alternatives

4.1.1. Environmental Justice:

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Bill Clinton on February 11, 1994, to focus federal attention 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 or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority- and low-income residents access to public information and participation in matters relating to human health or the environment. This EA has not identified any adverse or beneficial effects for any alternative unique to minority or low-income populations in the affected area. Additionally, none of the alternatives will disproportionately place any adverse environmental, economic, social, or health impacts on minority or low-income populations.

4.1.2. Climate Change:

Climate change is already affecting fish, wildlife, plants and their habitats around the globe. The Service's Southwest Region has been working with the [U.S. Geological Survey \(USGS\)](#), the academic community, and other natural resource management agencies and interest groups to translate available and emerging science into concrete actions that reduce the impacts of a changing climate on the broadly diverse ecosystems in Arizona, New Mexico, Oklahoma and Texas

The refuge believes that its hunt program will have negligible impacts on Climate Change; however, much is unknown about this subject. The Service has recently addressed the subject of Climate Change with the issuance of the publication “Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change.” This five year plan calls for developing long-term processes and protocols for biological planning and conservation at broad, landscape scales. This five year action plan calls for baseline data to be established. Refuges to date have no information or data regarding their carbon footprint to date. This subject will be further

addressed as future direction is developed and provided on how to step this Strategic Plan down to the field level.

4.2 Physical Environment

4.2.1 Impacts on Air Quality:

Alternative A (No Action):

Under Alternative A, no additional impacts to air quality are expected from the continuation of current management. The current level of public use on the refuge (which is approximately 73,000 visits per year based on 2015 data) does not appear to be impacting air quality, as current air quality in the area meets air quality standards established by EPA. Hunting accounts for approximately 6 percent (4,190 visits per year) of total visitation on the refuge. Hunter traffic on roads and trails may cause a slight decrease in air quality due to vehicle emissions and the stirring of road dust. These impacts are negligible, short-term, and local.

Alternative B (Proposed Action):

With additional hunt units being open, we assume that there will be an increase in the number of hunter visits. Increased hunting traffic on roads and trails would result in a slight increase in vehicle emissions and stirring of dust; however, this impact is expected to be negligible and short-term at the local scale. The slight increase in the amount of traffic that results from the increase in hunters will be spread over a larger area than is currently hunted. This small increase in the number of hunter visits when compared to overall public use on the refuge is considered insignificant; no changes to air quality are anticipated.

Alternative C (State Hunting Regulations):

Under this alternative, impacts to air quality would be greater than Alternative A and B, due to the overall increase in number of hunter visits. The increase in the number of hunters under this alternative is unknown, but is expected to be substantial. Not only would the number of hunters increase, but the time period in which the hunter numbers increases will occur over a longer period of time. This increase is likely to have minor long-term adverse effects on air quality.

4.2.2 Impacts on Water Quality:

Alternative A (No Action):

Current hunting activities (of big game and upland game) are not known to have any direct effects on water quality. However, there may indirect beneficial effects as a result of reducing the number of feral hogs on the refuge. The rooting and digging behavior of feral hogs increases the potential for soil erosion which could lead to decreased water quality due to sediment deposition. In addition, a decrease in the feral hog population, as a result of increased removal, may lead to a decrease in disturbed sites on which invasive plant species thrive. Under the current control measures the feral hog population will continue to grow and increase the severity of these issues, increased take of feral hogs in association with hunting would be another tool to control hog population increases. Increased hog populations associated with the current control hog control practices would likely have minor long-term adverse effects on water quality.

Alternative B (Proposed Action):

The proposed hunting activities would have no direct impacts to water quality (see Alternative A); however, there may be an indirect beneficial effect as a result of reduced feral hog numbers. The alternative will likely slightly improve water quality as the feral hog population is further reduced and there are fewer hogs to cause turbidity. The result would be beneficial to long-term water quality relative to Alternative A.

Alternative C (State Hunting Regulations):

Impact would be similar to alternative B.

4.2.3 Impacts on Soils:

Alternative A (No Action):

Under this alternative current impacts to soils would continue. Current hunting activities on the refuge are not known to have any direct or indirect effects on soil quality based on the current level of foot traffic on the open hunt units. Vehicles are confined to public access roads and parking areas. Feral hog populations, however, would continue to grow thus increasing the potential for impacts on soil resources. The feral hogs currently do moderate damage to farm fields and other infrastructure which leads to increased soil destabilization and erosion. Also, continued disruption of soil resources will hinder the establishment and maintenance of native habitats and wetlands by allowing invasive plant species to become established on disturbed sites.

Alternative B (Proposed Action):

The proposed action would result in a negligible increase in disturbance to surface soils (compaction by foot traffic) compared to Alternative A. These impacts are expected to be negligible because vehicles would continue to be confined to public access roads and parking facilities currently in existence. Refuge regulations would not permit the use of off-highway vehicles (i.e., ATV's and utility vehicles). In addition, the increase in hunter visits compared to overall public use on the refuge is considered minor. Increased take of feral hogs, would likely reduce potential impacts on soil resources. Feral hog damage to farm fields, infrastructure, and native habitat would likely be slightly reduced by the increased take of hogs. This alternative will likely slightly improve soil quality as the feral hog population is further reduced and there are fewer hogs to cause detrimental effects on soils. Therefore, this alternative would be beneficial to long-term soil quality relative to Alternative A.

Alternative C (State Hunting Regulations):

This action would result in an increase in disturbance to surface soils (compaction by foot traffic) compared to Alternative B. Impacts are expected to be negligible because vehicles would continue to be confined to public access roads and parking facilities currently in existence. Refuge regulations would not permit the use of off-highway vehicles (i.e., ATV's and utility vehicles). However, we cannot quantify the extent of the potential impact because the refuge would have no control over hunter numbers.

Feral hog damage to soils would likely decrease as a result of additional hogs being removed from refuge lands.

4.3 Biological Environment:

4.3.1 Impacts on Habitat:

Alternative A (No action):

Under current management, damage to riparian areas and woodland habitats would remain the same or get worse. In the units that are open to hunting, habitat quality is stable, however, in other parts of the refuge there are signs of deer overpopulation. Over abundant populations of deer result in browse lines, vegetative community shifts, increased trails, and increased competition for shared resources (e.g. grains from cooperative farming). Take of squirrel (less than 30 in 2 years) and rabbit (10 rabbits in 2 years) on the refuge is minor, and current upland game hunting practices do not impact habitat. Wild hogs may cause problems in aquatic systems via increased soil erosion and bacterial contamination. Rooting, trampling, and compaction influence plant regeneration, community structure, soil properties, nutrient cycling, and water infiltration. Feral hogs may induce the spread of invasive plant species because invasive species typically favor disturbed areas and colonize more quickly than many native plants. As disturbed areas increase, the occurrence of invasive plants would also increase. Physical damage, as well as the establishment of invasive plant species, would significantly degrade habitat quality.

Competition for food, water and space between feral hogs and native wildlife would remain the same. Consumption of acorn mast could affect forest health and could impact succession. Destruction of nests of ground nesting species such as Kentucky warbler, turkey, mallard, quail, reptiles and amphibians would continue and likely increase as the hog population increases. Damage to refuge roads, impoundments, streams, and farm fields through excessive rooting behavior would also be likely remain the same.

Alternative B (Proposed action):

Under this alternative, there would be no direct effects on habitat and indirect effects are expected to be beneficial. Big game hunting will help reduce deer and hog numbers. Deer browse lines, trails, and indirect vegetative community changes will likely be reduced. Fewer feral hogs will reduce the impacts of their destructive behavior, such as (spread of invasive species, uprooted plants, destroyed bird nests, impacted amphibians and reptiles, and fewer de-vegetated wallows. Current hunting practices for upland game results in little take and hunting activity, this is not expected to change under Alternative B.

Alternative C (State Hunting Regulations):

Under this alternative, impacts to habitat would be similar to Alternative B with an increased number of big game and upland game hunters.

4.3.2 Impacts on Wildlife:

Alternative A (No Action):

This alternative currently results in some short-term negative impacts on small mammals, birds, and other wildlife due to disturbance in areas where human access for hunting activities occurs. There would continue to be limited mortality to the hunted big game and upland game species. These impacts are considered to be negligible due to the small number of hunters and the limited number of days per year on which these impacts occur. Over-population of deer can result in

indirect impacts to other wildlife. An over-abundance of deer can result in vegetative community shifts, a reduction in agricultural grains, increased trails, and so forth, which impacts habitat condition for a variety of species. Feral hogs compete with native wildlife for resources and cause direct wildlife mortality through nest predation and opportunistic consumption of birds, reptiles and amphibians. Feral hogs have an extremely high reproduction rate. As discussed in the impacts on soil resources, degradation in water quality can have an adverse effect on aquatic wildlife species as well. Feral hogs also vector many diseases that can be contracted by other animal species. Physical damage, as well as the establishment of invasive plant species (see Impacts to Habitat Section), would significantly degrade habitat quality. Degraded habitat indirectly affects wildlife populations, affecting availability of foraging opportunities, availability of nest sites, and/or alteration of important habitat structural components required by certain species. Competition for food, water and space between feral hogs and native wildlife would also not be reduced. Any increase in population would lead to adverse impacts on other wildlife species. Take of squirrel and rabbit on the refuge is negligible, and current upland game hunting practices are not expected to affect other wildlife.

Alternative B (Proposed Action):

Impacts would be similar to those described in alternative A (disturbance related to increased human presence and noise associated with hunting). Increased hunting may result in additional short-term disturbance to wildlife over a larger area, since additional units would be open to hunting. This includes temporary displacement of deer, turkey, waterfowl, and other resident wildlife from foot traffic moving through the area. However, all non-deer hunting will be confined to Saturday thru Tuesday, deer hunting will be confined to a maximum of 6 (2-7 day) hunts per season and only 6 of the 9 hunt management units will be hunted within a given year, and upland game hunting will be closed from January 31st to September 1st. Additional permits would be issued for the new hunt units, but the duration and timing of hunts would remain the same. Under this alternative deer hunting and the associated incidental take of feral hogs would occur over a greater area (e.g. Webbers, Hisaw/Shelby, Delta Islands, Haskell, Girty, and Possum management units).

Songbirds, raptors, and rails breed at the refuge, whereas shorebirds and waterfowl primarily utilize the refuge as wintering and migratory habitat. Wintering waterfowl concentrations on the refuge are highest from late-November thru February. The refuge maintains a waterfowl sanctuary that excludes access to the public, including small-game and migratory bird hunters. This area provides sanctuary and roosting areas for migratory birds and helps to off-set potential disturbance effects. During controlled deer hunts, hunters are allowed to enter the waterfowl sanctuary, there impact will be mitigated by pointing out areas where large concentrations of wintering waterfowl are known to occur to hunters during the orientation, and asking hunters to stay out and to minimize their movement around these areas. However, as most deer hunters at Sequoyah hunt from a deer stand or blind, it is unlikely that they will walk past large concentrations of waterfowl frequently, if at all. Major waterfowl areas on the refuge may include Sandtown, Cook, Webbers, Hisaw/Shelby, and the Delta Islands.

The active breeding season for most birds (with the exception of winter breeding raptors) is within April-July. Hunting will not occur within this period therefore no conflict is expected. Breeding raptors (e.g. bald eagles) may initiate nesting during periods of hunting activity. To

mitigate this possible conflict, during the active breeding season, hunters will be instructed stay at least 600 feet from an active bald eagle nest. Known bald eagle nests will be pointed out, and mitigation methods will be described to the hunters during the safety orientation for each deer hunt (if active nesting were to begin that early in the season).

Increased activity (due to added hunt units and feral hog hunting) is expected with upland game hunting, and the incidental take of feral hogs. Upland game hunting will be spread across a greater area than in Alternative A. However, take of upland game species is expected to remain negligible. Incidental take of feral hogs will lessen impacts of feral hogs on other wildlife species, such as: nest depredation; competition for resources; direct consumption of small mammals, amphibians, and snakes; and so forth. In comparison to Alternative A, disturbance effects to wildlife may be negligible in the short-term and are not likely to significantly affect wildlife populations. Moderate beneficial effects are expected by reducing feral hog populations and improving deer herd management.

Alternative C (State Hunting Regulations):

Under this alternative, big game, upland game, and the incidental take of feral hogs will occur over a longer period, concurrent with state hunting regulations. The likelihood of disturbance to non-target wildlife (due to increased human presence and noise associated with hunting) would be greater relative to Alternatives A and B. More frequent big game and upland hunting activities would likely alter deer movement and use on the refuge and could potentially have a greater effect on the population relative to Alternatives A and B. Further the likelihood of disturbance to migratory and wintering waterfowl populations and breeding raptors would likely be greater as there would be no hunter orientation meeting and because the frequency of hunting would be greater. Therefore minor to moderate impacts would be expected on non-target wildlife. Minor to moderate beneficial impacts would be expected by reducing deer and hog populations.

4.3.4 Impacts on Threatened and Endangered Species and Special Status Species:

Alternative A (No Action):

Current hunting activities on the refuge are not known to have any direct or indirect impacts on threatened or endangered species. Interior Least Tern colonies are known to nest along the South Canadian River System within the SW section of SNWR, during the months of May-June. Tern nesting is limited to this unique location due to favorable conditions (i.e. sandbar islands, open habitat, clear shallow water). Also, Interior Least Terns have been observed foraging within large, shallow wetlands scattered throughout the refuge. Hunting activities will neither occur on, or directly adjacent to, open sandbar islands or known tern nesting habitat. Further interaction between foraging least terns and hunters is unlikely, as hunters generally prefer forested areas and terns generally use open water-bodies for foraging. Further, potential for least tern nest depredation does exist, therefore control opportunities that reduce the feral hog population, would therefore reduce the likelihood of feral hog depredation on tern nests. Impacts on terns from this alternative are expected to negligible.

American burying beetles (ABBs) are known to inhabit oak-pine woodlands, open fields, oak-hickory forests, open grasslands, and edge habitats adjacent to/within Sequoyah NWR. A census in 1992 and again in 2015, indicated a small population of beetles within the Sandtown & Cook Bottoms Management Units. Feral hogs could potentially depredate ABBs or indirectly eliminate

the presence of carcasses needed for forage and brood-rearing. Through hunting, and hog population control, the potential for competition between ABBs and feral hogs for carcasses could be reduced. However, to our knowledge there is no evidence that feral hogs compete with American burying beetles for carcasses. Direct impacts/conflicts between ABBs and hunters are unlikely, and therefore no conflict is expected. The endangered gray bat (*Myotis grisescens*) and the threatened northern long-eared bat (*Myotis septentrionalis*; hereafter NLEB) could potentially utilize the refuge for foraging and for cavity nesting (in the case of the northern long eared bat). However, their abundance is not likely to be affected by any changes to abundance or distribution of either feral hogs or deer. Gray bats are unlikely to use SNWR as roosting habitat and all foraging activities occur at night or during dusk and dawn, therefore conflict between gray bats and hunters is unlikely. NLEBs have never been confirmed to utilize SNWR for roosting habitat; yet, it is possible, although extremely unlikely, that hunters would erect a temporary tree stand on a tree utilized by a NLEB. As there are no known suitable hibernacula for NLEB at the refuge, and NLEB would only utilize trees for roosting in spring-fall, the likelihood of conflict between hunters and NLEB is very low. Further, NLEBs has never been confirmed to use the refuge so any conflict is unlikely.

Overall, under the No Action Alternative, the existing habitat conditions would likely be maintained. There would be no expected impacts to Threatened and Endangered Species. However, the possibility does exist that as feral hog numbers continue to increase, least tern nests could be destroyed and the likelihood of feral hog impacts to ABBs may increase.

Alternative B (Proposed Action):

Similar to Alternative A, potential direct and indirect effects of SNWR's hunting program to threatened and endangered species would be unlikely. However, as this alternative increases human presence on the refuge over a greater area, effects to threatened and endangered species may be slightly higher than Alternative A; impacts are expected to be negligible. Further, reductions to the feral hog population via hunting may decrease the detrimental indirect effects that feral hogs have on T & E species.

Alternative C (State Hunting Regulations):

Under this alternative, more frequent hunter visits could increase the chance of affecting threatened and endangered species through disturbance. This alternative would reduce the feral hog population, so the potential impact they may have on endangered species could be reduced. Although the likelihood of effects from hunters may be slightly greater than Alternatives A & B, it is not likely to have a significant effect on a regional or landscape-level scale.

4.4 Human Environment:

4.4.1 Impacts on Socioeconomics:

Alternative A (No Action):

Under this alternative the economic and social condition of the area would remain the same. The public is allowed a limited harvest of a renewable resource in a traditional manner, which is culturally and economically important to the local community. This alternative allows the public to enjoy hunting at no cost in a region where most private land is leased for hunting. This refuge is one of eight public properties open to hunting in the three county area.

Alternative B (Proposed Action):

Similar to Alternative A, The proposed action would allow a greater number of hunters. This could have a positive impact on the local economy through a minimal increase in the purchase of fuel, food, lodging and supplies by hunters coming to the community. This alternative will provide a better quality deer hunting activity and help reduce the deer population on the refuge. The public's participation in the activity will remain high and they will have positive impacts to the local economy. The deer hunting activities will be offered on more areas of the refuge with additional methods of take that will appeal to a wider group of hunters.

There will be more areas offered for small game hunters as well. This will likely appeal to a larger group of hunters that want to participate in this activity and the number of hunters contributing to the local economy will increase.

Under this alternative, active control of feral hogs help reduce the overall harvest yield losses incurred by farmers both on and off the refuge as well as destruction to neighboring lands. This result will not only minimize the economic loss experienced by farmers and adjacent landowners, but would contribute to better relationships between neighboring landowners and refuge personnel.

Alternative C (State Hunting Regulations):

This alternative would likely have a greater positive impact on the local economy through increases in the purchase of fuel, food, lodging and supplies by new hunters that are attracted to the refuge. The extension of the season lengths for both deer and upland game would give these hunters a much longer period of time to be contributing to the local economy.

Under this alternative, additional control of feral hogs would likely reduce the overall harvest yield losses incurred by farmers both on and off the refuge as well as destruction to neighboring lands.

4.4.2 Impacts on Visitor Services/Activities:

Alternative A (No Action):

There would be no change in existing visitor services and recreation opportunities on the refuge. The public would continue to have the opportunity to harvest a renewable resource and participate in wildlife oriented recreation that is compatible with the purposes for which the refuge was established.

Alternative B (Proposed Action):

This alternative would increase the amount of hunting opportunities/areas that are offered to the public. Hunters will not only have the option of pursuing upland game and white-tailed deer on the refuge; they will also be allowed to harvest feral hogs when the opportunity presents itself. Hunters will be able to choose to apply for deer hunts that occur across a greater area of the refuge. Implementation of this hunt will result in the Sandtown Bottom Unit (beyond Tuff Boat Ramp) being closed (for safety reasons) to public entry (except deer hunters) for a maximum of 20 days. The hunts will remain at a high level of quality as the refuge is able to maintain a high level of management on the frequency hunt units are used, and the number of hunters that are placed in these units. This high level of management will also result in very limited conflicts between deer hunters/upland game hunters and other user groups.

Alternative C (State Hunting Regulations):

This alternative would increase the amount of public hunting that occurs on the refuge for white-tailed deer, upland game, and feral hogs. Although the hunting opportunities will substantially increase, the quality of the hunting experience would decrease because hunter density could increase substantially and dynamics of the local deer population would change. The large amount of hunting will likely conflict with other recreational users on the refuge and will ultimately have long-term adverse effects on multiple public use programs. An example of this is the white-tailed deer and upland game seasons will overlap with the waterfowl hunting that occurs on the refuge. In addition, there could be competition for prime hunting sites. For safety reasons, the refuge would be required to close the hunt units to other public entry on Wednesday through Friday during the State muzzleloader season, which is currently nine days in late October through early November.

4.4.3 Cultural Resources:

Alternative A (No Action):

This alternative would not result in any direct impacts to cultural resources. However, increasing feral hog populations could, in the future, negatively impact cultural resources through their foraging and digging behavior.

Alternative B (Proposed Action):

Under this alternative, minimal impacts to the cultural environment are possible. However, no ground disturbance beyond light foot traffic is anticipated. Most areas to be open for these hunts are currently open to public access and use. A minor amount of increased disturbance can be expected as additional hunters would access and walk through the units. Some areas that are not currently open to public uses will be opened through this action. However, most of these units are located along the Canadian River (i.e.... Possum Hollow, Delta Islands, and Hi-Saw Island). These areas will experience an increase in foot traffic. However, these areas already experience time periods of high water that is swift and causes large amounts of ground disturbance.

The feral hog population should decrease through the added abilities to harvest hogs during the deer hunts and upland game hunting. Reduced impacts from feral hog rooting and digging behavior is likely. This would result in a decreased likelihood that cultural sites would be damaged by hogs.

Alternative C (State Hunting Regulations):

Impacts due to a greatly increased number of hunters using the refuge are possible. These hunters would also be hunting during a significantly longer period of time, due to the increase in season lengths for white-tailed deer and upland game. Ground disturbance will be the greatest factor in the potential damage in cultural resources. However, this ground disturbance is expected to be a result of foot traffic. Therefore, anticipated impacts are expected to be significantly higher than Alternative B.

4.4.4 Impacts on Public Health and Safety

Alternative A (No Action):

Under this alternative, there would be no change to impacts on public health and safety on the refuge.

Alternative B (Proposed Action):

Under this alternative there are potential negative impacts on public health and safety, since there would be a minor increase in hunting activity on the refuge, primarily due to opening additional hunt units.

The risk of an accident on the refuge would be minimized by limiting the number of hunters through a permit process, limiting the areas open for hunting, and shortening seasons throughout the refuge. Upland game hunter densities are generally very low and big game hunter densities are limited through a controlled hunt (permit) process. In addition, hunters must wear 400 sq. inches of hunter orange, including a cap. All hunters born after September 2, 1971 must have completed a state-certified hunter education course, and all participants in refuge Big Game and Upland Game hunts attend an orientation where safety is stressed. Hunter numbers and season lengths are very restrictive relative to State seasons under this alternative.

Alternative C (State Hunting Regulations):

Under this Alternative, public health and safety risks would increase compared to Alternative B, since there would be no limit on the number of permits issues.

4.4.5 Impacts on Refuge Facilities

Alternative A (No Action):

Under this alternative, there would be no change to impacts on refuge facilities.

Alternative B (Proposed Action):

Under this alternative minor additional use of roads, trails and parking areas to accommodate the hunt program would occur. Periodic maintenance or improvement of the existing small parking areas, roads, and trails would be similar to Alternative A. The slight increase in the volume of hunters would cause minimal negative impacts to refuge facilities. Existing roads would be sufficient; however, there would be a need to improve existing and develop new parking areas to accommodate the new hunt units. Additional costs will be covered through the refuge's operations and maintenance budget and will not significantly diminish resources dedicated to other refuge management programs.

Alternative C (State Hunting Regulations):

Under this alternative additional use of roads, trails and parking areas to accommodate the hunt program would occur. During periods of high hunter use, refuge parking may be inadequate resulting in illegal parking along roads and increased resource damage. Periodic maintenance or improvement of the existing small parking areas, roads, and trails would increase relative to Alternative B. The substantial increase in the volume of hunters would cause negative impacts to refuge facilities. With increased maintenance of existing roads, trails, and parking areas required for this alternative, costs may be significant relative to total refuge operations and maintenance costs and could potentially diminish resources dedicated to other refuge

management programs.

4.4.6 Humaneness and Animal Welfare Concerns:

Alternative A (No Action):

Under this alternative, mortality of white-tailed deer, feral hogs, squirrel, and rabbit would occur. All hunters must comply with ODWC's regulations regarding the possession of Hunters Education certification. During this course, established hunter ethics and responsibilities to help ensure hunters are using good judgment related to humaneness and animal welfare are addressed. Accurate, clean shots are expected. The target should be within the effective range of the firearm, ammunition, and the skills of the hunter; and a humane kill is likely. There would be no changes in impacts on humaneness and animal welfare concerns under this alternative.

Alternative B (Proposed Action):

As with Alternative A, there will be mortality of white-tailed deer, feral hogs, squirrel and rabbit. All hunters must comply with ODWC's regulations regarding the possession of Hunters Education certification. During this course, established hunter ethics and responsibilities to help ensure hunters are using good judgment related to humaneness and animal welfare are addressed. Accurate, clean shots are expected. The target should be within the effective range of the firearm, ammunition, bow and arrow, and the skills of the hunter; and a humane kill is likely.

Alternative C (State Hunting Regulations):

Impacts would be the similar as Alternative B, but a much greater number of hunters would be participating in hunting activities which would result in higher mortality to white-tailed deer, feral hogs, squirrel and rabbit.

4.5 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 actions 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. Impacts 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.

4.3.1 Anticipated Direct and Indirect Impacts of Proposed Hunt on Wildlife Species:

4.3.1.1 Resident Wildlife

Feral Hogs

Regional and Local Analysis

The hunting of feral hogs is not considered detrimental to the biological integrity of the refuge, is not likely to create conflict with other public uses, and is within the wildlife-dependent public uses to be given priority consideration. In fact, the removal of as many of these destructive, exotic, feral animals as possible would positively benefit the Refuge (and neighboring) habitat. Executive Order 13112, Invasive species, issued in February, 1999 instructs Federal Agencies to: (a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (1) identify such actions: (2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.

Feral hogs are an extremely invasive, non-native species and not considered a game species by the State of Oklahoma. This is due in part to intentional releases, improved habitat, increased wildlife management, disease eradication, limited natural predators, and high reproductive potential. There seem to be very few inhibiting factors to curtail this population growth (Taylor 1991). No bag limits or set seasons are established for feral hogs. Hunting of feral hogs provides the Refuge with another management tool in reducing this detrimental species, and at the same time, is widely enjoyed by hunters. Cumulative effects to an exotic species should not be of concern because the Refuge would like to extirpate this species on Refuge lands. They are a priority species for Refuge management only in terms of their negative impacts on Refuge biota and need for eradication. The public interest would best be served by allowing this activity on the Refuge. However, even with hunting, feral hogs are likely to always be present because they are prolific breeders. The State of Oklahoma allows for year-round hunting (day and night) of feral hogs.

White-tailed deer:

Regional and Local Analysis

Since the 1980s the white-tailed deer population at SNWR has grown rapidly. In the early 1900s white-tailed deer were nearly eliminated from Oklahoma, and at SNWR the population remained low through the 1980s. Spotlight surveys conducted at SNWR give a glimpse into general deer population trends at the refuge. In the early 1980s the spotlight surveys at SNWR averaged about 17 deer, by the late 1990s spotlight surveys averaged greater than 200 deer. Following the increase in deer, refuge staff started to notice significant browse lines, bedding sites, and deer trails throughout the refuge (USFWS 1996). As a result, the deer management objectives shifted

from protection in the 1980s to population control in the late 1990s. Current spotlight surveys indicate that the population has consistently averaged about 200 individuals per survey. Although browse lines and deer trails remain present at SNWR, it appears that control methods have stabilized deer populations on the Cook and Sandtown Management Units. The use of hunting as a herd management tool has not occurred in areas west of the Arkansas River. As a result, the Webbers Falls and the Shelby/Hi-Saw Management Units boast some of the largest concentrations of deer on the refuge. The proposed action is for the refuge to use an adaptive management plan to manage the deer populations, and hunt control methods will be implemented to meet desired age and sex population structure goals. Currently deer populations throughout Oklahoma and in Sequoyah, Muskogee, and Haskell counties are robust and deer are abundant. Deer hunting activities on refuge are unlikely to substantially affect deer numbers on a larger regional scale; however they will likely improve deer herd health at a smaller refuge management unit level. In 2015, deer harvest rates per hunt at SNWR are currently 19% for muzzleloader and 11% for archery, therefore hunts at SNWR are expected to only control population size at the refuge level and are unlikely to affect larger regional deer population levels.

Swamp and Eastern Cottontail Rabbit:

Regional Analysis and Local Analysis:

There is no State data for rabbit populations for Oklahoma. Rabbit populations will not be impacted by the proposed action because of their prolific breeding capabilities and more than adequate refuge habitat. Swamp rabbits (*S. aquaticus*) have litter sizes from one to six, and produce two to five litters per year while eastern cottontail rabbits (*S. floridanus*) can have one to seven litters of 1 to 12 young per year (Chapman and Ceballos 1990). Since the refuge was established rabbit hunting has occurred on the refuge. The estimated number of 10 was taken in a two year period. Low harvest numbers of rabbits can be an indication of a few things such as a low number of rabbit hunters; rabbits tend to hide and stay motionless compared to squirrels. Additionally, the refuge's short season (December – January on Saturday thru Tuesday) is much more restrictive than the State season.

Eastern gray and Fox Squirrel:

Regional Analysis and Local Analysis:

There is no State data for squirrel populations for Oklahoma. Squirrel populations will not be impacted by the proposed action because of their prolific breeding capabilities and more than adequate refuge habitat. Eastern gray squirrels breed twice a year and normally have two to six young in each litter, but this number can be as high as eight. Eastern gray squirrels can start breeding as early as five and a half months old (Lawniczak 2002). Fox squirrels can produce two litters in a year. Average litter size is two to three, but litters range between one and seven. Sexual maturity is attained at eight months for females (Fahey 2001). Since the establishment of the refuge squirrel hunting has occurred on the refuge. The estimated number of squirrels taken on Sequoyah NWR over a two year period was less than 30. The limit set by the State for 2015 for individual hunters is 10 squirrels per day. Additionally, the refuge's 76 day mini-season was much more restrictive than the 262 days the State allows.

4.3.1.2 Migratory Wildlife

Regional and Local Analysis

The refuge provides habitat for a variety of migratory birds such as raptors, waterfowl, shorebirds, and songbirds. Songbirds, raptors, and rails breed at the refuge, whereas shorebirds, and waterfowl primarily utilize the refuge as wintering and migratory habitat. The active breeding season for most birds (with the exception of winter breeding raptors) is within April-July. Hunting will not occur during this period and therefore no conflict is expected. Breeding raptors (e.g. bald eagles) may begin nesting during periods of hunting activity. To mitigate this possible conflict, during the active breeding season, hunters will be instructed stay at least 600 feet from an active bald eagle nest. Known bald eagle nests will be pointed out, and mitigation methods will be described to the hunters during the safety orientation for each deer hunt (if active nesting were to begin that early in the season).

4.3.1.3 Other (Non-hunted) Resident Wildlife

Regional and Local Analysis

Currently, hunting is allowed for white-tailed deer, squirrel, rabbit, dove and waterfowl. Other resident wildlife species are also present on the refuge, including songbirds, wading birds, and raptors; small mammals such as voles, moles, mice, shrews, and bats; reptiles and amphibians such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates such as butterflies, moths, other insects and spiders. Most of these species are common and widespread. In general these species are broadly distributed throughout the region and have limited home ranges. Hunting is not expected to affect any wildlife populations regionally. Some wildlife disturbance (increased human presence and sounds of gunshots) will occur locally during the hunting season; however, these impacts are expected to be minor. Small mammals, including bats, become inactive during winter when hunting season occurs, and many of these species are nocturnal. Both of these characteristics reduce/eliminate hunter interactions with small mammals. Hibernation or torpor by cold-blooded amphibians and reptiles also limits their activity during the winter months when hunting occurs. Hunters would rarely encounter amphibians and reptiles during most of the hunting season. Encounters with amphibians and reptiles would be greater during early fall but should not have cumulative negative effects on amphibian and reptile populations. Invertebrates become less active during the fall and winter months and there would be few interactions with hunters during the hunting season.

4.3.1.4 Endangered Species

It is the policy of the Service to protect and preserve all native species of fish, wildlife, and plants, including their habitats, which are designated as threatened or endangered with extinction.

Regional and Local Analysis

Gray bats are unlikely to use SNWR as roosting habitat and all foraging activities occur at night or during dusk and dawn, therefore conflict between gray bats and hunters is unlikely. NLEBs have never been confirmed to utilize SNWR for roosting habitat; yet, it is possible, although extremely unlikely, that hunters would erect a temporary tree stand on a tree utilized by a NLEB. As there are no known suitable hibernacula for NLEB at the refuge, and NLEB would only utilize trees for roosting in spring-fall, the likelihood of conflict between hunters and NLEB is very low. Further, NLEBs has never been confirmed to use the refuge so any conflict is unlikely.

Feral hogs could potentially deplete ABBs or indirectly eliminate the presence of carcasses needed for forage and brood-rearing. Through hunting, and hog population control, the potential for competition between ABBs and feral hogs for carcasses could be reduced. However, to our knowledge there is no evidence that feral hogs compete with American burying beetles for carcasses. Hunting activities will neither occur on, or directly adjacent to, open sandbar islands or known tern nesting habitat. Further interaction between foraging least terns and hunters is unlikely, as hunters generally prefer forested areas and terns generally use open water-bodies for foraging. Further, potential for least tern nest depredation does exist, therefore control opportunities that reduce the feral hog population, would therefore reduce the likelihood of feral hog nest depredation. Direct impacts/conflicts between ABBs and hunters is unlikely, and therefore no conflict is expected.

4.3.2 Anticipated Direct and Indirect Impacts of Proposed Action on Refuge Programs, Facilities, and Cultural Resources:

Other Refuge Wildlife-Dependent Recreation

As public use levels expand across time, unanticipated conflicts between user groups may occur. The refuge's visitor use programs would be adjusted as needed to eliminate or minimize problems and provide quality wildlife-dependent recreational opportunities. Experience has proven that time and space zoning (e.g., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. This would continue under the Proposed Action Alternative B.

The refuge would control access under the Proposed Action to minimize wildlife disturbance and habitat degradation, while allowing compatible wildlife-dependent recreation. Some areas, such as waterfowl sanctuaries or rookeries, could be closed seasonally to minimize disturbances by hunters or other recreational users.

Refuge Facilities

No additional facilities would be needed under the preferred alternative. Maintenance or improvement of existing facilities (i.e. parking areas, roads, trails, and boat ramps) will cause minimal short term impacts to localized soils and waters and may cause some wildlife disturbances and damage to vegetation. The facility maintenance and improvement activities described are periodically conducted to accommodate daily refuge management operations and other recreational uses. These activities will be conducted at times (seasonal and/or daily) that cause the least amount of disturbance to wildlife. During times when roads are impassible due to flood events or other natural causes those roads, parking lots, trails and boat ramps impacted by the event will be closed to vehicular use. The control of hogs would likely decrease damage to trails, roads, kiosks.

4.5.2.3 Cultural Resources

There would be an increase in foot traffic on the refuge through the new hunting programs. Some minor disturbances may occur, however; cultural resources are subterranean and foot traffic will have very little impact. These areas will likely not experience any negative impacts.

4.3.3 Anticipated Impacts of Proposed Hunt on Refuge Environment and Community:

4.5.3.1 Refuge Environment

The refuge expects very little adverse impacts of the proposed action on the refuge environment which consists of soils, vegetation, air quality, water quality. Some disturbance to surface soils and vegetation would occur in areas selected for hunting; however these impacts would be the same for non-consumptive users. The refuge would also control access to minimize habitat degradation.

The refuge would work closely with State, Federal, and private partners to minimize impacts to adjacent lands and its associated natural resources; however, no indirect or direct impacts are anticipated. The refuge expects some increased visitation and tourism to bring additional revenues to local communities.

4.5.3.2 Refuge Community

The economic impact of the proposed hunt program would be a relatively minor increase in sales of hunting licenses and ammunition to the limited number of people participating in these hunts. Local hotels may experience a slight increase in business as drawn hunters might utilize them. The new hunt would result in a net gain of public hunting opportunities in a region dominated by private land, which would have a beneficial impact on the general public and hunter retention/recruitment. The community would also benefit from a slight increase tourism and revenue.

4.5.4 Other Past, Present, Proposed, and Reasonably Foreseeable Hunts and Activities) Anticipated Impacts:

Cumulative effects on the environment result from incremental effects of a proposed action when these are added to other past, present, and reasonably foreseeable future actions. While cumulative effects may result from individually minor actions, they may, when viewed as a whole, become significant over time. The Refuge is not aware of any past, present or future planned actions that would result in a significant cumulative impact when added to the Refuge's proposed action, as outlined in Alternative B.

Past

Although we have no detailed records, it is safe to assume that all lands that now comprise the Refuge were previously hunted. Other past uses included farming and, ranching. Hunting of migratory birds and upland game was implemented in 1970. This includes dove, squirrel and rabbit during the month of September and quail, squirrel and rabbit during February. Bobwhite quail populations are currently very low and hunting of quail is currently against refuge regulations. The Refuge Manager decided to stop quail hunting on the refuge in 2010 and was removed from the CFRs in 2011. Waterfowl hunting pressure was historically high at SNWR.

Since the 1980s the white-tailed deer population at SNWR has grown rapidly. In the early 1900s white-tailed deer were nearly eliminated from Oklahoma, and at SNWR the population remained low through the 1980s. Spotlight surveys conducted at SNWR give a glimpse into general deer population trends at the refuge. In the early 1980s the spotlight surveys at SNWR averaged about 17 deer, by the late 1990s spotlight surveys averaged greater than 200 deer. Following the

increase in deer, refuge staff started to notice significant browse lines, bedding sites, and deer trails trough-out the refuge (Sequoyah NWR 1996). As a result, the deer management objectives shifted from protection in the 1980s to population control in the late 1990s. In 1990s, SNWR initiated a controlled muzzleloader hunt for white-tailed deer. Participation in this hunt has remained consistent and compared to similar hunts throughout the state, hunter success has been relatively high. Over the past several years, annual requests from hunters for increased opportunities for both white-tailed deer and feral hogs have steadily increased. Feral hogs were not present at the refuge until the last 10 years.

Present

At the present time, the refuge is open to four controlled muzzleloader hunts throughout the fall. Each hunt would span a three day period. Over the last five years, the average harvest was 75 deer per year with a high of 125 and a low of 42. Current spotlight surveys appear to indicate that the population has consistently averaged about 200 individuals per survey. Although browse lines and deer trails remain present at SNWR, it appears that control methods have at least stabilized deer populations on the Cook and Sandtown Management Units. The use of hunting as a herd management tool has not occurred in areas west of the Arkansas River. As a result, the Webbers Falls and the Shelby/Hi-Saw Management Units boast some of the largest concentrations of deer on the refuge.

Upland game hunting is uncommon and harvest rates for squirrel and rabbit have averaged 30 and 10, respectively, over the last two years. Incidental take of feral hogs by hunters is currently not allowed. The refuge currently manages its' feral hog population by: incidental take by refuge staff, law enforcement officers, and contractors; trapping; aerial control; and the limited use of hog baying dogs to take specific problem hogs. Waterfowl hunting remains extremely popular with 3,000-3,500 visitors utilizing the refuge annually. Hunting pressure is high and hunting activity increases throughout the season. Hunting for other game birds (e.g. snipe, woodcock, and dove) represents less than 1% of the total hunting use at SNWR.

Negative impacts from past/current white-tailed deer or upland game hunts have not been noted and none are anticipated in the future as potential conflicts with waterfowl hunters are mitigated by scheduling most of the hunts outside of active waterfowl hunting periods.

The refuge conducts habitat management activities, including farming, floodplain forest restoration, invasive species control, and prescribed burning. Adjacent to and surrounding the refuge, land uses vary from private land ownerships to national navigational waters. The USACE is responsible for managing all of the navigational waterways including the McKellan-Kerr Arkansas River Navigation System (MKARNS) navigational system that is within and borders Refuge boundaries. Outside the navigational waters, the USACE is also responsible for the management of land acres that buffer the many creeks, rivers, and lakes within the riparian corridors. Rural developments and agricultural lands threaten fish, wildlife, and their habitats through introduction of invasive plants and feral animals, crop monocultures, habitat fragmentation, and pollutants. In addition, the interstate (I-40) is just north of the refuge. This traffic corridor does not cause fragmentation of the refuge's property or boundary lines, however, it could potentially serve as a breaking point in corridors used by wildlife that connect refuge land to non-refuge lands.

Future

The implementation of big game hunting on the refuge is expected to be an effective management tool ensuring a healthy deer population while providing the public with a quality hunting experience. In addition, controlling the feral hog population will benefit native wildlife species and habitat. Refuge staff will continue to promote native flora and fauna diversity through active habitat management activities that achieve refuge wildlife habitat priorities and objectives. In addition, ongoing public uses will continue to be offered. Any future hunting or other recreation opportunities will be evaluated when those proposals are developed.

4.3.5 Anticipated Impacts if Individual Hunts are Allowed to Accumulate:

The Service has concluded that cumulative impacts on the refuge's wildlife populations, either hunted or non-hunted species will be negligible. The Service has also concluded that the proposed action will not cumulatively impact the refuge environment or refuge programs. This determination was based upon a careful analysis of potential environmental impacts of hunting on the refuge together with other projects and/or actions. Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the limited hunting seasons.

Because refuge hunting seasons overlap and are spread out in space and in time, the effect of accumulating impacts of individual hunts is decreased. For example, most of the time deer hunting does not occur at the same time as waterfowl hunting. Service staff recognizes that all uses of refuge lands create some impact to refuge wildlife and their habitats. These uses, when taken together, have the potential to create accumulating impacts as the number of refuge uses increases. Because of this potential, refuge uses are limited to those uses which have been formally determined to be compatible with the purposes for which the refuge was established and with the mission of the National Wildlife Refuge System. When these formal compatibility determinations are reviewed (every 10-15 years) possible accumulating impacts that may have occurred in succeeding years will be considered and addressed as necessary.

Field checks by refuge law enforcement officers will be planned, conducted, and coordinated with staff and other agencies to maintain compliance with regulations and assess species populations and numbers harvested.

As non-consumptive public use levels expand across time, the potential for unanticipated conflicts among and within user groups may be present. In the event such unanticipated conflicts may occur as a result of implementing this hunt program, the refuge's visitor service programs would be adjusted as needed to eliminate or minimize each problem to ensure high quality, wildlife-dependent recreational opportunities continue. Hunting season dates and regulations would be set and regulated to allow all user groups to experience a quality visit. The Refuge would have the flexibility to modify the hunt program in order to meet the needs of all wildlife-dependent recreational user groups.

4.3.6 Summary of Cumulative Effects

Increasing deer hunting and incidental take of feral hog may overall have positive benefits to refuge soils and habitats, native wildlife, water quality and quantity, and government

infrastructure. Incidental take of feral hogs may reduce the number of hogs available to cause damage to refuge resources and infrastructure. Whereas increased deer management may have benefits to not only vegetation composition and associated non-target wildlife use, but it may also improve overall deer population health by supporting these general refuge-specific deer management goals 1) preserve biological diversity by reducing or eliminating the negative environmental impacts associated with feral hogs and white-tailed deer overpopulation; and 2) to improve deer herd health (e.g. disease, genetic flow, etc.), age, and sex structure.

A reduction in the hog population will also benefit the public and refuge staff by helping to minimize the chance of hog or deer/vehicle collisions that result in numerous accidents, sometimes fatal, and millions of dollars in property damage throughout the United States annually. A reduction in the hog population will also reduce the potential of aggressive behavior of feral hogs on employees and visitors at the refuge.

The adverse direct and indirect effects of the proposed action on air, water, soil, habitat, wildlife, aesthetic/visual resources, and wilderness values are expected to be minor and short-term. The benefits to long-term ecosystem health that these efforts will accomplish far outweigh any of the short-term adverse impacts discussed in this document.

There are not now nor have there been additional state or federal activities occurring within or around the refuge that could contribute to either negative or positive cumulative impacts related to deer hunting or the incidental take of feral hogs. Several private landowners adjacent to the refuge have in the past and continue to trap and/or shoot feral hogs on their lands as an effort to help reduce the hog population.

The proposed action also may reduce negative economic and environmental impacts caused by feral hogs and deer. Regarding feral hogs, cumulative effects to an exotic, invasive species are not a concern. It is the objective of the Service to eradicate invasive species when possible. When this new hunt is opened, the expected increase in visitation would have beneficial economic impacts on the local community.

National Wildlife Refuges, including Sequoyah National Wildlife Refuge, conduct hunting programs within the framework of State and Federal regulations. By maintaining hunting regulations that are as, or more, restrictive than the State, individual refuges ensure that they are maintaining seasons which are supportive of management on a regional basis.

4.4 Indian Trust Assets:

No Indian Trust Assets have been identified on Sequoyah NWR. There are no reservations or ceded lands present. Because resources are not believed to be present, no impacts are anticipated to result from implementation of either alternative described in the EA.

4.5 Unavoidable Adverse Effects:

Implementation of deer hunting and incidental take of feral hogs on the refuge may result in some temporary, unavoidable adverse impacts. The harvest of white-tailed deer and upland game would occur, but would remain within the state bag limits. Some feral hogs would be killed; however, this species is considered an extremely invasive, non-native species that should be

controlled and/or eradicated whenever possible to minimize adverse impacts on native species, people, and habitats. There would also be some short-term disturbance to other resident wildlife, but these impacts are expected to be minimal. Opportunities for public viewing and photography of wildlife on the refuge would be not be impacted.

4.6 Irreversible and Irretrievable Commitment of Resources:

The Proposed Action will require additional staffing, law enforcement patrols, and funding to fully implement an increased hunting program. Hunt fees will be collected that will be used to support visitor services programs, including hunting, at the Refuge.

There will be a slight increase of irretrievable commitment of fossil fuels (diesel and gasoline), oils, and lubricants used by heavy equipment and vehicles for a short period of time for maintenance of hunt parking areas will be required. However, none of the alternatives would result in a large commitment of nonrenewable resources.

The Proposed Action would result in unavoidable harm or harassment to some wildlife. The Service would implement best management practices to minimize potential impacts.

4.7 Table 1 - Summary of Environmental Effects by Alternative:

Environmental Resource	Alternative A: No Action Alternative	Alternative B: Proposed Action Alternative	Alternative C:
Impacts to Air Quality	No change	No change	Minor long-term adverse impacts likely
Impacts to Water Quality and Quantity	Minor long-term negative impacts likely	Minor long-term negative impacts likely	Minor long-term negative impacts likely
Impacts to Soils	Minor to moderate long-term negative impacts likely	Minor short term negative impacts and minor long term positive impacts likely	Minor short term negative impacts and minor long term positive impacts likely
Impacts on Habitat	Minor to moderate long-term negative impacts likely	Minor short and long term positive impacts likely	Minor short and long term positive impacts likely

Impacts on Wildlife	Moderate to major long-term negative impacts	Minor short-term negative effects on wildlife disturbance and moderate positive overall benefits to wildlife thru improved deer mgt. and reduced hog population.	Minor to moderate short-term negative effects on wildlife disturbance and minor moderate positive overall benefits to wildlife by reducing the deer and hog population.
Impacts on Threatened and Endangered Species	No change or long-term minor adverse impacts	No change or long-term minor positive impacts. Potential minor positive benefits.	No change or long-term minor positive impacts. No change or long-term minor positive impacts. Potential minor positive benefits.
Impacts on Cultural Resources	No change	No change or long-term minor positive impacts. Potential long-term negative impacts	No change or long-term minor positive impacts. Potential long-term negative impacts
Impacts on Socioeconomic Resources	No change	Minor long-term positive impacts	Long-term positive impacts

5.0 CONSULTATION, COORDINATION, AND DOCUMENT PREPARATION:

Document prepared by Refuge Staff, Sequoyah National Wildlife Refuge, U.S. Fish and Wildlife Service, Vian, OK.

5.1 Agencies and individuals consulted in the preparation of this document include:

Oklahoma Department of Wildlife Conservation

Carol Torrez, Region 2, NEPA Coordinator for Refuges

Juli Niemann, Region 2, Division of Visitor Services

5.2 References:

Amelon, S., and D. Burhans. 2006. Conservation assessment: *Myotis septentrionalis* (northern long-eared bat) in the eastern United States. Pages 69-82 in Thompson, F. R., III, editor. Conservation assessments for five forest bat species in the eastern United States. U.S. Department of Agriculture, Forest Service, North Central Research Station, General Technical Report NC-260. St. Paul, Minnesota. 82 pp.

Brack, V., and J. O. Whitaker. 2001. Foods of the northern myotis, *Myotis septentrionalis*, from Missouri and Indiana, with notes on foraging. *Acta Chiropterol.* 3: 203–210.

Caceres, M. C., and R. M. R. Barclay. 2000. MYOTIS SEPTENTRIONALIS. *Mammalian Species* No. 634:1-4.

Carter, Timothy C. and G. Feldhamer. 2005. Roost tree use by maternity colonies of Indiana bats and northern long-eared bats in southern Illinois. *Forest Ecology and Management* 219: 259–268.

Clark, B.K, Bowles, J.B. and B.S. Clark. 1987. Status of the endangered Indiana bat in Iowa. *American Midland Naturalist*, 118(1): 32-39.

Creighton, J.C., C.C. Vaughn, and B.R. Chapman. 1993. Habitat preference of the endangered American burying beetle (*Nicrophorus americanus*) in Oklahoma. *The Southwest Naturalist* 38: 275-277.

Creighton, J.C., and G. Schnell. 1998. Short-term movement patterns of the endangered American burying beetle *Nicrophorus americanus*. *Biological Conservation* 86: 281-287.
Foster, R. W. and A. Kurta. 1999. Roosting ecology of the Northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). *Journal of Mammalogy* 80(2):659-672.

Garroway, C. J. and H. G. Broders. 2008. Day roost characteristics of northern long-eared bats (*Myotis septentrionalis*) in relation to female reproductive status. *Ecoscience* 15(1):89-93.
Griffith, L. A. and J. E. Gates. 1985. Food habits of cave-dwelling bats in the central Appalachians. *Journal of Mammalogy* 66(3):451-460.

Krochmal, A. R. and D. W. Sparks. 2007. Timing of Birth and Estimation of Age of Juvenile *Myotis septentrionalis* and *Myotis lucifugus* in West-Central Indiana. *Journal of Mammalogy* 88(3):649-656.

Hall, J. S., and N. Wilson. 1966. Seasonal populations and movements of the gray bat in the Kentucky area. *American Midland Naturalist* 75:317-24.

Harvey, M.J. 1994. Status of summer colonies of the endangered gray bat, *Myotis grisescens* in Tennessee. Unpub. Rep. to the Tennessee Wildlife Resources Agency. Tennessee Technological University, Cookeville, TN. 44 pp.

Jones, B.D. 1996. Oklahoma wetland resources. p. 315-320. In Fretwell, J.D., J.S. Williams, and P.J. Redman. (eds.). *National Water Summary on Wetland Resources*. US Geological Survey, Washington, DC, USA, Water-Supply Paper 2425.

Lacki, M. J. and J. H. Schwierjohann. 2001. Day-Roost Characteristics of Northern Bats in Mixed Mesophytic Forest. *The Journal of Wildlife Management* 65(3):482-488.

Laval, R. K., R. L. Clawson, M. L. LaVal and W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. *Journal of Mammalogy* 58(4):592-599.

Mumford R. E., and J. B. Cope. 1964. Distribution and status of the chiroptera of Indiana. *American Midland Naturalist* 72(2):473-48.

Nagorsen, D. W., and R. M. Brigham. 1993. *The Mammals of British Columbia*. 1. Bats. Royal British Columbia Museum, Victoria, and the University of British Columbia Press, Vancouver. pp. 164.

Oklahoma Department of Environmental Quality, 2010. Water quality in Oklahoma integrated report. http://www.deq.state.ok.us/wqdnew/305b_303d/2006_integrated_report_entire_document.pdf.

Onboard Informatics. Advameg Inc., 2003-2010. Web. 20 January, 2011. <http://www.citydata.com/>.

Perry, R. W., and R. E. Thill. 2007. Roost selection by male and female northern long-eared bats in a pine-dominated landscape. *Forest Ecology and Management* 247:220-226.

Ratcliffe, B.C. 1996. The carrion beetles (Coleoptera: Silphidae) of Nebraska. *Bulletin of the Nebraska State Museum* Vol. 13.

Sasse, D.B. and P.J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the white mountain national forest. *Bats and Forests Symposium* October 1995, Victoria, British Columbia, Canada, p.91-101.

Sequoyah National Wildlife Refuge. 1996. White-Tailed Deer Management Plan. U.S. Fish and Wildlife Service. Vian, OK.

Sequoyah National Wildlife Refuge. 2013. Feral hog management plan. U.S. Fish and Wildlife Service. Vian, OK.

Sequoyah National Wildlife Refuge. 2015. Inventory and Monitoring Plan. U.S. Fish and Wildlife Service. Vian, OK.

Sisson, F. 2000. A cultural resources overview and assessment for Sequoyah National Wildlife Refuge, Oklahoma. A component of the refuge comprehensive conservation plan. Cultural Resources Consultant, Anadarko, OK.

Stevenson, L.K. 1986. Some ecological aspects of *Myotis keenii* in Oklahoma. M.S. Thesis. Pittsburg State Univ., Pittsburg, KS. 61 pp.

Timpone, J. C., Boyles, J.G., Murray, K.L., Aubrey, D.P., and L.W. Robbins. 2010. Overlap in roosting habits of Indiana Bats (*Myotis sodalis*) and northern bats (*Myotis septentrionalis*). *American Midland Naturalist*, 163:115-123.

Tuttle, M.D. 1976. Population ecology of the gray bat (*Myotis grisescens*): philopatry, timing and patterns of movement, weight, loss during migration, and seasonal adaptive strategies. Occasional Paper No. 54, University of Kansas Museum of Natural History, Lawrence. 38pp.

Tuttle, M.D. and J. Kennedy. 2005. Field guide to eastern cave bats. Bat Conservation International, Inc., Austin, TX. 41pp.

U.S. Fish and Wildlife Service. 1991. American Burying Beetle Recovery Plan. Technical/Agency Draft. Newton Corner, Massachusetts. 73 pp.

U.S. Fish and Wildlife Service. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Whitaker, J.O. and R.E. Mumford. 2009. Northern *Myotis*. P. 207-214. In *Mammals of Indiana*. Indiana University Press, Bloomington, Indiana. Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.

Van Zyll de Jong, C.G. 1979. Distribution and systematic relationships of long-eared *Myotis* in western Canada. *Canadian Journal of Zoology*, 57: 987-994.

Appendix A

DEFINITION OF TERMS

Carrying capacity is the maximum population of a particular organism that a given environment can support without detrimental effects.

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 are incremental impacts resulting from other past, present, and reasonably foreseeable future actions, including those taken by federal and non-federal agencies, as well as undertaken by private individuals. Cumulative impacts may result from singularly minor but collectively significant actions taking place over a period of time.

Impact Type

Beneficial/positive impacts are those resulting from management actions that maintain or enhance the quality and/or quantity of identified Refuge resources or recreational opportunities. Adverse/negative impacts are those resulting from management actions that degrade the quality and/or quantity 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 Plan and possibly longer.

Intensity of Impact

Insignificant/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.

DRAFT