Oklahoma Lesser Prairie Chicken Conservation Plan

A Collaborative Strategy for Species Conservation

5/25/2012 Draft

This report was compiled and prepared by Jonathan Haufler[1]-Lead Scientist and Project Manager, Dawn Davis[1] – Lesser Prairie Chicken Specialist, and Jan Caulfield[2] – Facilitator and Public Relations Specialist.

[1] Ecosystem Management Research Institute
Seeley Lake, Montana
www.emri.org

[2] Jan Caulfield Consulting
Juneau, Alaska
www.jancaulfield.com

DRAFT

Cover Photo Credit: Larry Lamsa

TABLE OF CONTENTS

Executive Summary iv

Introduction 1

Status of Lesser Prairie Chicken 2

Range-Wide 2

Oklahoma 2

Plan Scope and Purpose 4

Background and Plan Development 4

Project Framework 4

Scoping and Information Sources 5

Science Team 5
Implementation Team 5
Input from Energy Companies and Landowners 6

Habitat Needs 6

Habitat Requirements 7

Leks 7
Nesting Habitat 8
Brood Habitat 8
Autumn/Winter Habitat 9

Threats and Stressors 9

Habitat Fragmentation and Genetic Concerns 10
Agriculture and Other Land Uses 11
Effects of Anthropogenic Structures 12
Livestock Grazing 13
Altered Fire Regimes 14
Shinnery Oak and Sand Sagebrush Removal 15
Expired or Expiring Conservation Reserve Program (CRP) Fields 16
Drought and Climate Change 17
Cumulative Anthropogenic Stressors 18

Habitat Suitability Model for LEPC 19

Model computation 27

Ecological Sites as Indicators of Habitat Potential 28

Management Plan 29

Desired Population Size 29

Habitat Goals 31

Core Areas and Desired Conditions 33
Outside Core Conservation Areas 34

DRAFT

Population Connectivity Across State Lines 35
Climate Change 35
Other Habitat Considerations 35
Monitoring Programs 36
Key Research Needs 36
Existing Conservation Programs 37
Oklahoma Department of Wildlife Conservation (ODWC) 37
Natural Resource Conservation Service (NRCS) and Farm Service Agency (FSA) 38
U.S. Fish and Wildlife Service (USFWS) 41
Oklahoma Association of Conservation Districts (OACD) 42
Conservation Easements/Tax Credits 43
Development Agreements 43
Energy Industry Potential Voluntary Programs 43
Roads and Fence Management Opportunities 45
Desired Management Results For LEPC Habitat 46
Education and Outreach Opportunities 46
Program Coordination 47
Adaptive Management 47
Plan Revision 47
Action Steps, Responsibilities, and Timelines 48
Develop Habitat Potential Rating for Ecological Sites and Desired Restoration Conditions for each Site 48
Maximizing Habitat Improvement Opportunities In Core Conservation Areas 48
Development of the Candidate Conservation Agreement with Assurances (CCAA) 50
Definition of Net Conservation Benefits for CCAA Eligibility 50
Develop Opportunities and Criteria for Voluntary Offset Programs 50
Establishing Development Agreement Guidelines 51
Establishing Off-site Mitigation Guidelines and Conservation Banking Programs 51
Identify Additional LEPC Funding Sources 51
Establish “Level Playing Field” for Voluntary Avoidance of Development 51
Enhance Opportunities for Conducting Prescribed Burning 52
Use of Oil and Gas LEPC Best Management Practices (BMP’s) 52
Establish Wind Energy and Transmission Line BMP’s 52
Develop Energy CCAA (s) 53
Develop an Education and Outreach Program for LEPC 53
Develop Recognition Awards 53
Develop LEPC Habitat Demonstration Areas on ODWC WMA’s 53
Establish LEPC Management Agreements with USFS and TNC 54
Set up CRP Guidelines for LEPC in Oklahoma 54
Establish Tax Incentives for Voluntary LEPC Management 54
Restore Abandoned Development Sites 54
Development of LEPC Management Plans for Each Core Conservation Area 54
Implement Key Research Projects 55

DRAFT

Conduct Monitoring of LEPC and LEPC Habitat 55
Conduct LEPC Population Sensitivity Analysis 55
Risk Assessment 55
Acknowledgements 55
Literature Cited 56
Appendix A 67
Ecological Site Characteristics 67
Oklahoma Lek Surveys 70
Appendix B 71

DRAFT

EXECUTIVE SUMMARY

The lesser prairie-chicken (LEPC) is a North American grouse species that historically occupied sand sagebrush and shinnery oak vegetation communities and associated mixed-grass prairies of the southern Great Plains. LEPC and the habitat upon which they depend have diminished across their historical range by about 90% due to a variety or causes. In 1995 the U.S. Fish and Wildlife Service (USFWS) reviewed the status of LEPC and determined that the species was warranted for listing under the Endangered Species Act, but was precluded from immediate listing as species with more pressing needs required action first. Unless LEPC populations sufficiently stabilize or increase, the species may be listed in the future, resulting in additional federal regulations and potential restrictions on human activities and developments within its range.

The Oklahoma State Legislature passed a concurrent resolution on April 12, 2011 that directed the Secretary of the Environment and the Oklahoma Department of Wildlife Conservation (ODWC) to develop the Oklahoma Lesser Prairie Chicken Conservation Plan (OLEPCCP) to "protect, enhance, and restore their habitat while also addressing other factors leading to their decline." This plan is intended to benefit the people, economy, and wildlife resources of Oklahoma by providing a framework for effective management and habitat improvement that will address the factors contributing to the decline of the LEPC and facilitate population increases.

The OLEPCCP will address:

- The science describing the habitat and other needs of the LEPC and its management, and identification of research/data gaps.
- The characteristics of high quality LEPC habitat, the types of management that would contribute to the maintenance or restoration of this quality habitat, and how much habitat is needed – and its distribution – to maintain viable LEPC populations.
- How LEPC conservation can be conducted while minimizing effects on human economies and developments.
- Appropriate habitat improvement/conservation goals and long-term management actions/strategies to achieve these goals.
- Coordinated strategies to implement management actions – including interagency coordination and incentives or other programs that will make restoration and maintenance of LEPC habitat economically viable for landowners and industries.

A science team was established to assist with the compilation and review of available information on LEPC and specifically to assess what is known about LEPC in Oklahoma. An implementation team for LEPC in Oklahoma was also established to compile information and coordinate management programs for implementing the OLEPCCP. Input was also provided early in the planning process by wind, transmission, and oil and gas companies, as well as landowners, ranching, and agricultural interests. The draft plan has been prepared for additional review and comment based on input received on the first draft of the plan released previously.

DRAFT

The science team identified nesting and brood-rearing habitat as the greatest habitat needs for LEPC in Oklahoma, and developed a habitat model describing the vegetation parameters required for these needs. The science team recommended a 10-year population goal of 5,000 LEPC. To provide for this population, the science team recommended establishing 15 core conservation areas for LEPC arranged in complexes with suitable linkage zones to allow movements among the core areas. Each core area should average approximately 50,000 acres in size with at least 35,000 acres being good to high quality LEPC habitat. Maps of the 15 core areas were produced and are included in the Appendix of the plan. The science team also identified various threats or stressors to LEPC including conversion of native prairie to cropland, long-term fire suppression, grazing practices that reduce LEPC habitat quality, tree invasion, herbicide spraying that reduces LEPC habitat quality, habitat fragmentation from oil, gas, and wind energy developments, fences, utility lines and transmission lines, and prolonged drought.

The management plan emphasizes maintaining and restoring high quality LEPC habitat within the core conservation areas using a variety of incentive-based programs and tools including the following:

- Natural Resource Conservation Service Lesser Prairie Chicken Initiative
- ODWC Lesser Prairie Chicken Habitat Conservation Program
- U.S. Fish and Wildlife Service (USFWS) Partners for Fish and Wildlife Program
- Energy Industry Voluntary Offset Program
- Conservation Easements and Development Agreements
- USFWS and ODWC Candidate Conservation Agreement with Assurances
- Oklahoma Association of Conservation Districts Wildlife Credits Program
- Voluntary Best Management Practices and other Conservation Initiatives by Energy Companies

Use of these programs and tools will be combined to maximize incentives within core conservation areas, with particular emphasis on achieving the following results:

- Maintaining and restoring large blocks of native grass and shrub plant communities in core areas connected by linkage zones that allow for dispersal movements of LEPC.
- Returning the natural role of fire especially in sand sagebrush and shinnery oak plant communities.
- Removing red cedar from areas within LEPC range where this plant species has expanded.
- Minimizing energy developments within core conservation areas, and where it occurs, siting development in less sensitive locations.
- Promoting grazing regimes that emphasize light to moderate levels of grass utilization.
- Promoting use of best management practices for energy and other human developments.
- Reducing road density and levels of road use in key habitat areas.
- Minimizing use of herbicides, especially in sand sagebrush and shinnery oak plant communities.
- Reducing density of fences, and marking fences especially near leks.

Accomplishing the above will require coordinated efforts of agencies and organizations involved in LEPC conservation along with increased collaboration with landowners and industry. The implementation team is working to develop this coordination among agencies and organizations. Landowners must be provided with assurances that they will not be required to take additional actions beyond what they

DRAFT

agree to for helping provide LEPC habitat. Landowners may also need to be compensated for development opportunities that they voluntarily forego within core areas.

Landowners need access to "one stop shopping" for consistent technical assistance from all agencies to minimize confusion over the types of programs and incentives that are available. Coordinated education and outreach programs are needed so that landowners, industry and the public clearly understand LEPC conservation needs, and the voluntary programs that are available to help produce desired conservation actions. LEPC conservation must be maintained as a priority management objective by ODWC and other agencies if the above programs and actions are to be successfully accomplished.

Many aspects of LEPC ecology remain unknown and are critical to meeting future habitat needs, so additional research is recommended. Initial areas where additional research is needed include:

- Impacts of various anthropogenic structures and activities on LEPC habitat use, nesting success, and survival.
- Densities, nesting success, and survival rates of LEPC in varying quality of habitat.
- Effectiveness of various treatments in specific ecological sites in restoring high quality LEPC habitat, and longevity of these benefits.
- Validation of the LEPC habitat model.
- Value of small grain cropland as a component of LEPC habitat.
- Importance of and characteristics of shrubs as a component of LEPC habitat.
- Attitudes of agricultural producers and others towards LEPC and LEPC conservation programs.

The OLEPCCP includes recommendations for monitoring of LEPC and coordinating with on-going multistate initiatives for the conservation of this species. Monitoring should also incorporate adaptive management, so that future management actions use methods that have proven to be effective. The OLEPCCP should be considered a working document, and accommodate changes as significant new information becomes available.

DRAFT

INTRODUCTION

The lesser prairie-chicken (*Tympanuchus pallidicinctus*; hereafter LEPC) is a North American grouse species that historically occupied sand sagebrush (*Artemisia filifolia*) and shinnery oak (*Quercus havardii*) vegetation communities and associated mixed-grass prairies of the southern Great Plains. Aside from the Gunnison sage-grouse (*Centrocercus minimus*) the LEPC has one of the most restricted ranges of any North American grouse species. Since the 19th century, LEPC and the habitat upon which they depend have diminished across their historical range by about 90% (Crawford and Bolen 1976a, Taylor and Guthery 1980a). Habitat losses by way of conversion of native prairie to cropland (Crawford and Bolen 1976a), long term fire suppression (Woodward et al. 2001), grazing management practices that reduce LEPC habitat quality (Jackson and DeArment 1963, Taylor and Guthery 1980a, Riley et al. 1992), tree invasion (Fuhlendorf et al. 2006), herbicide spraying that reduces LEPC habitat quality (Peterson and Boyd 1998), habitat fragmentation from both oil and gas (Hunt 2004) and wind energy (Pruett et al. 2009b) developments, fences and utility lines (Wolfe et al. 2007), and prolonged drought (Dixon 2011, Lyons et al. 2011) have been identified as potential contributing factors in the decline of LEPC numbers and further isolated distributions.

Concern has been expressed by agencies, conservation organizations and others that LEPC populations, habitat quality, and habitat quantity continue to degrade throughout its range. In response to declining LEPC abundance and distribution, a petition was submitted to the U.S. Fish and Wildlife Service (USFWS) in 1995 to list the LEPC as threatened under provisions of the federal Endangered Species Act (ESA). The USFWS's finding was that listing was "warranted but precluded," indicating the USFWS felt the species warranted protection but was precluded from listing by higher priority species (Federal Register 63:110, 31400-31406). The status of the bird is reviewed annually in a candidate notice of review, and LEPC remains a candidate species for federal listing today. Unless LEPC populations stabilize or increase, and threats to the species reduced, the species may be listed in the future resulting in additional federal regulations and potential restrictions on human activities and developments within its range.

The possibility of an ESA listing has increased concerns for the species' status, as well as for the possible constraints a listing could cause to various activities on public and private lands. Since the USFWS's determination, the LEPC has received added scientific and management attention as well as funding for conservation-oriented research, management, educational outreach, and cooperative efforts with landowners. An Interstate Working Group, including participation by the Oklahoma Department of Wildlife Conservation (ODWC) has been working together to prioritize research needs and coordinate management efforts among the five states encompassing the range of LEPC. Federal and state funds have been made available for habitat conservation and restoration on private lands through cooperative partnerships with landowners.

The Oklahoma State Legislature passed a concurrent resolution on April 12, 2011 that directed the Secretary of the Environment and ODWC to develop the Oklahoma Lesser Prairie Chicken Conservation Action Plan (OLEPCCP) to "protect, enhance, and restore their habitat while also addressing other

DRAFT

factors leading to their decline." The plan is to be developed in consultation with research institutions, agencies, landowners, and other stakeholders – and is to address research needs, management actions to support responsible development, and ways to provide technical assistance and incentives to landowners to improve or restore suitable habitats. This plan is intended to benefit the people, economy, and wildlife resources of Oklahoma by providing a framework for effective management and habitat improvement that will address the factors contributing to the decline of the LEPC and facilitate population increases.

STATUS OF LESSER PRAIRIE CHICKEN

RANGE-WIDE

The LEPC is endemic to shinnery oak, sand sagebrush, and associated mixed-grass prairie communities in eastern New Mexico (Bailey 1928, Ligon 1961, Hubbard 1978) and portions of southeastern Colorado (Hoffman 1963, Giesen 1994a), southwestern Kansas (Schwilling 1955, Horak 1985, Thompson and Ely 1989, Jensen et al. 2000), western Oklahoma (Duck and Fletcher 1944, Copelin 1963, Horton 2000), and the Texas panhandle (Henika 1940, Oberholser 1974, Sullivan et al. 2000). Davis et al. (2008) reported: "Although few records exist to verify the historical distribution of LEPC, the geographic distribution of the LEPC during the 1800s is speculated to have encompassed 138,000 square miles (Taylor and Guthery 1980a based on Aldrich 1963). By 1969 this area had been reduced to 48,000 square miles, (Taylor and Guthery 1980a based on Aldrich 1963)." Taylor and Guthery (1980a) reported a 78% decrease in the distribution of the LEPC since 1963 and an estimated 92% decrease since European settlement.

Davis et al. (2008) also reported: "Historical records of population numbers are lacking but suggest that during the early decades of the 20th century LEPC were relatively common within their 5-state range (Sands 1968, Crawford 1980). However, by the 1930s, populations were near extirpation in Colorado, Kansas, and New Mexico and markedly declined in Oklahoma and Texas (Baker 1953, Crawford 1980). Although accurate estimates are not available, populations are believed to have fluctuated range-wide throughout the 1940s and 1950s. Populations increased through the 1980s but appeared to decline again during the 1990s (Mote et al. 1998)." Although the LEPC still occur in all 5 of the states within its historical range, survey data collected during the past decade indicate that populations have declined in Oklahoma and Texas, remained stable in Colorado, have continued to fluctuate in New Mexico, and have increased in Kansas (Davis et al. 2008).

OKLAHOMA

Once encompassing portions of 22 counties, the geographic distribution of LEPC in Oklahoma has decreased to 37% of its former distribution (Horton 2000). Presently, LEPC occur in western Oklahoma including isolated parts of Texas, Beaver, Harper, Ellis, Woods, and Woodward counties (Horton 2000) and can occasionally be found in Cimarron, Roger Mills, and Dewey counties (Elmore et al. 2009). Figure 1 displays the currently known distributions of LEPC in Oklahoma and surrounding states. Although the historical breeding population of Oklahoma is unknown, Duck and Fletcher (1944) estimated a total

DRAFT

population of greater than 14,000 LEPC in 11 counties during the 1940s, although Cannon (1980) reported that Duck and Fletcher's estimate for Beaver County appeared to be low, suggesting that total population numbers may have been greater than Duck and Fletcher (1944) reported. Copelin (1963) estimated that the spring population remained at approximately 15,000 birds across 12 counties, including Blaine County where LEPC were apparently absent in 1944. By 1978, LEPC occupied 8 counties and the population was estimated to have declined to 7,500 birds (Cannon and Knopf 1980). The most recent published population estimate for Oklahoma was fewer than 3,000 birds (Horton 2000).

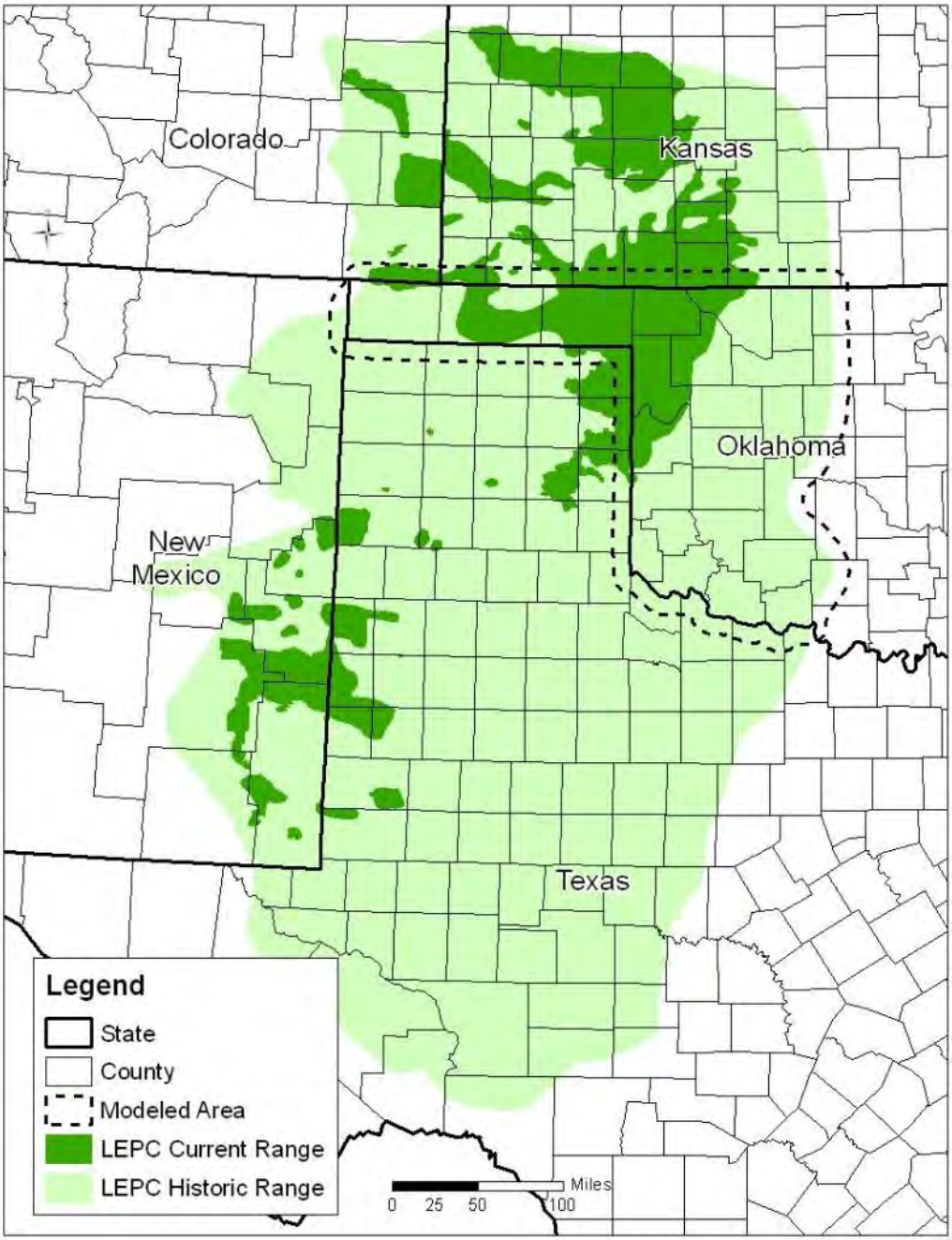


Figure 1. The current and historical ranges of LEPC in Oklahoma. Map from Horton et al. (2010).

PLAN SCOPE AND PURPOSE

The OLEPCCP plan addresses:

- The science describing the habitat and other needs of LEPC's and its management, and identification of research/data gaps.
- The characteristics of high quality LEPC habitat, the types of management that would contribute to the maintenance or restoration of this quality habitat, and how much habitat is needed – and its distribution – to maintain viable LEPC populations.
- How LEPC conservation can be conducted while minimizing effects on human economies and developments.
- Appropriate habitat improvement/conservation goals and long-term management actions/strategies to achieve these goals.
- Coordinated strategies to implement management actions – including interagency coordination and incentives or other programs that will make restoration and maintenance of LEPC habitat economically viable for landowners.

This OLEPCCP is designed to parallel efforts such as planning being conducted by the Lesser Prairie Chicken Interstate Working Group, the Natural Resource Conservation Service's Lesser Prairie Chicken Initiative (LPCI) and other such conservation efforts. It focuses on LEPC needs in Oklahoma while recognizing that populations of the species in Oklahoma must connect to and interact with populations in neighboring states. It uses mapping results generated by the Southern Great Plains Crucial Habitat Assessment Tool (CHAT) and the Oklahoma LEPC Spatial Planning Tool, but presents a more specific mapping and planning output than these tools.

BACKGROUND AND PLAN DEVELOPMENT

PROJECT FRAMEWORK

The OLEPCCP has been developed using input from a diversity of information sources as well as from the public. The steps involved in the planning process have included:

- Establishment of a science team of LEPC experts who provided recommendations for population goals, habitat needs to support the population goals, and a habitat evaluation model for use in describing and quantifying LEPC habitat quality.
- Establishment of an implementation team of agency and organization biologists and managers who have responsibilities for delivery of LEPC programs on public and private lands to make recommendations concerning LEPC management programs and their interactions.
- Meetings to gather input and recommendations from the wind and transmission industries, oil and gas industries, and ranching representatives.

DRAFT

- Meetings with landowners and the public to obtain input and recommendations on their concerns and interests in LEPC conservation programs.
- Establishment of a LEPC plan website on the ODWC website to provide the public with information about the planning process. (http://www.wildlifedepartment.com/wildlifemgmt/lepc/action_plan.htm).
- Preparation and release of two draft versions of the OLEPCCP on the ODWC website and at public meetings for review and input.
- Modifications to the draft plans.
- Preparation and release of the final plan.

After the release of this second draft of the plan, a second set of public meetings as well as opportunities to comment through the internet, email, or mail will occur. Using this additional input, a final management plan will be produced .

Scoping and Information Sources

Science Team

A science team was established to assist with the compilation and review of available information on LEPC in general and specifically to assess what is known about LEPC in Oklahoma. More specifically, this team reviewed LEPC habitat requirements, responses to threats or stressors, population and habitat goals to maintain a viable population of LEPC in Oklahoma, and recommendations for needed management actions. Members of the science team included experts on LEPC associated with agencies, universities, and organizations:

- Russ Horton and Doug Schoeling with ODWC,
- Christian Hagen with Oregon State University and the U.S.D.A Natural Resource Conservation Service (NRCS),
- Ken Collins with the USFWS,
- George Thomas with the U.S. Bureau of Land Management (BLM),
- Terry Bidwell, Dwayne Elmore, and Sam Fuhlendorf with Oklahoma State University (OSU),
- Steve Sherrod, Don Wolfe, and Lena Larsson with Sutton Avian Research Center, and
- Chris Hise with The Nature Conservancy (TNC)

Implementation Team

An implementation team for LEPC planning in Oklahoma was established to compile information and coordinate management programs for implementing the OLEPCCP. The implementation team included representatives from agencies and organizations involved with LEPC management in Oklahoma:

- George Thomas, BLM
- Steve Glasgow and Brandon Reavis , NRCS

DRAFT

- Erik Bartholomew, Jena Donnell, Steve Conrady, Rich Fuller, Alva Gregory, Mel Hickman, Russ Horton, Mark Howery, Scott Parry, Allan Janus, Alan Peoples, Mike Sams, Doug Schoeling, Rod Smith, Kyle Johnson, Alan Stacey, Weston Storer, Larry Wiemers, and Eddie Wilson, ODWC
- Clay and Sarah Pope, Oklahoma Association of Conservation Districts (OACD)
- Angie Burckhalter, Oklahoma Independent Petroleum Association
- Ron Voth, Oklahoma Prescribed Burn Association
- John Hendrix, USFWS
- Bryan Hajny, U.S.D.A. Forest Service (USFS)
- Jay Pruett and Chris Hise, TNC
- Marla Peek, Oklahoma Farm Bureau

Input from Energy Companies and Landowners

Energy companies representing wind, transmission, oil and gas interests were invited to various meetings and to provide input to the development of the OLEPCCP. Specific meetings were held with wind energy and transmission companies and with oil and gas industry. Following these initial meetings, energy interests were invited to joint meetings held with agencies and other organizations interested in LEPC conservation planning and management. In addition, discussions took place with representatives of Oklahoma Farm Bureau, Oklahoma Cattlemen's Association and the Oklahoma Corporation Commission to obtain some initial input to the planning process. These groups were invited to the subsequent joint meetings.

Three informal focus group meetings with landowners were held in early March 2012 in Beaver, Buffalo, and Woodward, Oklahoma to gain their thoughts and viewpoints on the planning process. Public meetings on drafts of the plan were announced and held in Beaver and Woodward to gain input from landowners on their concerns and to determine what programs would be most effective in obtaining voluntary involvement of landowners for LEPC conservation.

Habitat Needs

The approach developed for the OLEPCCP was to describe LEPC habitat requirements based on available information, use this information to build a LEPC habitat model for Oklahoma. In addition, LEPC habitat needs were related to reference communities described for ecological sites as developed by NRCS (http://esis.sc.egov.usda.gov/). This allowed for development of an ecosystem-based framework to identify what is desired in terms of habitat conditions and potential locations for LEPC habitat in OK.

A population goal that represents the current estimate of the minimum desired LEPC population size to maintain a viable population in Oklahoma was recommended by the LEPC science team and used as the basis for identifying desired amounts and distribution of habitat to be maintained or restored in the state. The desired habitat conditions were described and quantified in reference to native ecosystems.

DRAFT

Habitat Requirements

During the breeding season (primarily mid-March- May), male LEPC congregate on lek sites and perform courtship displays to attract females for mating. Nests are initiated mid-April through late May, typically within 2 weeks of lek attendance and copulation (e.g., Bent 1932, Copelin 1963, Snyder 1967, Merchant 1982, Haukos 1988). Hatching peaks in late May through mid-June throughout the range (e.g., Copelin 1963, Merchant 1982). Re-nests (following nest depredation or abandonment of the initial clutch) are initiated mid-May through early June, with hatching mid-June through early July (e.g., Merchant 1982, Pitman et al. 2006). In the autumn and winter, birds assemble into mixed flocks feeding primarily in sand sage, shinnery oak, or mixed-grass prairies, but also often in waste grain fields (Hagen and Giesen 2005).

Habitat components necessary to fulfill LEPC life history needs include nesting habitat, brood-rearing and summer habitat, and autumn/winter habitat. The average home range of an individual bird is about 4 square miles (Giesen 1998, Riley et al. 1994, Taylor and Guthery 1980c). However, the collective home range of all birds that attend a particular lek site averages approximately 19 square miles (>12,000 acres) (Bidwell et al. 2003), indicating much larger areas are needed to ensure the long-term persistence of LEPC populations (Elmore et al. 2009). Although the minimum habitat patch size to support LEPC is not clear, several studies have speculated that habitat mosaics containing patches ranging from 1,200 to 25,000 acres of contiguous native rangelands may be necessary to sustain viable LEPC populations (Davison 1940, Copelin 1963, Crawford and Bolen 1976a, Taylor and Guthery 1980b, Wildlife Management Institute 1999, Woodward et al. 2001, Bidwell et al. 2003).

Leks

LEPC have high fidelity to lek sites (Campbell 1972) and males often use traditional leks sites year after year. Lek sites are characterized by sparse, low vegetation (less than 4" (10 cm)) and are often located on a knoll or ridge, or grama-grass (*Boutela* spp.) flat (Jones 1963, Copelin 1963, Cannon and Knopf 1979, Taylor and Guthery 1980a, Giesen 1991). Disturbed areas such as roads, abandoned oil and gas well pads, areas around livestock watering facilities, herbicide treatments and prairie dog towns (Crawford and Bolen 1976a, Davis et al. 1979, Sell 1979, Taylor 1979, Ahlborn 1980, Locke 1992, Bidwell et al. 2003) may also be used as lek sites. Jones 2009 reported on a lek being established in a sand sagebrush site one year after a burn. A study conducted by Jarnevich and Laubhan (2011) indicated that areas with slight topographic relief are favored.

To ensure a viable population, Applegate and Riley (1998) recommended clusters of 6-10 or more leks, each with a minimum of six males, separated from one another by a distance of 1.2 miles or less. A number of studies have reported distances between leks of a mile or less (Crawford 1974, Crawford and Bolen 1976a, Taylor 1979, Locke 1992, Jamison et al. 2002a). If each lek in the cluster was surrounded by a 2 mile radius area (i.e., the minimum breeding season patch size around a lek), the entire cluster of leks and core habitat complex might occupy up to 32 square miles (~21,000 acres), with a wider

perimeter of habitat for autumn and winter foraging and escape cover. This is more or less consistent with the 25,000-acre estimate of Bidwell et al. (2003) for a lek complex.

Leks were not considered by the LEPC science team to be a limiting factor to LEPC in Oklahoma. Generally, there are sufficient areas with appropriate conditions for use as leks to meet this LEPC habitat requirement. For this reason, leks were not specifically incorporated into the habitat model developed for LEPC conservation in Oklahoma. However, leks are very important in management for LEPC as they help wildlife managers understand the distribution and trends of LEPC in an area, and indicate where birds are finding nesting habitat. Monitoring of leks (discussed below) is an important component of an LEPC management plan. While it is difficult to assess densities of LEPC populations from lek data, this information does provide a valuable index of the population status of LEPC in an area over time. Further, lek locations provide valuable information on where maintenance and improvement of nesting and brood rearing habitat will be most effective. The presence of birds on leks reveals that at least minimum quality habitat exists in the area and that birds are present to respond to habitat improvements. Leks are therefore considered an important consideration in developing management plans for specific sites.

Nesting Habitat

Female LEPC typically select nest sites within 2 miles of leks (Suminski 1977, Riley 1978, Giesen 1994b). Pitman et al. (2006) reported that the majority of hens they monitored nesting within 1 mile of a lek, but not necessarily the lek where they were captured. The importance of shrub and herbaceous cover as a key component influencing nest fate of LEPC is well documented (e.g., see Davis et al. 2008). In sand sagebrush-grasslands, nests are most often in sand sage or in tall bunchgrasses (Giesen 1994b, Pitman et al. 2005, 2006). Further, successful nests are typically associated with greater heights and cover of shrubs and/or tall perennial grasses (e.g., native bluestems) (Davis et al. 1979, 1981; Riley et al. 1992, Patten et al. 2005, Davis 2009, Lyons et al. 2011). Typically the height and density of shrubs, forbs, or residual grasses are greater at the nest site than in the surrounding rangeland, and are greater at successful nests than at unsuccessful nests (Riley 1978, Davis et al. 1979, Wisdom 1980, Haukos and Smith 1989, Riley et al. 1992, Pitman et al. 2005, Patten et al. 2005, Davis 2009, Lyons et al. 2011). In southwestern Kansas, LEPC that nested in areas with denser cover were more successful in hatching nests than females with less cover (Hagen et al. 2007b). A maximum height selection for grasses and shrubs appears to be around 18- 20 inches (Lyons et al. 2011). In Conservation Reserve Program (CRP) grasslands planted to mixed, native warm-season grasses, nests are predominately found in mid- and tall grasses such as western wheatgrass (*Pascopyrum smithii*), little bluestem (*Schizachyrium scoparium*), big bluestem (*A. gerardi*), and switchgrass (*Panicum virgatum*), where clumps of tall residual vegetation from the previous growing season are common (Fields 2004). Nests have been found in CRP planted to Old World bluestems (*Bothriochloa* spp.) (Wolfe et al. 2003) but such stands are generally thought to offer poorer quality nesting habitat than native warm season grass stands.

Brood Habitat

Areas used for brood-rearing are usually within 1.8 miles of lek sites and typically have more forbs, and less grass cover than nesting sites (Ahlborn 1980, Applegate and Riley 1998). Brood-rearing locations are usually associated with higher levels of insect abundance (Jamison et al. 2002b, Hagen et al. 2005) and where chicks can move easily on the ground (Bidwell et al. 2003). Active sand dunes with shrubs, especially within shinnery oak or sand sagebrush vegetation types are common in brood-rearing habitat. Jones (2009) reported male LEPC and females with broods using sand sagebrush areas one and two years following a burn. Greater forb density was found in these areas. Shrubs and hybrid shinnery – post oak mottes have been reported to be used for shade in summer (Copelin 1963, Donaldson 1969, Bell 2005 Larsson et al. 2012) for thermoregulation during high temperatures (Bell et al. 2010, Larsson et al. 2012). At higher temperatures, LEPC broods in New Mexico selected locations with more over-head cover and taller plant heights (Bell et al. 2010). There was also evidence that sand shinnery oak was preferred habitat irrespective of temperature (Bell et al. 2010).

Autumn/Winter Habitat

LEPC typically range across larger areas during the autumn and winter months, occupying the same general vegetation types as are used for nesting and brood-rearing (Giesen 1998). LEPC were found to use mixed-grass, sand sagebrush, or shinnery oak for resting and roosting (Taylor and Guthery 1980a). The birds feed in these vegetation communities, or may congregate in agricultural fields with waste grains as long as they are located in close enough proximity of rangelands that provide adequate cover for resting and concealment (Jones 1964, Crawford and Bolen 1976c, Ahlborn 1980, Taylor and Guthery 1980b, Jamison 2000). Shinnery oak provides leaves, catkins, acorns, and insect galls as seasonal food resources.

Larsson et al. (2012) hypothesized that LEPC mortality from predation rises when birds are more exposed, with highest risk occurring during the breeding season when cover is sacrificed by males attending leks and when hens are searching for nest sites. Predation risk was also hypothesized to be high in winter when the birds seek solar radiation for warmth to avoid hypothermia (Larsson et al. 2012). It is therefore important that vegetation (height and density) is maintained for autumn/winter habitat to provide microclimatic variation.

The Oklahoma LEPC science team discussed autumn/winter habitat and concluded that while it is an important habitat component, the requirements for autumn/winter will be adequately met if high quality nesting and brood rearing habitat is provided. For this reason, autumn/winter habitat was not treated as a separate habitat need in the LEPC habitat model.

Threats and Stressors

The Oklahoma LEPC habitat model has a primary purpose of describing desired conditions for nesting and brood rearing habitat with a focus on native ecosystems to maintain LEPC in Oklahoma. However, conversion of habitat to other land uses and various threats and stressors to LEPC must also be considered relative to the existing and potential future uses of lands within LEPC range. It is important

DRAFT

to understand these interactions, and to quantify them to the extent possible given current knowledge of these relationships.

HABITAT FRAGMENTATION AND GENETIC CONCERNS

Habitat fragmentation is the process of breaking up large tracks of a species' habitat into smaller patches that may then become separated from other suitable habitat patches by intervening areas of unsuitable conditions reducing overall habitat quality or in some cases isolating populations. LEPC require some natural variability or "patchiness" in conditions to provide for the needs for leks, nesting, brood-rearing, and winter habitat which have some differences in conditions, as indicated above. They also have the ability to fly moderate distances among habitat patches, although longer travel distances may increase vulnerability to predation or other hazards (Elmore et al. 2009) but no specific research on this has been conducted. Historically, LEPC habitat patchiness was provided by the combination of variation in soils, topography and other features, and was further influenced by natural fire and grazing regimes. This historical landscape has been significantly modified through conversions to agriculture, changes to grazing and fire regimes, tree invasions, energy developments, and other factors (Elmore et al. 2009). Much of the remaining suitable habitat within the geographic distribution of LEPC has become fragmented (Crawford 1980, Braun et al. 1994). According to Davis et al. (2008) "Fragmentation may threaten local LEPC populations through several mechanisms: habitat juxtaposition and remaining patches of rangeland may be smaller than necessary to support populations (Samson 1980); necessary habitat heterogeneity may be lost; habitat patches may accommodate high densities of predators; and LEPC interchange among suitable patches of habitat may decrease, possibly affecting genetic viability (Wilcove et al. 1986, Knopf 1996)".

Davis et al. (2008) also noted: "Recent LEPC declines in the southern portion of its range in New Mexico, although probably at least in part drought-related, have led to concern over the effects of fragmentation caused by oil exploration and drilling. While it is often difficult to describe cause-and-effect linkages among specific sources of fragmentation and eventual population responses, recent studies have found LEPC population declines in Oklahoma and New Mexico to be associated with several measures of overall habitat fragmentation, including patch size, edge density, and total rate of landscape change (Woodward et al. 2001, Fuhlendorf et al. 2002)."

Habitat fragmentation may lead to changes in the genetics of isolated populations. In a range-wide evaluation of LEPC, birds from New Mexico had the fewest haplotypes and were markedly different from other populations, suggesting that LEPC in New Mexico have been isolated from other populations across their range (Hagen 2003, Hagen et al. 2010). In addition, estimates of genetic diversity within 4 semi-isolated leks from the Caprock Wildlife Habitat Management Area in New Mexico suggested increased inbreeding leading to an increase in homozygosity within the leks studied (Bouzat and Johnson 2004). Current genetic effective population size (N_e) estimates of LEPC in New Mexico and Oklahoma are low, while long-term N_e assessments indicate that the Oklahoma population was historically larger or fluctuated less in size than the New Mexico population (Pruett et al. 2011). Although no deleterious effects to demographic rates have been documented in New Mexico LEPC

populations (Van Den Bussche et al. 2003), inbreeding can result in a loss of genetic diversity and a reduction in reproductive fitness (Bouzat et al. 1998 a, b). Using demographic rates, the New Mexico effective population size and census size ratio (N_e/N_c) estimate was higher than in Oklahoma where the female survival rate and life span was significantly lower (Patten et al. 2005, Pruett et al. 2011). Similar contemporary genetic estimates and slightly higher genetic diversity in Oklahoma are likely the result of retention of ancestral diversity or gene flow. The current level of fragmentation may influence demographic processes such as dispersal and, consequently, genetic interchange (Bellinger et al. 2003, Johnson et al. 2003, Bouzat and Johnson 2004, Johnson et al. 2004). Resistance to disease and the ability of populations to respond to environmental perturbations may also decrease with the loss of genetic variation (Lacy 1997). Thus, loss of genetic variation may negatively impact the long-term viability of LEPC populations across their 5-state range.

Agriculture and Other Land Uses

Change in land use refers to a change from a native ecosystem condition to another land use that represents a long-term or permanent change. For example, settlement of the southern Great Plains introduced farming and an accompanying availability of small grains. This changed the foraging habits of LEPC throughout the 5-state range. Early farms were scattered, relatively small in acreage, and dryland cropping methods (e.g., corn, wheat, sorghum) were inefficient. This resulted in localized winter food sources and possibly increased over-winter survival of LEPC. However, as the landscape pattern shifted from predominantly native prairie with a scattering of grain fields to the inverse, the reduced nesting and brood-rearing cover began to have a detrimental effect on LEPC populations. As discussed by Davis et al. (2008), many authors cite the extensive conversion of native grasslands to cropland as an important factor in the decline of LEPC habitat as it reduces available nesting habitat and thereby reduces numbers of breeding birds (Copelin 1963, Jackson and DeArment 1963, Crawford and Bolen 1976a, Crawford 1980, Taylor and Guthery 1980a, Braun et al. 1994).

As reported by Crawford and Bolen (1976a), landscapes in which more than 37% of native rangeland has been converted to cropland or other uses may be incapable of supporting LEPC, and populations have declined in areas with only 20% rangeland conversion. Within the 5-state range where LEPC occur, much of the arable lands for dryland crops were in use by the 1960s and the development of center-pivot irrigation systems resulted in another period (1970-1985) of extensive habitat conversion from native grassland to areas of irrigated cultivation. Davis et al. (2008) summarized information on effects of agricultural conversions on LEPC noting that in Kansas, LEPC avoided nesting within 300-400 yards of fields with center-pivot irrigation, effectively increasing the impact footprint of irrigated croplands (Pitman et al. 2005). Although irrigated cropland has eliminated or fragmented a significant amount of sand sagebrush prairie within the range of the LEPC in Kansas (Jensen et al. 2000), water conservation measures have limited the increase in center-pivot irrigation since 1981 (Robb and Schroeder 2005). Additionally, irrigation drawing on the Ogallala aquifer has resulted in extensive conversion of LEPC rangelands to croplands in Texas and Oklahoma (Leslie et al. 1999, Massey 2001). Because nesting and brood-rearing are critical to population stability (Hagen et al. 2009) further conversion of native rangeland to cropland in important LEPC habitat should be discouraged.

DRAFT

EFFECTS OF ANTHROPOGENIC STRUCTURES

The effects of anthropogenic structure and activities on LEPC habitat use and population parameters remain one of the most important research needs for this species. In particular, additional research is needed on the effects of wind energy development, oil and gas development, transmission and utility lines, roads, buildings, and other anthropogenic structures and activities on LEPC. Research conducted in one study in Kansas reported on in multiple publications provided information on habitat use by LEPC in relation to anthropogenic structures (Pitman 2003, Pitman et al. 2005, 2006, Hagen 2003, 2010, Hagen et al. 2011, Robel et al. 2004). Pitman et al. (2005) found that LEPC had a lower probability of nests occurring closer to most anthropogenic features (transmission line, buildings, improved roads, center pivot fields) than a similar number of randomly located nests. For oil wells, they found that the closest nests were significantly farther away than random points in one of their study areas but not in the second study area, while nest locations did not differ significantly from random points for unimproved roads. Mean distance of nests from these structures were substantially greater than random nest locations, while the closest nests found in each of two study areas to transmission lines were 852 and 467 ft., to oil wellheads were 454 and 175 ft., to buildings were 6,321 and 3302 ft., to improved roads were 4944 and 654 ft., and to center pivot fields were 3700 and 548 ft. Hagen et al. (2011) reported that home ranges of LEPC in this same study were farther from anthropogenic structures than from randomly selected points. Hagen et al. (2011) proposed the following siting guidelines to protect 90% of breeding and summer habitat of LEPC: transmission lines ≥2,268 ft, oil and gas wells ≥972 ft, buildings ≥4,536, paved roads ≥2,754 ft, and ≥ 4,536 ft setback for wind turbines. Pruett et al. (2009b) raised the concern of transmission lines possibly deterring movements of LEPC.

A significant challenge in determining the effects of anthropogenic structures on LEPC is finding unbiased methods of analysis. The best design would be a replicated BACI (before, after, control, impact) design, but these are very difficult to produce. Hagen et al. (2011) reported on a BACI design for the construction of a transmission line through their study area in Kansas. They reported that in the first year post-treatment, "centers of [LEPC] use were closer to power lines than would be expected at random in the impact area," which they attributed to the fidelity of the birds to their pre-construction habitat use. They recommended that longer-term studies with replicated designs are needed. Other studies have attempted to look at locations of nests or home ranges derived from telemetry data of LEPC, comparing the distance of these telemetry points to anthropogenic structures compared to distances of random points to these structures. Such analyses must be careful to assure that the comparisons do not have biases incorporated into the design, especially with regard to how random points as a comparison are generated.

LEPC require large, mostly-contiguous tracts of shrub and grassland ecosystems to fulfill their life history requirements. The cumulative impacts of anthropogenic structures and activities not only result in direct habitat loss but may fragment remaining suitable habitat and deter use by LEPC (Pitman et al. 2005). LEPC seem to have a general avoidance of improved roads, power lines, and other man-made infrastructures (Pitman et al. 2005). LEPC leks adjacent to heavily traveled roads were abandoned at a higher rate than those found further from anthropogenic disturbance (Crawford and Bolen (1976b).

Davis et al. (2008) reported: "Studies to assess whether noise from oil and gas exploration may have played a role in the abandonment of a number of historically active lek sites in southeast New Mexico show that abandoned lek sites were exposed to higher ambient sound levels than active sites (Hunt 2004). The same study also reported a significantly higher number of operating wells within one mile of abandoned lek sites." For a species that relies on auditory communication it is unknown whether this pattern of lek abandonment reflects sensitivity to noise or some other form of disturbance.

Few studies have examined the impacts of oil and gas developments on LEPC (Beck 2006, 2009). Hunt (2004) found evidence that oil and gas activities increased the likelihood of lek abandonment by LEPC in New Mexico. Pitman et al. (2005), Hagen (2003, 2010), Hagen et al. (2011), and Robel et al. (2004) reported on LEPC locations in comparison to oil pads and roads on two study areas in Kansas, as reported above. Thus, evidence exist that oil and gas development can cause avoidance by LEPC for lek locations, nest locations, and home ranges. Causative factors could be noise, disturbance, presence of structures, or combinations of these (Beck 2006, 2009). Additional research on oil and gas impacts on LEPC is needed to determine the causes and extent of LEPC avoidance.

Presently, empirical data are lacking on how wind power developments affect LEPC and/or LEPC habitats. Areas within remaining occupied LEPC habitat are currently being evaluated for possible wind energy sites. In Oklahoma, Pruett et al. (2009a) reported that there are approximately 250 wind turbines in LEPC range with at least 1,300 more proposed. These developments include the towers and turbines that harness the energy, as well as access roads, and transmission line connections to substations or other existing power grids. Physical disturbance affected by the construction of turbines, turbine noise, and physical movement of turbines during operation have the potential to disturb nesting LEPC (Robel et al. 2004). The effects of habitat fragmentation may indirectly affect local LEPC populations by decreasing the area of habitat available for nesting and brood-rearing (Pitman et al. 2005). The USFWS recommended that wind turbines be erected ≥ 5 miles from prairie grouse lek sites (Manville 2004). Anecdotal observations of LEPC habitat use around wind energy developments have reported both the presence of birds close to the facilities and abandonment of areas where major wind facilities have been constructed. Clearly more research on the effects of anthropogenic structures and especially wind energy facilities on LEPC is needed. However, given the documented avoidance of LEPC to other anthropogenic structures, some level of avoidance of wind facilities and associated activities is expected.

Livestock Grazing

The Great Plains historically supported large herds of bison (*Bison bison*) and other native herbivores that grazed the grass and shrub ecosystems in varying intensities. This produced a mosaic of plant communities representing lightly to heavily grazed areas, each of which provided habitat to various species of wildlife (Bragg and Steuter 1996, Knopf and Samson 1997). Grazing by wildlife or domestic livestock is essential to maintain the health of native grass and shrublands of the Great Plains. LEPC habitat likewise depends upon a range of grazing conditions, with substantial areas of moderately and lightly grazed areas necessary at a landscape scale to maintain LEPC habitat (Bidwell et al. 1995). In

DRAFT

some locations, past grazing pressures have produced short-grass plant communities leaving insufficient amounts of lightly grazed conditions to support good quality LEPC nesting habitat (Crawford 1980, Jackson and DeArment 1963, Davis et al. 1979, Taylor and Guthery 1980a, Davies 1992). Uniform livestock grazing over large areas, even at moderate grazing levels, or grazing practices that do not leave adequate residual herbaceous cover in the spring are considered detrimental to LEPC populations (Bent 1932, Davis et al. 1979, Crawford 1980, Bidwell and Peoples 1991, Riley et al. 1992, Giesen 1994b) as these produce grass heights that are below that necessary for nesting cover and also shift composition of plant communities so that desirable food and cover plants can be reduced below desired levels.

Residual cover at and around nests is an important component of nest success providing better concealment from predators (Davis et al. 1979, Wisdom 1980, Riley et al. 1992, Giesen 1994b, Pitman et al. 2005, Patten et al. 2005). Intensive and/or persistent grazing on sandy soils may reduce or eliminate residual tall grass cover needed for nesting (Davis et al. 1979, Riley et al. 1992, Berg et al. 1997, Sims and Gillen 1999). Other studies have reported that tall grasses are important for successful nesting (Hoffman 1963, Jackson and DeArment 1963, Litton et al. 1994, Lyons et al. 2011). In clayey soils, heavy grazing pressure may result in conversion of tall and mid-grass communities to shortgrass-dominated plant communities (Quinn and Walgenbach 1990) with lower LEPC habitat quality. Changes in species composition, vegetative structure of plant communities, and overall density of plants negatively impacted LEPC numbers (Hunt and Best 2010) and are considered a major reason for declines in LEPC populations (Taylor and Guthery 1980a, Leslie et al. 1999, Mote et al. 1998, Bailey et al. 2000).

Davis et al. (2008) reported: "The impacts of grazing on LEPC can vary widely, depending on climatic conditions, the state or health of range vegetation, and the type of grazing regime utilized. Drought tends to magnify grazing impacts, as both processes reduce plant cover (Giesen 2000). When forage is reduced by drought, what remains tends to be grazed more heavily unless animal numbers are reduced. As a result, some grazed areas may supply adequate habitat during periods of normal rainfall, but may be unable to support LEPC during droughts (Merchant 1982)."

Altered Fire Regimes

Davis et al. (2008) provided a good description of the relationship of fire to LEPC: "Fire was a naturally occurring form of disturbance on the pre-Columbian Great Plains and was ignited not only by lightning but, for at least 12,000 years, also by aboriginal Americans. The impact of fire was a major force in shaping the structure of the vegetation community (e.g., Knopf and Samson 1997). The long history of large ungulate herbivores on the Great Plains is also well accepted (Milchunas et al. 1988). Large ungulates are attracted to recently-burned areas by the new growth that is typically more palatable and of greater nutritional quality than vegetation in unburned areas. In turn, recently burned and, consequently, heavily-grazed areas supported more forbs and were less likely to burn in subsequent years due to a reduction in grass litter." This effect of this historical pattern, known as the fire-grazing interaction, createf a mosaic of patches (burned/unburned, heavily grazed/lightly grazed, dominated by forbs/dominated by grasses) that shifted spatially over time (Vinton et al. 1993, Hartnet et al. 1996, Fuhlendorf and Engle 2001). Since LEPC tend to nest in areas with greater heights and density of grasses

(e.g. Riley et al. 1992, Pitman et al. 2005, Lyons et al. 2011) but then move their just-hatched chicks to areas with less grass, more forbs, and greater insect availability (e.g. Bidwell et al. 2003, Jamison et al. 2002b, Hagen et al. 2005, Bell et al. 2010), this historical shifting mosaic well satisfied their critical reproductive needs.

Average intervals of fire return to any given area varied and were generally more frequent in eastern sections of the Great Plains where litter accumulation rates were greater. Within the range of the LEPC, fire return intervals varied from an average of 5 years in eastern sections of the range to 10-20 years in the more-arid, westernmost parts of the species' range (Hann 2003, Masters 2004). Since widespread European settlement in the 1800's, the frequency and scale of deliberately-set fires have greatly diminished and, where possible, lightning-ignited fires have been actively suppressed. Suppression of the historical fire regime, along with fencing of the prairies, interrupted the fire-grazing interaction and initiated an alteration of vegetation communities on the Great Plains that has diminished habitat quality for LEPC. Not only has the shifting mosaic been muted but, with little or no fire, woody plants have encroached onto grasslands where they were once uncommon. Fire suppression has also increased the stature and dominance of shrubby species (e.g. shinnery oak) and the vigor of herbaceous prairie vegetation has been diminished. With insufficient fire, woody invasion is accelerating in a positive-feedback process that seriously threatens the quality of the grasslands remaining available to LEPC.

Even when prescribed fire is used as a part of range management, such fires are typically less intense than the historical fires that helped mold the Great Plains landscape. With manmade structures scattered across many landscapes and landowner liability issues, prescribed fires are seldom set when wind speeds exceed 15 mph or when humidity is low enough to create effects of a pre-settlement fire during a prescribed fire event. Such fires are not as intense and, as a result, are less effective at suppressing woody vegetation than those that preceded European settlement."

Patch-burn grazing is a management tool that has been shown to create a landscape pattern and habitat structure favorable to LEPC (Fuhlendorf et al. 2006, Elmore et al. 2009).

Shinnery Oak and Sand Sagebrush Removal

Shinnery oak and sand sagebrush are two of the most important types of plant communities for LEPC habitat in Oklahoma, providing nesting and brood rearing habitat and a winter food source (Riley et al. 1992, Patten et al. 2005, Hagen and Giesen 2005). Herbicides are regularly used as a brush management practice to increase grass production for livestock. The effects of this practice on LEPC have been variable depending on the manner and extent of treatment and impacts of livestock grazing following treatment. Davis et al. (2008) reported: "Past widespread application of herbicides, such as Tebuthiuron has eliminated shinnery oak over large areas (156 square miles) administered by the Bureau of Land Management (BLM) in southeastern New Mexico, resulting in extensive loss of habitat (Peterson and Boyd 1998). However, limited reduction in densities of shinnery oak and sand sagebrush after herbicide applications did not reduce LEPC populations where adequate cover and foods remained (Donaldson 1969, Olawsky and Smith 1991) and subsequent livestock management allowed an increase in tall grasses (Davis et al. 1979, Doerr and Guthery 1983). In some locations, competition from shinnery

oak impedes restoration of grasses and forbs needed for LEPC nesting and brood-rearing." When carried out on a limited basis, shinnery oak control or suppression may help increase tallgrass cover associated with high quality habitat and LEPC nesting success (Copelin 1963, Donaldson 1969, Ahlborn 1980, Haukos and Smith 1989).

Grisham and Haukos (2011) reported on a study conducted in New Mexico that compared LEPC use of shinnery oak pastures that were either treated with Tebuthiuron herbicide and either grazed or not grazed, or not treated with herbicide and either grazed or not grazed. The herbicide treatment did not appear to affect nesting use by LEPC, but there did appear to be a preference for grazed pastures over those that were not grazed. Patten et al. (2005) reported that areas with higher levels of shrub cover (>20%) were preferred by LEPC and had higher nesting success, and cautioned that application of herbicide to reduce shrub densities could negatively affect LEPC habitat. Gregory (Oklahoma Department of Wildlife Conservation, personal communication 2012) expressed concern that herbicide control of sand sagebrush or shinnery oak might not only reduce densities of these shrub species to levels that reduce the quality of LEPC habitat, but may also reduce the abundance of forbs, further reducing the quality of LEPC habitat. Thacker et al. (2011) examined sand sagebrush pastures in northwest Oklahoma that had been treated with 2,4-D herbicide either in 1984 or 2003 and compared these to an untreated pasture, although the specifics of this treatment were not provided. They found reductions in sagebrush cover and density from both ages of treatments. In addition, they reported on a decrease in the abundance of forbs between the 2003 treatment and the untreated pastures, but an increase in forbs in the 1984 pasture compared to the untreated pasture. They cautioned that the slow response of sagebrush and forbs following 2,4-D treatments may have lasting effects on LEPC habitat.

Expired or Expiring Conservation Reserve Program (CRP) Fields

The Conservation Reserve Program (CRP) is a voluntary program that is dependent on private landowners enrolling highly erodible lands into 10-year grassland establishment agreements. As economic pressures (e.g., higher commodity prices, biofuel demands) are being placed on producers, there is growing concern that landowners may take CRP fields out of grass and put them back into production. Oklahoma currently has 665,637 acres enrolled in CRP much of which is located within the current LEPC range. Over 191,000 acres of CRP is set to expire September 30, 2012 with an additional 220,231 acres expiring through 2017. It is anticipated that most of the acres set to expire in Oklahoma during 2012 will re-enroll or be replaced with new acres during the General Sign-up 43. However, reenrollments will depend on what is set as the national cap on CRP in a new Farm Bill.

Lands enrolled in CRP might provide an important management opportunity for increasing and improving LEPC habitat. LEPC have expanded their range in response to multiple-species native grass CRP stands in the central plains, particularly in west-central Kansas (Rodgers 2005, Rodgers and Hoffman 2005). Although evaluations suggested that birds in Colorado occasionally used CRP grasslands as roosting cover (Giesen 2000, Fields et al. 2006), recent survey efforts have found LEPC using CRP grasslands for both lek and roost sites. This has been directly correlated with increasing LEPC populations in Prowers County. In New Mexico, conversion of cropland to CRP grasslands was believed

DRAFT

to have been detrimental to LEPC populations by decreasing winter food resources (Bailey and Williams 2000); however about 70-80% of the original CRP seedings in eastern New Mexico consisted of dense, single-species stands of weeping lovegrass (*Eragrostis curvula*) or Caucasian bluestem (*B. bladhii*).

Exotic old world bluestems and weeping lovegrass were extensively seeded in CRP tracts in Texas, New Mexico, and Oklahoma sections of the LEPC range but offer limited habitat value for LEPC (Rodgers and Hoffman 2005). As reported above, while LEPC nests have been found in these fields, they are generally considered to be poor nesting habitat (Wolfe et al. 2003). Efforts to replace these exotics with native species have been largely unsuccessful due to the difficulty in killing the exotic grasses (either by short-term tillage or with herbicides) and their highly competitive nature (preventing establishment of native species). However, research has shown that CRP can provide suitable habitat for LEPC if planted in a diverse native grass/forb mixture, managed for suitable vegetation structure, and if located near occupied native rangelands (Hagen et al. 2004, Fields et al. 2006, McLachlan et al. 2011). Modeling efforts have further demonstrated that land enrolled in CRP may potentially increase the carrying capacity of the landscape for LEPC by as much as 10-30% for the central mixed-grass and shortgrass regions of the species' range, respectively (McLachlan et al. 2011). Thus, CRP can be an effective conservation tool for LEPC and has the potential to sustain, and possibly increase LEPC numbers (Ripper et al. 2008).

Drought and Climate Change

Davis et al. (2008) reported: "Drought impacts LEPC through its effect on seasonal growth of vegetation necessary to provide nesting and roosting cover, food, and escape from predators (Merchant 1982, Peterson and Silvy 1994, Morrow et al. 1996). Major droughts of the 1930s, 1950s, and early 1990s markedly reduced LEPC populations across their range (Hagen and Giesen 2005). Increased annual precipitation resulted in small population increases in the mid-1980s, but drought conditions in early 1990s caused noticeable range-wide declines (Giesen 1998). The sensitivity of LEPC to drought was discussed by Crawford (1980) and Hamerstrom and Hamerstrom (1961); home ranges may be larger in drought years (Copelin 1963, Merchant 1982), and recruitment may be less likely after drought years (Merchant 1982, Morrow 1986, Giesen 1998). Southern portions of LEPC range in New Mexico, which on average receive less total precipitation (e.g., the Carlsbad region), are impacted more frequently and more severely by drought. LEPC populations in these areas may have always been smaller and more variable than those farther to the north, although population data are insufficient to say this with certainty. Along with other prairie grouse, LEPC have a high reproductive potential in years of adequate conditions. Thus, drought conditions are unlikely to be the sole causative factor in long-term LEPC population declines. The effects of drought on population growth rate may be more significant in small, fragmented populations."

Global climate change poses a significant threat to LEPC through a variety of mechanisms. In particular, climate shifts over the last 30 years indicate the southern Great Plains will experience drier summers, wetter springs in the north, drier springs in the south, and more frequent extreme weather events throughout, including both floods and extended drought (Matthews 2008, Karl et al. 2009, Boal et al.

DRAFT

2010). More extensive and severe droughts could reduce the number of years with favorable moisture conditions and impact LEPC populations. Although there is limited research demonstrating how avifauna will respond to regional climatic shifts, increasing temperatures could result in a northward expansion of wildlife populations (Peterjohn 2003) assuming adequate habitat conditions are available, and projected decreases in precipitation and estimated vegetation changes may reduce LEPC habitat in some areas (McLachlan et al. 2011). Range shifts are already occurring in some Great Plains species (Root et al. 2003). Climatic shifts may occur more quickly than species and their habitats can correspondingly shift northward, potentially creating a disconnection between appropriate climatic conditions and suitable habitat conditions (Inkley et al. 2004). As drought has been reported to negatively affect LEPC, predicted increases in future drought events could have negative consequences on LEPC populations.

Cumulative Anthropogenic Stressors

The LEPC is sensitive to habitat fragmentation caused by anthropogenic features and habitat conversion (Crawford and Bolen 1976, Pitman et al. 2005, Hagen et al. 2011) and requires large contiguous patches of suitable habitat (Crawford 1974, Hagen et al. 2004). Research has documented avoidance by nesting LEPC of roads and various forms of infrastructure that occur in rangeland habitat (Hagen et al. 2004, 2011, Robel et al. 2004, Pitman et al. 2005, Hagen 2010) and areas with human activity (Pitman et al. 2005). Moreover, LEPCs can collide with power lines and fences, causing injury and mortality (Bidwell et al. 2003, Wolfe et al. 2007). Collectively, these studies suggest that anthropogenic features can influence habitat use, pose potential barriers to movement, and can cause substantial mortality of LEPC (Wolfe et al 2007, Hagen et al. 2011).

Direct mortality associated with vehicle collisions have been reported for LEPC, but this is a relatively small percentage of overall mortality in prairie grouse (Wolfe et al. 2007). Collisions with utility lines resulted in approximately 5% of known LEPC mortalities Kansas (Hagen et al. 2007b), and was similar to collision rates reported for prairie-chickens in Oklahoma (3% and 5% for lesser and greater prairie-chickens, respectively) (Wolfe et al. 2007, Pruett et al. 2009a). In addition, results from Behney (2009) suggested that the density of utility poles may influence raptor density and suggested that LEPC may avoid vertical structures because of risk of predation by raptors, and the use of such structures by raptors as observation sites for hunting. Although Behney (2009) found vertical structures are unlikely to influence predation of LEPC by raptors at leks, power lines placed near leks may negatively affect breeding activities of males because of behavioral avoidance. The presence of a power line may fragment LEPC habitat even if raptors are not present (Hagen et al. 2011) and may cause LEPC avoidance of otherwise suitable nesting and brood-rearing habitat and thus further restrict the LEPC range (Behney 2009).

Recent work on greater sage-grouse (*Centrocercus urophasianus*) suggested sage-grouse fence collisions during the breeding season are relatively common and widespread (Stevens 2011), and corroborate previous studies suggesting collisions with fences may reduce LEPC survival (Wolfe et al. 2007). In Oklahoma, collision mortality was second only to avian predation in causes of mortality for radiomarked

LEPC (Wolfe et al. 2007). Of the documented collisions, 86.4% of the mortalities were classified as fence collisions, while the remainder involved power lines and automobiles (Wolfe et al. 2007). Hagen et al. (2007b) found that mortality causes of 92 LEPC in their study had low levels of mortality from fences or power lines. Both Patten et al. (2005) and Wolfe et al. (2007) speculated the increased extent of fencing, power lines, and landscape-scale infrastructure fragmentation in Oklahoma likely increased LEPC collision mortality over what they observed in New Mexico. Ligon (1951) expressed concern that spread of these anthropogenic features might limit LEPC populations. However, the full extent of collision mortality is not known and is difficult to measure. Regardless, these studies add to the growing evidence that LEPC are susceptible to fence collision and frequency of collision is likely more widespread than previously believed.

Habitat Suitability Model for LEPC

The LEPC science team developed a habitat suitability model for LEPC in Oklahoma. The habitat model was guided by all of the research currently available on the habitat needs of LEPC. In particular, information such as habitat parameters that have been shown to be selected for by LEPC helped guide the selection of variables to include in the habitat model as well as levels of the variables that appear to exceed the specific selection by the species. Further, the values for variables were evaluated in comparison to what various sites have been found to be capable of producing based on vegetation samples collected for various purposes by NRCS, ODWC, OSU, or others represented at the science team. The team then developed their best estimate of the relationship between LEPC habitat quality and the specific habitat variable. The model uses graphs that depict the best estimates of the relationship of specific vegetation attributes (variables) to LEPC habitat quality. These variables are combined to produce a habitat quality rating for any specific area.

The model has been developed as a tool to assist in:

- Quantifying specific relationships of vegetation attributes to LEPC habitat quality that LEPC experts have estimated are the most important vegetation parameters needed by LEPC. This provides a consistent quantification of these relationships based on currently available information.
- Providing a tool that can be used to develop consistent evaluation methods of habitat quality for use in site specific habitat management evaluations or plans.
- Providing for the consistent evaluation of the potential value of different ecological sites (discussed below) for LEPC in Oklahoma. This in turn provides for identifying and evaluating the desired restoration conditions (reference conditions) for specific ecological sites that can help guide habitat management in Oklahoma.
- Providing a basis for quantifying potential mitigation benefits for LEPC (and reductions in habitat quality from various impacts).
- Guiding the definition of “net conservation benefit” for use in eligibility of enrollment in a Candidate Conservation Agreement with Assurances (discussed below).

The habitat model is designed to help evaluate existing or potential habitat quality of specific sites. It is based on the compiled information from the literature and further from the expert opinion in interpreting this information for LEPC habitat quality in Oklahoma by the science team. Each of the variables included in the habitat model can be further evaluated with future research especially on the nesting and brood habitat requirements for LEPC in Oklahoma.

The following graphs display the variables included in the model.

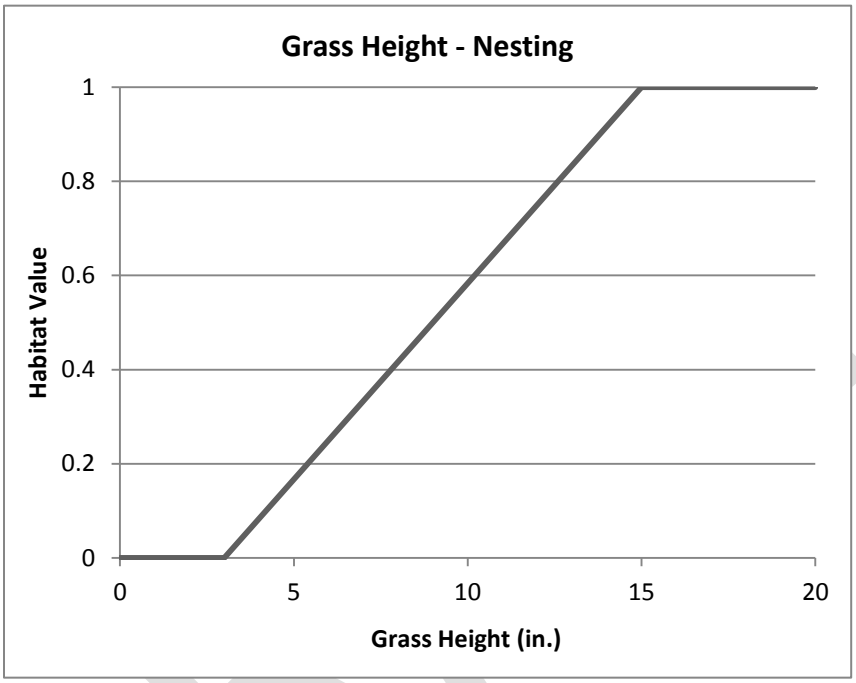


Figure 2. Relationship between average grass height and habitat values for lesser prairie chicken nesting. The equation between 3 in. and 15 in. is *y=0.0833x-0.25*. This variable is N1.

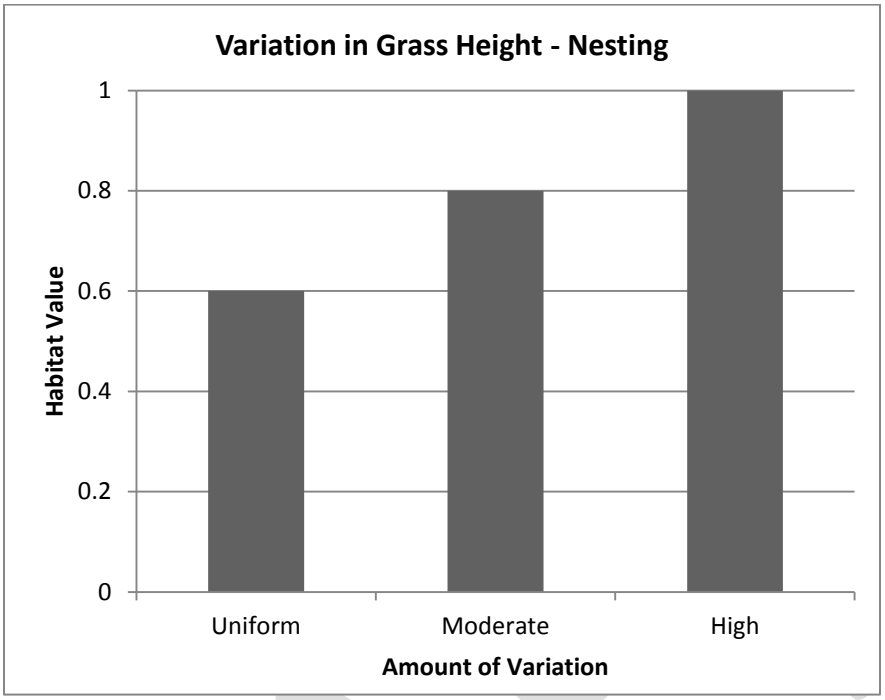


Figure 3. Relationship of variability in grass heights to quality of LEPC nesting habitat. This is variable N2.

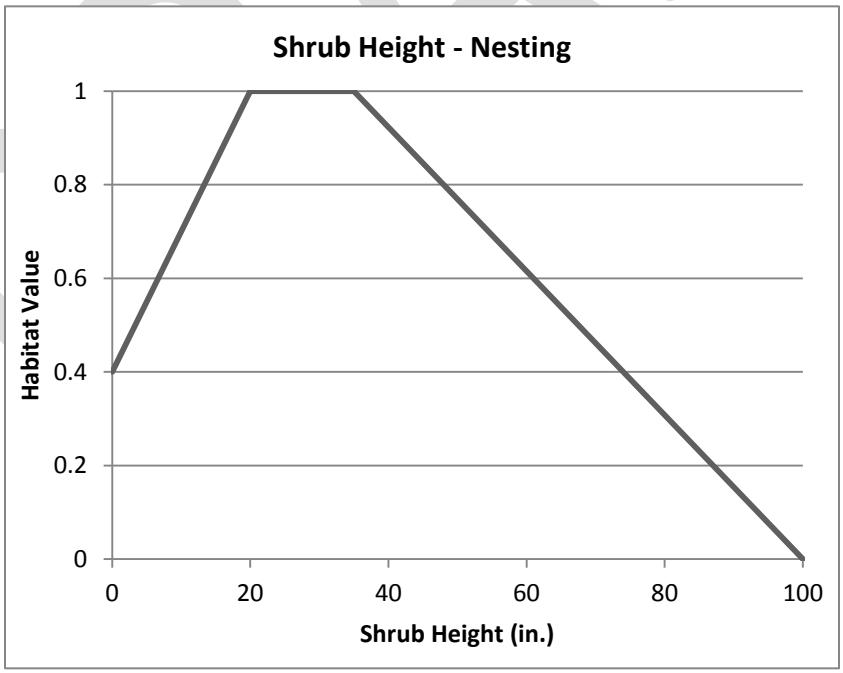


Figure 4. Relationship between average shrub height and habitat values for lesser prairie chicken nesting. The equation between 0 in. and 20 in. is *y=0.03x+0.4* and the equation between 35 in. and 100 in. is *y=-0.0154x+1.5385*. This is variable N3.

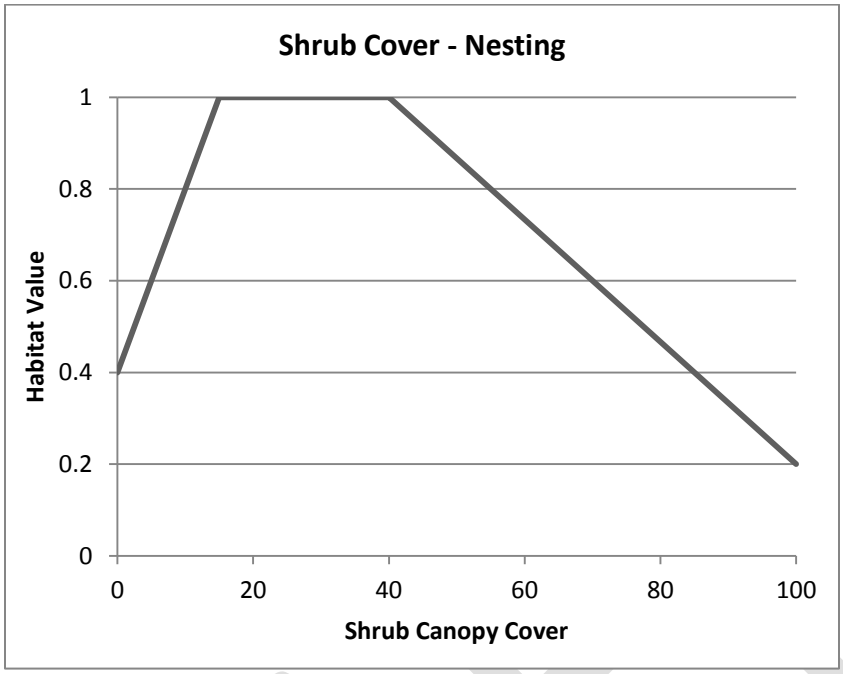


Figure 5. Figure 5. Relationship between shrub cover (measured as absolute cover) and habitat values for lesser prairie chicken nesting. The equation between 0% and 15% is *y=0.04x+0.4* and the equation between 40% and 100% is *y=-0.0133x+1.5333.* This is variable N4.

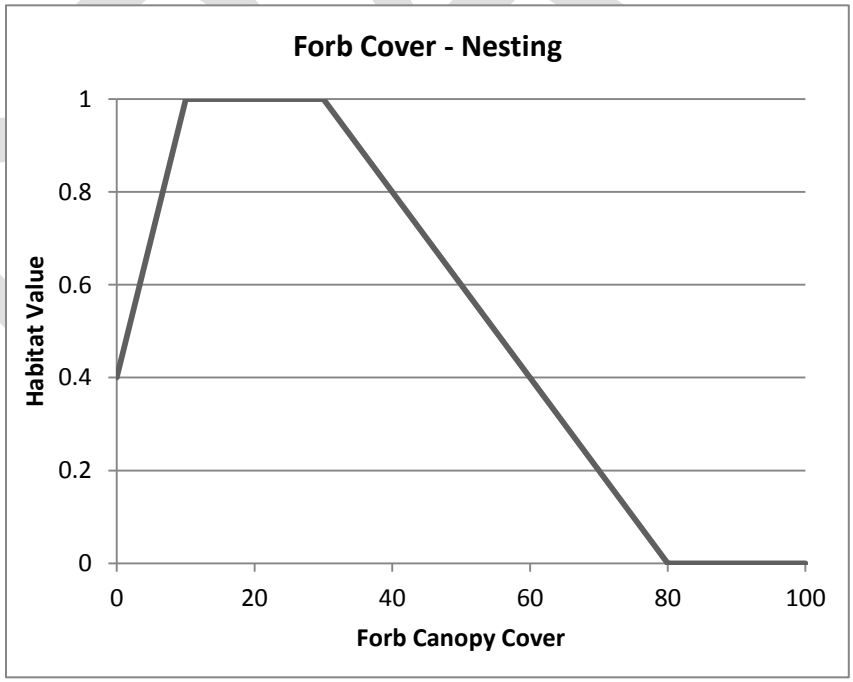


Figure 6. Relationship between forb cover (measured as absolute cover) and habitat values for lesser prairie chicken nesting. The equation between 0% and 10% is *y=0.06x+0.4* and the equation between 30% and 80% is *y=-0.02x+1.6.* This is variable N5.

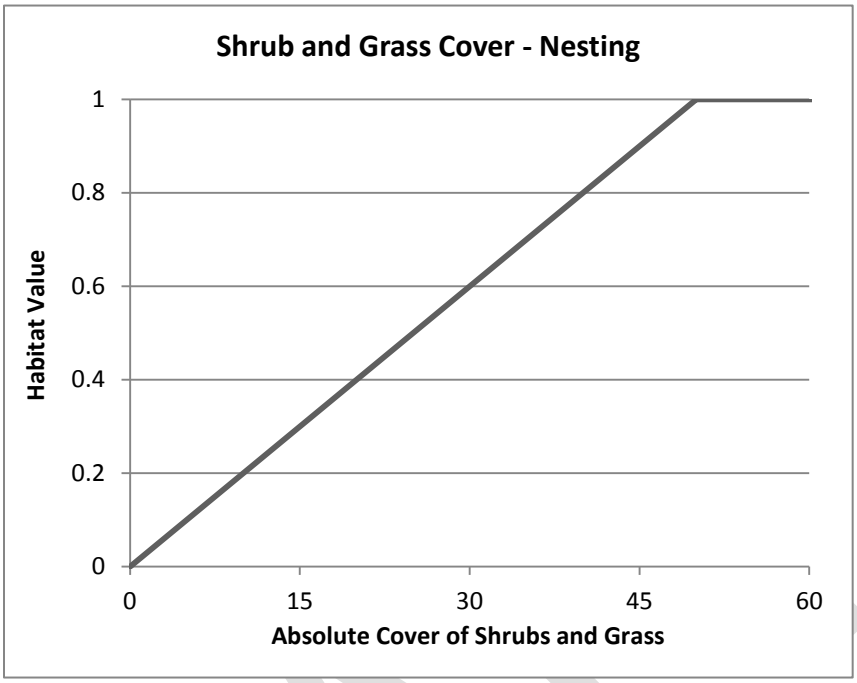


Figure 7. Relationship between shrub and grass cover and habitat values for lesser prairie chicken nesting. The equation between 0% and 50% is *y=0.02x*. This is variable N6.

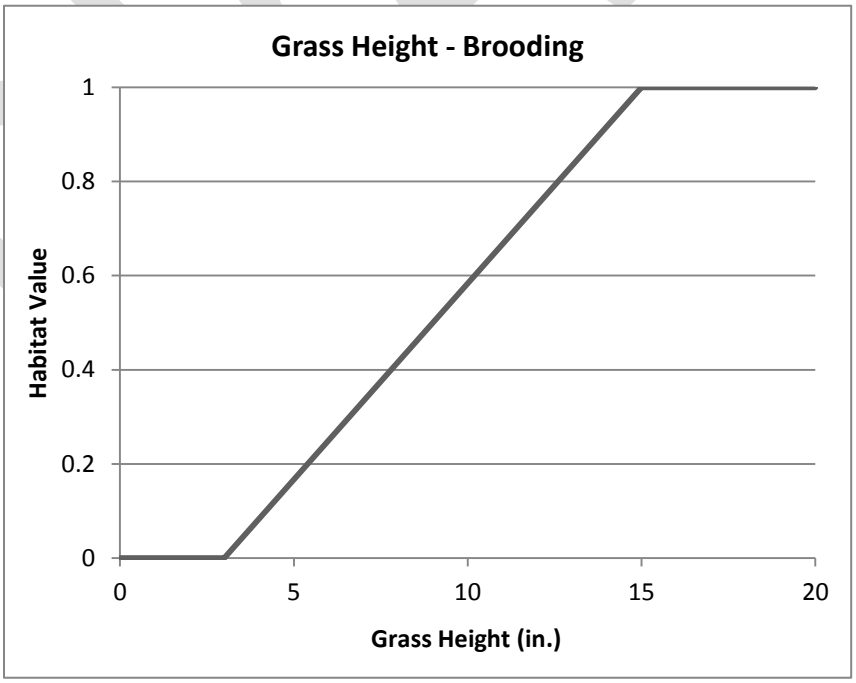


Figure 8. Relationship between average grass height and habitat values for lesser prairie chicken brooding. The equation between 3 in. and 15 in. is *y=0.0833x-0.25*. This is variable B1.

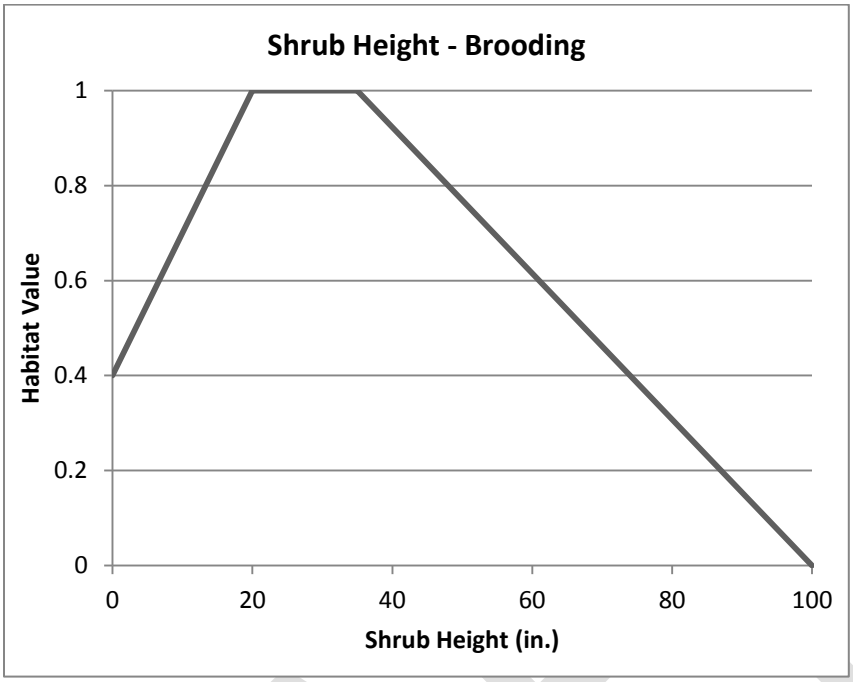


Figure 9. Relationship between average shrub height and habitat values for lesser prairie chicken brooding. The equation between 0 in. and 20 in. is *y=0.03x+0.4* and the equation between 35 in. and 100 in. is *y=-0.0154x+1.5385*. This is variable B2.

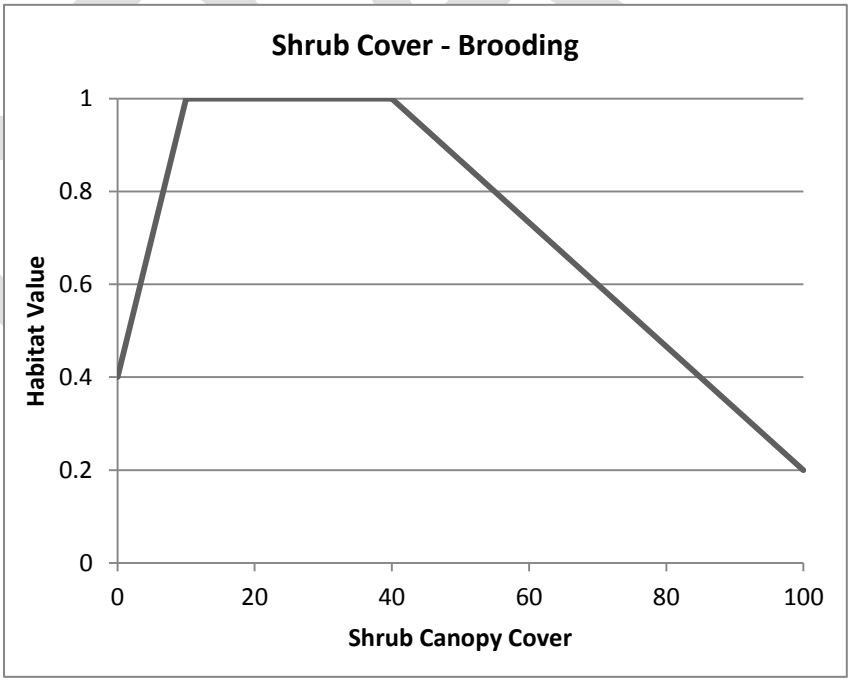


Figure 10. Relationship between shrub cover (measured as absolute cover) and habitat values for lesser prairie chicken brooding. The equation between 0% and 10% is *y=0.06x+0.4* and the equation between 40% and 100% is *y=-0.0133x+1.533.* This is variable B3.

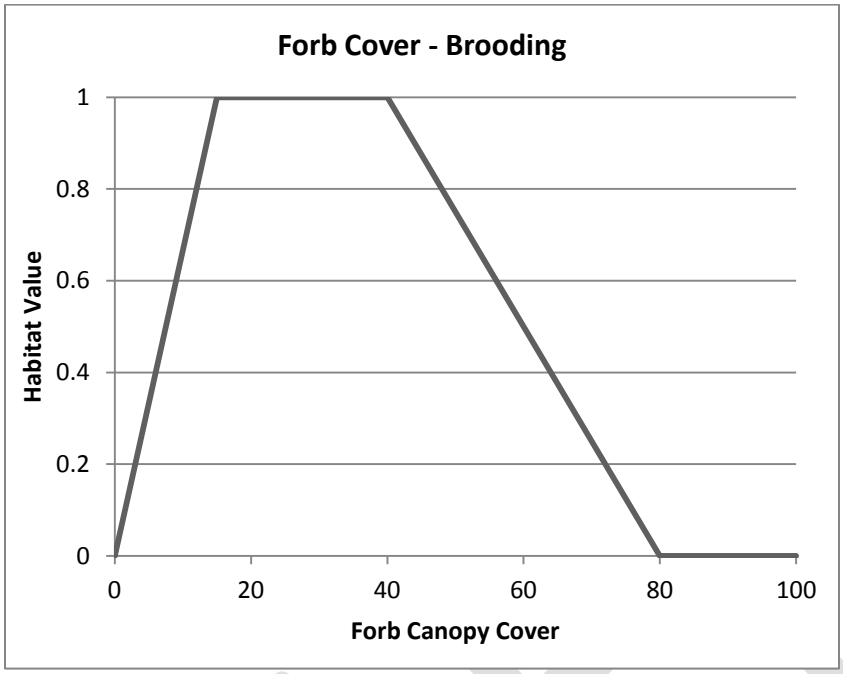


Figure 11. Relationship between forb cover (measured as absolute cover) and habitat values for lesser prairie chicken brooding. The equation between 0% and 15% is *y=0.1x* and the equation between 40% and 80% is *y=-0.025x+2.* This is variable B4.

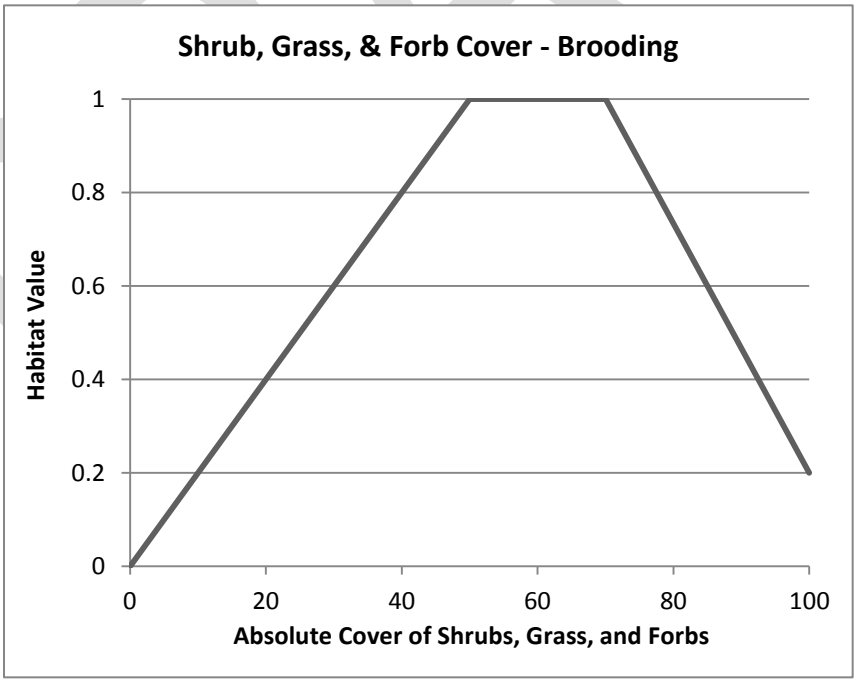


Figure 12. Relationship between shrub, grass, and forb cover and habitat values for lesser prairie chicken brooding. The equation between 0% and 50% is *y=0.02x* and the equation between 70% and 100% is *y=-0.0267x+2.8667*. This is variable B5.

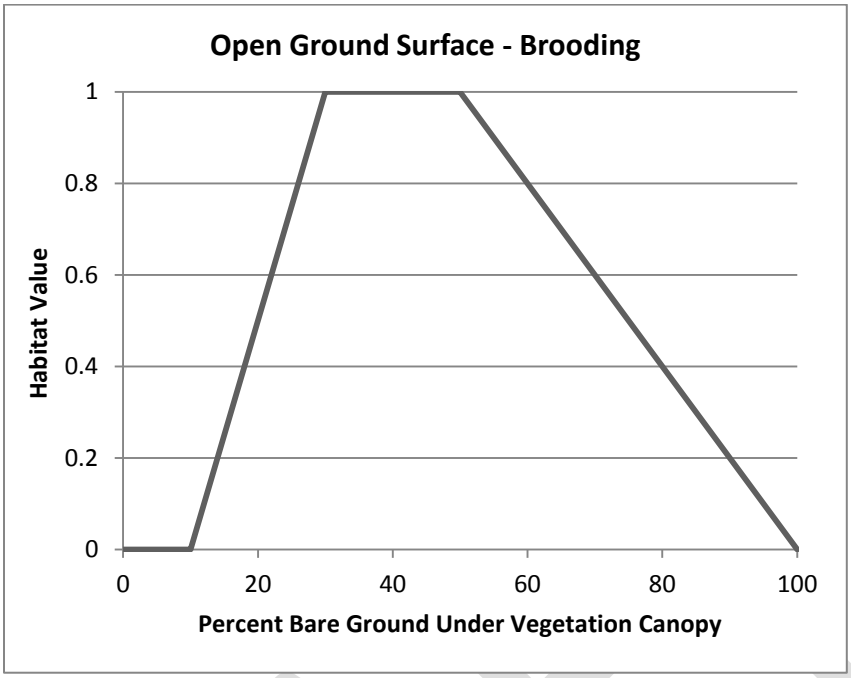


Figure 13. Relationship between open ground surface and habitat values for lesser prairie chicken brooding. The equation between 10% and 30% is *y=0.05x-0.5* and the equation between 50% and 100% is *y=-0.02x+2*. This is variable B6.

Figure 14. Relationship of presence of trees to quality of LEPC habitat. This variable applies to both nesting and brood-rearing habitat. This is variable T1.

MODEL COMPUTATION

This habitat suitability model can be calculated in two potential ways. One would be to evaluate the quality of each habitat patch for each habitat need (nesting, brood-rearing) and then evaluate the quality of a broader landscape area in terms of the amount of each of these habitat components present. This would require development of the composition and distribution of habitat patches in the broader landscape. Alternatively, each habitat patch can be assigned a value for each of the habitat variables. The quality of each habitat patch could then be computed separately for nesting habitat and brood-rearing habitat based on the following formulas using geometric means:

$$(((N1*N2)*N3*N4*N5*N6)^{(1/5)})*T1 = \text{nesting habitat quality (NHQ)}$$

$$((B1*B2*B3*B4*B5*B6)^{(1/6)})*T1 = \text{brooding habitat quality (BHQ)}$$

For application at landscape scales, the model results can be calculated for a uniform size area, such as a section, and the overall value of nesting and brood-rearing habitat determined. The lower of the two habitat values would indicate which was more likely to be limiting in the area. Examining the distribution of nesting and brood-rearing habitat quality could reveal key locations to concentrate habitat improvement efforts.

DRAFT

Ecological Sites as Indicators of Habitat Potential

The OLEPCCP planning process will identify desired LEPC population goals and the habitat amounts, conditions and distribution estimated to be needed to attain these goals and sustain the species in Oklahoma. The plan will identify locations for core conservation areas for maintaining and improving habitat to support LEPC conservation. To accomplish this, it is important to know not only where LEPC currently exist in Oklahoma, but also what additional areas have the best potential to support LEPC.

An important tool to use in identifying areas of potential habitat quality for LEPC is the "ecological sites" classification system developed by NRCS (http://esis.sc.egov.usda.gov/). An ecological site is defined as "a distinctive kind of land with specific characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation". An ecological site description (ESD) contains information about the site's soils, plant communities and their dynamics, productivity, and other information. Ecological sites are the newer rendition of the older "range site classification system". Both of these systems use soils as a primary classification element, and soil maps allow for the delineation of ecological sites where this mapping has occurred.

The above description of LEPC habitat requirements reveals the vegetation conditions that this species needs, and what constitutes high quality habitat. For the OLEPCCP, an ecosystem-based approach for maintaining and improving habitat conditions is recommended for several reasons. First, an ecosystem-based approach, as discussed below, identifies the areas with the best potential for providing high quality LEPC habitat, maximizing the effectiveness of management efforts. Second, agriculture producers are generally familiar with plant communities and the concept of ecological sites, and a planning approach that focuses on providing desired plant communities that offer multiple benefits (e.g., grass production and LEPC habitat) rather than specific habitat features for LEPC will gain greater support. Third, an ecosystem-based approach emphasizes the dynamics of the desired plant communities, and helps focus on the most appropriate management practices for a specific location and the long term maintenance of these conditions.

The ecological site classification allows for the mapping of potential LEPC habitat based on the ability of specific soils to provide plant communities that support quality habitat for LEPC. Ecological sites also provide the basis for developing state and transition models that depict possible changes to plant communities due to natural processes and disturbances as well as anthropogenic disturbances. Knowledge of the historical disturbance processes that occurred in an area allows for the description and potential quantification of historical habitat conditions, and can be used to describe reference conditions for comparison to desired future conditions for the species.

Vodehnal and Haufler (2008) coordinated the development of the Grassland Conservation Plan for Prairie Grouse that used ecological sites to help identify desired habitat conditions for this species. Ecological sites are described and mapped within Major Land Resource Areas (MLRA's), a broader classification of areas that have similar geo-climatic conditions. The current range of LEPC in Oklahoma is included in 4 MLRA's; 70A, 77A, 77E, and 78C. ESD's developed for each of these MLRA's can be used

DRAFT

to identify sites that historically supported the most favorable habitat conditions for LEPC (Appendix A: Table A-1), and can also be used to evaluate potential for restoration of LEPC habitat today. Further, by evaluating the changes to ecological sites from various human activities, coarse measures of cumulative effects of primary conversion factors can be quantified (Appendix A: Table A-1). A similar rating system based on ecological sites was developed for bobwhite quail (*Colinus virginianus*) in Oklahoma (Bidwell et al. 2009).

Using the values of LEPC habitat represented by their historical habitat potential, goals can be set for desired amounts of high quality habitat based on the locations and amounts of ecological sites. While some non-native plant communities such as Conservation Reserve Program (CRP) fields may also be incorporated into LEPC habitat planning, maintaining and restoring desired native grassland/shrub communities is the preferred management approach. Ecological sites reveal the potential for a specific location to provide LEPC habitat with application of restoration treatments. In particular, sites that have not been tilled (Ostlie 2003) have some of the highest potential for maintenance or restoration. Focusing habitat improvements in those areas with the highest existing values as well as potential values as LEPC habitat will assure the most effective and efficient conservation plan.

In most cases, the desired plant community that would optimize habitat quality for LEPC would be one subjected to light to moderate grazing as well as the historical fire regime for the ecological site. Using ecological sites to provide the reference conditions, desired plant communities to be maintained or restored on any specific site can be identified. While the reference community conditions may need to be evaluated relative to sustainability under predicted future climate conditions, the site will still provide the underlying reference for its capabilities in terms of plant compositions, structures, and dynamics.

Table A-1 (Appendix A) reveals that a limited number of ecological sites provide the highest potential for quality LEPC habitat. Targeting these sites, especially ones that have not been extensively converted to other uses, offers an effective and efficient way of developing desired LEPC habitat in terms of both quantity and quality. Both quantity and quality of habitat are essential components of an LEPC management plan, as enough habitat must be provided to sustain adequate numbers and distributions of the species as well as providing needed connectivity, however developing sufficient high quality habitat is also essential, as these high quality areas are what will provide source populations with high survivorship and more consistent recruitment (Breininger et al. 1999, Patten and Kelly 2010), a desired feature for LEPC in Oklahoma (Pruett et al. 2011).

MANAGEMENT PLAN

DESIRED POPULATION SIZE

As discussed above, various estimates of historical LEPC population sizes have been reported. Duck and Fletcher (1944) estimated a total population of greater than 14,000 LEPC in 11 counties during the

1940s, although Cannon (1980) suggested that this estimate was too low. Copelin (1963) estimated that the spring population was approximately 15,000 birds across 12 counties, including Blaine County where LEPC were apparently absent in 1944. In 1978, Cannon and Knopf (1980) reported that LEPC occupied 8 counties and the population was estimated to have declined to 7,500 birds. Horton (2000) estimated the population of LEPC in Oklahoma was fewer than 3000 birds, and that number is believed to have since declined. Lek surveys conducted by ODWC (Appendix A, Table A-2) provide a limited data base on past LEPC trends in Oklahoma that does not allow estimates of population size to be derived. The population size of LEPC in Oklahoma in 1995 when LEPC were determined to be warranted but precluded for listing under the Endangered Species Act was not estimated. However, trend information (Appendix A, Table A-2) would indicate that the population is either similar or less than that occurring at the time of this determination. McLachlan et al. (2011) estimated the current LEPC carrying capacity of Oklahoma is about 7,784 birds based on available habitat estimates derived from remotely sensed information. This estimate is based on a habitat assessment not on a population assessment and includes a number of assumptions about the information used in the assessment.

A process of determining current population levels and distribution in Oklahoma is currently in progress. The Lesser Prairie Chicken Interstate Working Group reported a goal established by ODWC in 2008 to increase the population of LEPC in Oklahoma by 25% over the next 20 years (Davis et al. 2008), but no justification or process for determining this goal was presented. Sustainable population estimates considering both demographics and genetics produce varying estimates of desired population sizes (Patten et al 2005, Pruett et al 2011, McLachlan et al. 2011). A goal for a sustainable population of LEPC for Oklahoma has not been definitively identified.

The Oklahoma LEPC science team considered the available information on LEPC historical numbers as well as desired population sizes recommended for sustainable populations for other species. They also considered population goals for surrounding states. Based on the available information, they recommended setting a ten-year population goal for lesser prairie chickens of 5,000 birds within a network of core conservation areas in Oklahoma. Additional LEPC habitat and application of best management practices (BMP's) throughout LEPC range in Oklahoma would be expected to eventually support additional birds outside of the core areas, with a possible long term population goal of 10,000 birds in both core areas and surrounding LEPC range in Oklahoma. An initial five-year benchmark would be to stabilize the population and turn the trend from decline to increase. The population goal of 5,000 within 10 years and 10,000 in the long term is consistent with similar goals set for other species and with what can be expected in terms of habitat capabilities with effective management efforts.

The Attwater's prairie chicken, a species of prairie grouse occurring in coastal Texas was listed as endangered by the USFWS in 1967. The current recovery plan has established a population recovery goal of a minimum of 6,000 birds maintained for 10 years. The range of this species is much more restricted than that of LEPC, but this population goal is a general indicator of need for a similar species. A 10 year goal of 5,000 LEPC for Oklahoma is generally consistent given that LEPC have a much larger range and will also have populations in neighboring states.

DRAFT

HABITAT GOALS

The 10 year population goal of 5,000 LEPC in Oklahoma must be equated to the amount of habitat required to support his number. Population densities of LEPC are not well documented especially in relation to habitat quality of an area. Texas estimated a mean density of 5.63 LEPC/sq. mi. (range 2.18-8.64), and set a 30 year LEPC goal of approximately 20,000 birds (Davis et al. 2008). New Mexico used an estimate of 4.85 birds/sq. mi. of suitable occupied habitat, with a current estimate of 14,568 (Neville et al. 2005) and 10,670 (Davis 2006) birds. Using the estimate of 10,000 birds, New Mexico set a population goal of 14-18,000 birds by 2017. Kansas used an estimate of 10 breeding birds/sq. mi. resulting in a current population estimate of 24,000 birds (Davis et al. 2008). Kansas set a goal of eventually maintaining 40,000 breeding LEPC, which they estimated would require restoring approximately 1 million acres of LEPC habitat which equates to a density of 10.24 LEPC/sq. mi. of restored habitat to support the additional 16,000 birds.

How population densities of LEPC vary in relation to habitat quality is poorly understood and is lacking an empirical database. Therefore, assumptions are required to estimate how much high quality habitat for LEPC would be needed to support a desired population size. If a population density of 5-10 breeding birds/sq. mi. were used as in other states, then to support a population goal of 5,000 birds, 500-1,000 sq. mi. (320,000- 640,000 ac) of LEPC habitat would be the minimum goal for Oklahoma.

The science team acknowledged the lack of good empirical data on which to base a habitat goal for LEPC in Oklahoma. They recommended that the habitat goal should do more than simply recommend a total number of acres, as LEPC require habitat blocks of substantial size if they are to maintain viable populations. They recommended that a system of core conservation areas (core areas) be identified. Core conservation areas are defined as a network of specifically mapped areas where conservation efforts for LEPC would be prioritized to produce the highest quality LEPC habitat with minimal levels of development to provide for sustainable populations of LEPC.

The science team recommended establishing 15 core areas, with each core area comprised of approximately 50,000 ac of which at least 35,000 acres should be good-high quality LEPC habitat (Figure 15). Some of the 15 areas should be aggregated into complexes containing several core areas located within 5 miles of each other to provide demographic support. Additional core areas should be reasonably distributed throughout LEPC range in northwestern Oklahoma. To the extent possible, core areas should be no more than 20 miles apart. Establishing “linkage zones” between core areas was also recognized as being needed to allow movements of birds to provide both demographic and genetic support. The requirements for desired habitat conditions in linkage zones are at a lower threshold than in the core areas. Specific habitat requirements within linkage zones were not specifically defined, but should at a minimum provide habitat patches of at least 40 acres in size distributed no further than 1 mile apart to allow for dispersing birds to meet short term habitat needs including food and cover. The primary emphasis will be on improving habitat within the core areas. In remaining areas within LEPC range but not within a core conservation area or linkage zone, BMP’s and incentives for improvements

Draft LEPC Core Conservation Areas

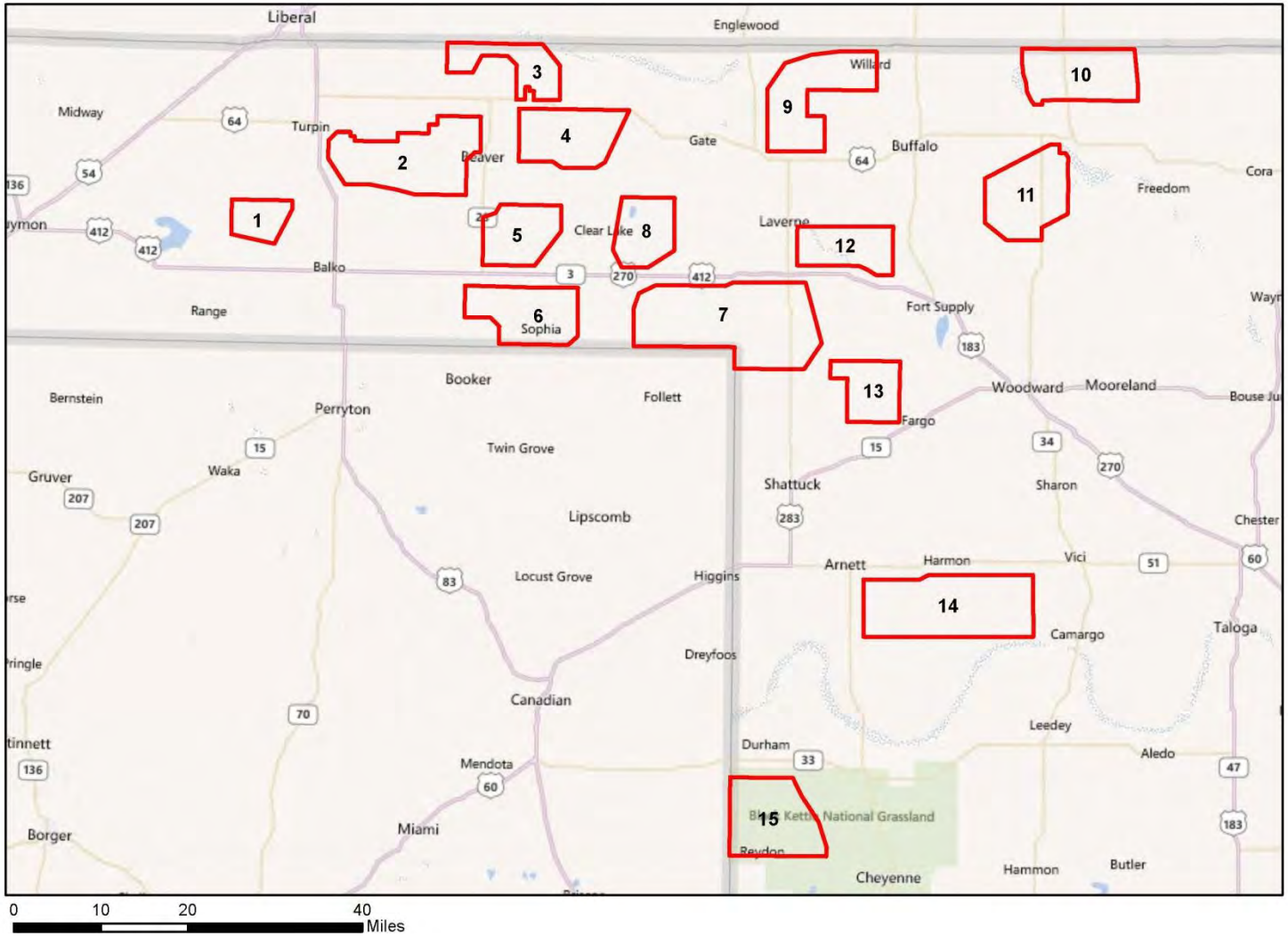


Figure 15. Location of 15 core areas in western Oklahoma to support habitat goals for LEPC population recovery.

in LEPC habitat would still be recommended, so that in the long term the goal of 10,000 birds range-wide can be attained.

Identification of specific core areas is considered to be essential to conservation of LEPC because of its need for large blocks of high quality habitat and its sensitivity to habitat fragmentation. Habitat treatments occurring throughout LEPC range all help improve conditions at specific sites, but can result in "random acts of kindness" where insufficient blocks of high quality habitat are produced to support sustainable LEPC populations. Therefore, core areas that can help concentrate LEPC habitat maintenance and restoration in large blocks, centered on the known areas with the highest populations and habitat quality for LEPC are essential for conservation planning for this species. The selection of core areas is consistent with the Tier 1 step suggested by the USFWS (2012) in their Land Based Wind Energy Guidelines in identifying the most important areas for LEPC. These guidelines suggest that important issues should be assessed at the landscape scale early in the siting process. Tier 1 recommends identifying areas of high sensitivity due to the presence of blocks of native habitats, paying particular attention to known or suspected "species sensitive to habitat fragmentation, which is what the core area designation has done at a landscape scale in Oklahoma. Selecting sites for development outside of the core areas would then benefit from the additional Tiers suggested in the Guidelines.

The science team considered the recommended habitat goals to be the minimum needed for assurances of LEPC population sustainability given the paucity of information on LEPC population densities in differing habitat qualities. As additional information on LEPC densities in varying quality habitat is generated through new research, the habitat goals may be revisited. However, sufficient high quality habitat needs to be present to support populations of LEPC that can survive through varying seasonal whether events and other stochastic population disturbances. Population density information that includes responses to such events will require considerable research before long term sustainable habitat conditions can be accurately predicted.

These 15 core areas equate to a goal of approximately 525,000 acres of high quality LEPC habitat in Oklahoma. The identified core areas total 743,167 ac, and if 65% of this area can be managed to be good to high quality LEPC habitat, this would produce approximately 520,000 ac of habitat. This amount of desired habitat is consistent with the estimates used by the other states reported above. Core areas indicate high priority locations for voluntary conservation actions for LEPC, especially. In particular, core areas will be priority areas for incentive programs to restore high quality habitat. In addition, core areas have a goal of avoiding or minimizing developments that will reduce LEPC habitat quality. Incentives to improve LEPC habitat outside of these core areas should also be available but will be of secondary priority to improvements in the core areas. The high quality habitat produced in core areas should allow these areas to serve as population sources for LEPC that will help expand the population in surrounding areas over time, even in areas with lower overall habitat quality.

Core Areas and Desired Conditions

Selection of core area locations was based on a number of criteria including existing populations of LEPC as indicated by known lek locations and sizes, existing habitat conditions (CHAT vegetation layer),

amounts of converted land uses (CHAT layer and NAIP imagery), amounts of preferred ecological sites (NRCS soils layer), location of public lands or other conservation lands (ODWC, USFS, TNC) that can contribute to habitat goals, extent of conflicting demands for alternative land uses, and known receptivity of landowners to use incentive programs (local biologist knowledge). The most recent map of lek locations, including lek surveys conducted in 2012 was used as the existing population map, recognizing that additional leks exist in areas that have not been possible to survey from public roads and that were not included in the aerial survey sampling design initiated in 2012. Information contained in the Oklahoma LEPC Spatial Planning Tool (Appendix B: Figure B-1) and the CHAT (Appendix B: Figure B-2) was used as input layers including the vegetation layer, road and transmission line maps, as well as existing information on habitat fragmentation. An additional layer of ecological sites generated from NRCS soils maps and NAIP imagery were also used to help in core area selection. On-going LEPC conservation projects were noted, as were locations of concentrations of CRP. Known locations of existing or projected energy developments were considered as well, and adjustments made to avoid conflicts with these developments where possible, however presence of substantial existing populations of LEPC and LEPC habitat took precedence in some locations. Maps of core areas for Oklahoma are included as Figures B-3 through B-17 in Appendix B.

Within core areas, the primary objective will be to maintain or restore the native plant community(ies) for each ecological site that will maximize LEPC habitat. In general, this would be the plant community representative of a light to moderate grazing regime with a periodic (5-10 year) fire return interval. Any patch of land within these core areas can be evaluated for its current condition in comparison to the reference plant community. Conservation practices that would move habitat conditions towards the desired plant community could then be identified and implemented using appropriate treatments under the various available incentive programs or other management opportunities. Within core areas, anthropogenic disturbances including agricultural lands, homes, wind farms, oil and gas development, unmarked fencing, utility lines, communication towers, and primary roads should be avoided or minimized. If cumulative effects of anthropogenic disturbances exceed 35% of a core area, its functionality and thus its ability to meet its desired objective may be significantly compromised. Core areas can serve as desired locations for offsite mitigation efforts to compensate for impacts to LEPC habitat from energy development outside of core areas.

The overall habitat quality of a core area can be assessed using the habitat suitability model described above. The habitat objective should be to improve habitat quality of a core area to an overall score of 0.6 for both nesting and brood-rearing habitat, with numerous substantial habitat patches that exceed a quality of 0.8. This assures that high quality LEPC habitat is present that will maximize survivorship and recruitment in these areas, and will provide a source population that in most years should produce dispersing young that can help to populate additional surrounding habitat patches.

Outside Core Conservation Areas

Linkage zones will be mapped between core areas to provide for LEPC movements. Within linkage zones, habitat goals will be substantially less than in core areas, as discussed above. However, small blocks of moderate to good quality habitat should occur within linkage zones and be spaced so that

dispersing birds can find areas to persist during movements. In addition, major barriers to movements (e.g., large expanses of unsuitable habitat) need to be avoided, or the linkage zones will fail to serve their function.

In areas that are within the LEPC range, but outside of a core area or linkage zone, incentive programs should encourage maintenance and improvement of habitat conditions where that potential exists. Existing leks should be identified and construction of anthropogenic features avoided near leks where possible. Nesting and brood rearing habitat near leks would be important areas to be maintained and improved. Where development occurs near leks or other good quality habitat for LEPC, BMP's should be emphasized. For example, if development activities are unavoidable near nesting or brood habitat then such activity should occur outside of the nesting and brood-rearing period (15 March-15 July) to avoid disturbance to displaying males and nesting females, or at a minimum avoid activity during the early morning breeding hours. If utility corridors must cross existing habitat, power lines should be placed as close as possible to an agricultural edge or concentrated with other anthropogenic features such as major roads. Clustering human infrastructures may minimize disturbance to larger areas of native rangeland.

Population Connectivity Across State Lines

Core conservation areas and the high quality habitat provided in these areas considered the known distribution of LEPC and their habitat conditions as displayed in the CHAT in neighboring states. Linkage zones between Oklahoma core areas and important LEPC habitat in neighboring states will be important to maintain. Oklahoma core areas will be incorporated into planning being conducted by the Western Association of Fish and Wildlife Agencies and the LEPC Interstate Working Group and others so that broader scale conservation objectives for LEPC are recognized and promoted.

Climate Change

Climate change may be a significant impact to LEPC in the future. While some potential impacts cannot be effectively addressed, one area that can be considered is developing recommendations for restoring plant communities that may be sustainable under future predicted climate conditions. The ecosystem-based approach described above allows for an analysis of the native plant communities adapted to each ecological site. The reference conditions developed to help guide restoration treatments can be evaluated relative to their likely sustainability under predicted conditions. Where communities or their compositions are likely to be stressed, modifications can be incorporated to create more sustainable communities that will still provide habitat needs for LEPC as climate conditions change.

Other Habitat Considerations

Various other management recommendations were identified to improve LEPC habitat. Restoring fire especially to sand sagebrush and shinnery oak communities is important. A 5-10 year fire return interval with 10-30% on average of important management areas burned annually would be optimal. This would improve and maintain both nesting and brood-rearing habitat in these plant communities while also improving grass production and quality. In eastern portions of LEPC range, large expansions of red cedar

(*Juniperus virginianus*) have altered plant communities and eliminated LEPC habitat. Removing red cedar by either mechanical control or prescribed burning will help restore habitat in many areas.

Where non-native plant species occur, restoring native grasses and forbs is recommended. Herbicides may be an important tool for habitat improvement especially where non-native species predominate, however widespread use of herbicides, particularly for control of shinnery oak or sand sagebrush should be discouraged within LEPC range and especially in core conservation areas. Promoting grazing regimes that emphasize light to moderate grazing of key LEPC areas is also important.

Monitoring Programs

An important component of LEPC management is monitoring the status of the population in Oklahoma. The LEPC Interstate Working Group recently agreed to a consistent monitoring methodology to be used throughout LEPC range. McRoberts et al. (2011a, b) evaluated various methods of surveying LEPC leks, and determined that helicopter surveys, flown along transects at an elevation of 50 ft at 60 mph were effective in counting numbers of LEPC on leks. The planned methodology will use helicopters flown at an altitude of approximately 80 feet and traveling at 35-40 mph along assigned transects. The survey plans to cover 200 tracts of land each containing 85 square miles spread out from southeast New Mexico, through the Texas Panhandle to northern Kansas and Colorado, including tracts in Oklahoma. The survey will provide a consistent index of LEPC population trends for all 5 states within its range. In addition to the standard monitoring program for the 5 states, ODWC or other organizations may want to monitor additional areas using the same protocol to gain more complete information on the distribution and trends of LEPC in Oklahoma. Oklahoma has monitored birds along road survey routes. This monitoring can provide trend information as shown in Table A-2 in the Appendix.

Key Research Needs

Considerable research has been directed at LEPC, especially since its designation as a warranted but precluded species under the ESA. While much has been learned, as indicated by the results of studies compiled in this plan, many critical questions still remain. Some of the most important information needs include:

- Impacts of various anthropogenic structures and activities on LEPC habitat use, nesting success, and survival.
- Densities, nesting success, and survival rates of LEPC in varying quality of habitat.
- Effectiveness of various treatments in specific ecological sites in restoring high quality LEPC habitat, and longevity of these benefits.
- Validation of the LEPC habitat model.
- Value of small grain cropland as a component of LEPC habitat.
- Importance of and characteristics of shrubs as a component of LEPC habitat.
- Attitudes of agricultural producers and others towards LEPC and LEPC conservation programs.

DRAFT

For each of these general research questions, more specific testable hypotheses could be generated. As discussed below, an adaptive management monitoring program is strongly recommended to learn most efficiently from the LEPC habitat improvement treatments being applied though the various conservation programs.

Existing Conservation Programs

Various programs are currently available to provide funding and technical assistance to landowners who voluntarily agree to conduct improvements to benefit LEPC. In particular, lands within core conservation areas are particularly important to improve the status of LEPC in Oklahoma and to reduce the potential need for listing of this species. Conservation programs have a primary focus on improving habitat for LEPC by maintaining and restoring the condition of native grass and shrublands. This will produce additional benefits to the landowner in terms of rangeland health and productivity. Technical assistance will be provided in evaluating opportunities on each landowner's property and in preparing a management plan. An associated tool, the candidate conservation agreement with assurances protects landowners who improve LEPC habitat from potential future restrictions should LEPC be listed under the ESA. Programs are available from a number of agencies, as discussed below. Agencies are coordinating their efforts so that technical service providers from any of the programs are aware of the full suite of possible programs to maximize opportunities for each landowner.

Oklahoma Department of Wildlife Conservation (ODWC)

ODWC is the state agency responsible for managing wildlife and fish in the state of Oklahoma. ODWC implements a number of programs that provide technical and financial assistance to landowners to undertake conservation projects that benefit their grasslands and restore and enhance habitats important to the LEPC, and programs and tools that assist with development and conservation planning, management and mitigation.

State Wildlife Habitat Incentive Program (SWHIP)

Through the state SWHIP program, ODWC provides cost share assistance for specific habitat improvement practices. Under the SWHIP, landowners enter into 10-year contracts with the Wildlife Department for approved projects to develop, preserve, restore and manage wildlife habitat on private lands. The Department shares part of the cost of habitat improvement work, based on allowable costs determined by the NRCS. In exchange, the landowner agrees to maintain the habitat for a period of 10 years. For more information see:
http://www.wildlifedepartment.com/wildlifemgmt/wildlifehabitat.htm

Lesser Prairie Chicken Habitat Conservation Program

This program was designed to help private landowners develop, preserve, restore, enhance and manage LEPC habitat on their land. Landowners received technical and cost-share financial assistance to develop and maintain LEPC habitat. Eligible conservation practices include brush management, water development, native grass planting, fence marking and removal, fire break construction and prescribed fire. Landowners will work with ODWC to develop a habitat management plan and will enter into a

DRAFT

contract that specifies the conservation projects that will be accomplished. For more information see: http://www.wildlifedepartment.com/wildlifemgmt/lepchcp.htm

Quail Enhancement Program

The ODWC Quail Enhancement Program focuses on improving quail habitat and increasing the public's knowledge of bobwhite biology, habitat requirements and management. Improvements to quail habitat will also provide many benefits to LEPC, although the habitat requirements of the two species do differ in a number of ways. Technical assistance to improve habitat is available to landowners free of charge by Department biologists statewide, including on-site visits and management recommendations. Any landowner in the state of Oklahoma is eligible for technical assistance, regardless of property size. For more information see: http://www.wildlifedepartment.com/wildlifemgmt/quailenhancement.htm.

Voluntary Offset Program

Through the Voluntary Offset Program (VOP), developers can enter into voluntary agreements with the ODWC and make financial contributions to a habitat conservation fund to help offset acknowledged impacts to wildlife habitat from development activities. The VOP is a voluntary mechanism to accomplish offsite mitigation and has been used to offset or partially offset acknowledged impacts to LEPC habitat. Examples include two agreements and payments made by Oklahoma Gas and Electric Company in 2009 and 2010 in compensation for two adjacent wind facilities, and a March 2012 agreement with Chermac Energy Corporation to compensate for a planned 55 mile high voltage transmission line.

LEPC Spatial Planning Tools

The Oklahoma Lesser Prairie Chicken Spatial Planning Tool (Horton et al. 2010) is a spatially explicit model designed to assist development planning by providing developers with information that will allow them to avoid, minimize and mitigate negative effects of development on the lesser prairie chicken in Oklahoma. The tool was developed through a cooperative multi-party effort to promote voluntary habitat conservation actions and to prioritize agency management actions. See www.wildlifedepartment.com/lepcdevelopmentplanning.htm

The Crucial Habitat Assessment Tool (CHAT)

CHAT is a multi-state effort that is designed to model crucial habitat for the LEPC throughout its historical range and identifies priority habitat as an aid in early stages of development or conservation planning. The tool identifies 5 categories of LEPC habitat: irreplaceable, limiting, significant, unknown, and common. For more information see: www.kars.ku.edu/geodata/maps/sgpchat/.

In addition to these habitat programs and tools directly implemented by ODWC, the agency is a very active partner in delivering the NRCS Lesser Prairie Chicken Initiative, WHIP and EQIP programs and the USFWS Partners for Wildlife program, described in the following sections.

Natural Resource Conservation Service (NRCS) and Farm Service Agency (FSA)

LESSER PRAIRIE CHICKEN INITIATIVE (LPCI)

LPCI works with landowners to improve the effectiveness of voluntary conservation practices to expand LEPC habitat and benefit the long-term sustainability of producers' agricultural operations, with the long-term goal of increasing the abundance and distribution of the species. The initiative area includes high priority LEPC habitat in its current range plus a contiguous 10 mile buffer, in Oklahoma and 4 neighboring states. Many of the conservation practices that promote healthy grazing lands are also productive for the LEPC and other wildlife. Through the LPCI, landowners and operators receive financial and technical assistance to implement conservation practices that benefit both their ranch lands and LEPC habitat. Beneficial conservation practices include prescribed grazing, upland wildlife habitat management, brush management, prescribed burning, range plantings, and restoration and management of rare or declining habitats. Technical and financial assistance to farmers and ranchers to improve LEPC habitat is funded through NRCS Farm Bill Assistance programs, including: the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentive Program (WHIP) and Grassland Reserve Program (GRP). Through these programs, NRCS develops contract agreements with landowners and agricultural producers to implement conservation practices, and shares in the cost of these practices. In Oklahoma, the LPCI works with landowners in 14 counties in LEPC current range, in cooperation with the ODWC and other agency and non-government organization partners. Counties offering signups through the initiative include Alfalfa, Beaver, Beckham, Cimarron, Custer, Dewey, Ellis, Harper, Major, Roger Mills, Texas, Washita, Woods and Woodward. In 2010, LEPC habitat was improved on 18,000 acres in Oklahoma, with $636,000 in Farm Bill funds. In 2011, 26,000 acres was managed with $889,000 in funding, and an additional $900,000 is expected to be available in 2012. To participate, a landowner works with NRCS to conduct a LEPC habitat assessment for the property and develop an approved management plan detailing desired habitat improvement outcomes and conservation practices to be implemented. Through the LPCI, the NRCS will also be conducting scientific research and monitoring to evaluate the effectiveness of conservation practices in improving LEPC habitat, and provides outreach, education and training for landowners, agencies, and other partners related to grassland and habitat conservation. More information is available at NRCS Landscape Conservation Initiatives: Lesser Prairie Chicken www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/farmbill/initiatives/?&cid=nrcsdev11_023912, or NRCS, Lesser Prairie Chicken Initiative: Oklahoma www.ok.nrcs.usda.gov/programs/eqip/STATEWIDE/LPCI.html

WILDLIFE HABITAT IMPROVEMENT PROGRAM (WHIP)

WHIP is a program offering cost-share incentives to landowners to voluntarily develop and improve wildlife habitat on private lands. Participants work with NRCS and their local conservation district to develop a wildlife habitat development plan and contract. The plan describes the landowner's goals for improving wildlife habitat, includes a list of practices and a schedule for installing them, and specifies the steps necessary to maintain the new habitat for the life of the agreement. All privately owned rural lands are eligible for participation in WHIP. For the 2012 federal fiscal year WHIP funding was directed to the new Working Lands for Wildlife Program. Financial assistance will be offered to combat the decline of seven specific wildlife species including the LEPC. For more information see:

DRAFT

www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/financial/whip/?&cid=STELPRDB1046975.

Environmental Quality Incentive Program (EQIP)

EQIP is a voluntary conservation program that promotes agricultural production, forest management, and environmental quality as compatible goals. Through EQIP, farmers and ranchers may receive financial and technical assistance to install or implement structural and management conservation practices on eligible agricultural land. The NRCS administers EQIP with funding coming from the Commodity Credit Corporation. EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practice and a maximum term of 10 years. EQIP activities are carried out according to a conservation plan of operations developed with the program participants. The conservation practices must be installed in accordance with Oklahoma NRCS standards and specifications. Farmers and ranchers may elect to use a certified third-party provider for technical assistance, if available. For more information see: www.ok.nrcs.usda.gov/programs/eqip/OKgen_prog_description.html.

Grassland Reserve Program (GRP)

GRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. The NRCS and Farm Service Agency (FSA) coordinate implementation of GRP, which helps landowners restore and protect grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable ranching operations. When properly managed, grasslands and shrublands can result in cleaner water, healthier riparian areas, and reduced sediment in streams and other water bodies. These lands are vital for the production of forage for domestic livestock and provide essential habitat elements for maintaining healthy wildlife populations. These lands also improve the aesthetic character of the landscape and provide scenic vistas, open space, recreational opportunities, and soil erosion protection. For more information see: www.ok.nrcs.usda.gov/programs/grp/index.html.

Conservation Reserve Program (CRP)

CRP is a voluntary program for agricultural landowners administered by the FSA. Through CRP, agricultural producers can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. The Commodity Credit Corporation (CCC) makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices. Participants enroll in CRP contracts for 10 to 15 years. For more information see: www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp.

Conservation Reserve Program, State Acres for Wildlife Enhancement (SAFE)

SAFE is a new CRP continuous signup practice offered by the FSA. The purpose of this practice is to restore mixed-grass prairie type association in Northwestern Oklahoma to benefit multiple wildlife species. SAFE targets restoration of vital wildlife habitat. Counties that have land within the CRP-SAFE

DRAFT

project area include Texas, Beaver, Harper, Woods, Ellis, Woodward, Roger Mills, Dewey, Custer, and Beckham. Oklahoma has been approved to enroll 15,100 acres in the SAFE program. Through this practice, participants will improve habitat stability for a number of grassland obligate species. While not mentioned specifically in the title, LEPC is a species targeted through CRP-SAFE. This practice will also indirectly improve water and air quality, reduce soil erosion and provide hunting and nature viewing opportunities. For more information see: www.ok.nrcs.usda.gov/programs/crp/CRP-SAFE.html.

U.S. Fish and Wildlife Service (USFWS)

Partners for Fish and Wildlife Program

The Partners Program restores, improves and protects fish and wildlife habitat on private lands through partnerships between the USFWS, landowners and others. The objectives of this national program are to:

- Restore, enhance and manage private lands for fish and wildlife habitat
- Significantly improve important fish and wildlife resources while promoting compatibility between agricultural and other land uses
- Restore declining species and habitats
- Promote a widespread and lasting land use ethic.

The Partners Program was initiated in Oklahoma in 1990. As 97 percent of the land in the state is in private ownership, collaboration with landowners is essential to achieving habitat conservation goals. Projects that benefit LEPC and other wildlife can fit well with most farming and ranching operations. Typical conservation practices directed to LEPC habitat conservation include invasive species removal (eastern red cedar, non-native grasses), fence marking or removal, native vegetation planting, prescribed fire, and brush control. Through the Partners Program, the USFWS provides technical assistance and financial incentives to landowners that improve the state of LEPC and important habitat on their property. Cooperating landowners agree to use funds for approved wildlife related projects, manage and maintain the project area for at least 10 years for the benefit of wildlife, and control livestock grazing in the project area. The program provides technical and financial assistance through a 10-year cost-share agreement (up to $20,000 per landowner at a maximum federal cost share of 65%). Landowners agree to maintain the conservation practices for the duration of the agreement. Since its inception, the Partners Program has helped private landowners restore fish and wildlife habitat on more than 301,163 acres in Oklahoma at 948 project sites. From 2000-2010, $898,000 has been utilized in Oklahoma in cooperation with ODWC in their state WHIP program, and over the past couple of years about 50% of the Partners funding has been directed toward LEPC range. The program also entered into a cooperative agreement with the Oklahoma Conservation Commission that provided $100,000 for prescribed burn cooperatives. More information is available at:
www.fws.gov/southwest/es/oklahoma/pwp.htm.

Candidate Conservation Agreement with Assurances (CCAA)

A CCAA is a formal agreement between the USFWS and one or more parties (landowners) to address the conservation needs of proposed or candidate species, or species likely to become candidates, before they become listed as endangered or threatened under the Endangered Species Act (ESA). Landowners voluntarily commit to conservation actions that will help stabilize or restore the species with the goal that listing will become unnecessary. The goal of CCAA's is that conservation can preclude the need for federal listing as threatened or endangered or can occur before the species status has become so dire that listing is necessary. Although a single property owner's activities may not eliminate the need to list the species under the ESA, conservation, if conducted by enough property owners throughout the species' range, can eliminate the need to list. A CCAA may benefit landowners in several ways. First, if the conservation actions preclude listing, no regulatory programs that could occur through ESA are implemented. Second, if the conservation actions are not sufficient and the species is listed, the CCAA automatically becomes a permit authorizing the landowner's incidental take of the species, covering any adverse effects of activities on the species. Thus, the CCAA provides landowners with assurances that they will not face future additional conservation measures or restrictions beyond those they agree to at the time they enter into the Agreement. Third, for landowners who want to conserve the species or want to manage habitat on their land, the Agreement provides an avenue to potential federal or state cost-share programs. In Oklahoma, the ODWC is working with the USFWS to develop a CCAA for private landowners engaged in agricultural activities. To enter into a CCAA, a landowner would be required to agree to implement an approved conservation plan that would achieve a net environmental benefit to LEPC habitat. The Agreement is a powerful incentive for landowners to participate in conservation actions that benefit the species. CCAAs are also contemplated for other types of development, such as wind energy or oil and gas development activities. For more information see: www.fws.gov/midwest/endangered/permits/enhancement/ccaa/index.html.

Oklahoma Association of Conservation Districts (OACD)

Wildlife Credits Program

OACD is working to develop a wildlife credit program to provide landowners with stewardship payments for work done to protect and expand the habitat of LEPC. The program pilot is funded through a NRCS Conservation Innovation Grant (CIG) and is patterned after the Oklahoma Carbon Credit Program implemented by OACD. The ODWC also contributes substantial funding to assist with development and implementation of the Wildlife Credits Program. To qualify for compensation, landowners sign a contract with OACD to undertake improvements to wildlife habitat, such as fence removal, invasive species control, and native grass plantings. They also agree to forego activities for the term of their contract that would significantly harm LEPC habitat. OACD is now conducting outreach meetings to provide information to landowners and encourage them to become partners. Payments to landowners are expected to be approximately $10-$12/acre per year, over a five-year contract. It will also be important to be able to offer landowners a CCAA (once that tool is available) for their conservation practices as an added incentive. OACD has an initial goal of having 10,000-15,000 acres under agreement in the next 18 months. The program may eventually form the basis for a mitigation bank for industry and larger developers. Those parties would pay off-site mitigation funds into the bank to mitigate for impacts to LEPC habitat, and the bank would fund incentive payments to landowners for

conservation practices on their lands. For more information contact: OACD, Clay Pope, Executive Director: claypope@pidi.net, 405-699-2087, www.okconservation.org.

Conservation Easements/Tax Credits

Oklahoma's Uniform Conservation Easement Act (2000) provides for the use of conservation easements to protect natural resources and under specified conditions to provide a tax benefit for landowners. A conservation easement is a legal means by which a landowner voluntarily sets permanent limitations on the future use of his or her land, and enters into an agreement with a qualified entity chosen by the landowner to "hold" or enforce the easement (e.g., a conservation group). The landowner retains ownership of the property, but the easement and its limitations follow the property through the chain of title and future owners are bound to abide by the restrictions of the easement.

Each conservation easement is unique. Each one is negotiated between the landowner and the easement holder, and tailored to protect the conservation needs specific to each property and the resource being protected. The entity that holds the easement is required to monitor the property and provide document ion that the restrictions of the easement are being met.

There are substantial federal tax advantages in donation of an easement to a qualified government agency or non-profit organization. In order for a conservation easement donation to be seen as a tax-deductible gift, it must be a "perpetual donation", solely for conservation purposes. Also, the easement must be donated to a qualified conservation organization or public agency that is willing and able to enforce the covenants of the easement in perpetuity.

Under the Oklahoma Act, the purposes a conservation easement may serve include "retaining or protecting natural, scenic, or open-space values of real property, assuring its availability for agricultural, forest, recreational or open-space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving the historical, architectural, archeological, or cultural aspects of real property." Natural resources may be protected by conservation easements granted to local water authorities or non-profit organizations such as the Trust for Public Land or The Nature Conservancy.

Development Agreements

A development agreement is a voluntary, consensual binding contract between two or more parties, typically between a land owner/land developer and government agency or agencies. A development agreement is a very flexible tool that allows the developer and agency to consent to conditions relative to the future development of a property. An agreement can make it possible for agencies to ensure that certain public benefits are obtained without regulatory action (e.g., protection of LEPC habitat), while providing the land owner/developer assurances, such as that the agency will not take future action that may jeopardize a long term project.

Energy Industry Potential Voluntary Programs

Energy industry developments and activities (oil, gas, transmission lines, and wind) have the potential to impact LEPC habitat, as discussed above. These industries can help reduce or mitigate their impacts

DRAFT

through use of voluntary offset programs, as discussed above. Other actions can also help provide for viable LEPC populations in Oklahoma.

Within core areas, energy companies can help by avoiding or minimizing development. Where important LEPC core areas do overlap with various desirable energy development areas, additional voluntary conservation considerations by energy companies may be possible, as discussed below. Providing for LEPC habitat needs especially in core areas can help reverse the declines in LEPC populations, and will lessen the likelihood of LEPC being listed under the ESA.

The potential impacts of wind energy development on habitat use and population parameters of LEPC are largely unknown, but species experts are concerned that they may be considerable. Until additional research can better document what the extent of impacts are, wind energy development within LEPC core areas should be minimized. Where wind energy and LEPC core areas overlap, assistance from wind energy companies in delaying development in these areas would help, particularly for the next 5+ years so that additional research on potential wind energy impacts on LEPC can be completed to better design wind energy developments to minimize their effects on LEPC. A level playing field for wind energy development is needed, so that if one company shifts the location of a development outside of a core area, or delays development within a core area, another company should not be allowed to develop in the same area, or not only will the conservation benefits to LEPC be lost, but the company providing conservation benefits will be disadvantaged. Possible mechanisms to achieve this are needed. Where wind energy development overlaps with core areas, a gradated voluntary offset program is suggested, such that developments in these more sensitive areas would provide a proportionally higher offset to compensate for the likely increased impact of such developments and provide for additional off site mitigation. The specifics of such a program could be set up with the assistance of the wind energy industry. Tools such as the Oklahoma LEPC Spatial Planning Tool (Horton et al. 2010), discussed above, can help quantify some of these tradeoffs. VOP benefits need to be monitored, documented, and communicated to the funding provider.

A compensation program for landowners in wind/core LEPC overlap areas is another tool that is important to develop. Landowners in high potential wind energy areas could anticipate significant economic return from wind development. Providing such landowners with a program where they will voluntarily enter into a development agreement (discussed above) for a set duration (e.g., 10 years) in exchange for monetary compensation could provide an important window of opportunity to 1) better understand wind energy/LEPC interactions, 2) improve additional areas for LEPC habitat that are lower in wind energy potential, and 3) allow additional development of wind energy technology that might help minimize potential impacts.

Oil and gas development areas have been shown to be avoided by LEPC, as discussed above, although more research is needed. Where LEPC core areas and oil and gas development areas overlap, energy companies can help to avoid or minimize impacts. Directional drilling, while not feasible in all formations and potentially being more costly than traditional drilling, might be utilized to minimize impacts within LEPC core areas. Shared or clustered drilling pads should be used, and new efforts for

companies to work together to identify such opportunities should be explored. While concerns over liability and responsibilities at shared sites are noted, efforts are needed to develop new ways of operating that can address these concerns while providing needed benefits of LEPC conservation. Timing of energy development should also be considered. As with wind energy, delaying of drilling in core areas may allow for additional options for LEPC conservation to be developed as well as new technical developments for oil and gas extraction. Finding ways to minimize disturbance, such as amounts of vehicle traffic in core areas is also recommended. The oil and gas industry has developed BMP's for use in LEPC range. These should certainly be applied in core areas in addition to the above considerations. Finally, development agreements discussed above for wind energy are also a consideration. However, due to the common occurrence of split estates and complicated mineral rights, such programs may be very difficult to employ. Where oil and gas development does occur in core areas, a voluntary offset program should be established. This would provide resources to help mitigate the impacts of oil and gas development in core areas through offsite habitat improvements. As with wind energy VOP's, this program should be monitored to document benefits. Also, as with wind energy development, mechanisms for providing a level playing field among oil and gas development companies who forgo development opportunities needs to be established. No current mechanisms appear to be in place to provide this level playing field.

The above recommendations for conservation actions for energy development in core areas can also be considered in LEPC habitat outside of core areas, but the imperative for their use is reduced. As discussed above, an intermediate level of conservation activities will be desired in linkage zones. Certainly BMP's should be identified and recommended as standard operating procedures for all companies whenever they are developing energy within LEPC range. The LEPC Crude Oil and Natural Gas Development Voluntary Best Practices for Oklahoma developed by OIPA with assistance from ODWS are a good example of such BMP's. More generic BMP's for wind energy development (USFWS 2012) have also been developed. More specific BMP's for wind energy development in LEPC occupied areas might be extracted or expanded from this document.

Transmission lines are another potential impact to LEPC. As with other energy developments, the key consideration is siting these lines, to the extent feasible, outside of LEPC core areas. Where this is not possible, transmission lines should strive to follow existing anthropogenic disturbances, be placed in or near agriculture areas as opposed to native rangeland, or be sited across areas with lower potential as LEPC habitat. Finally, where transmission lines cross core areas, a gradated voluntary offset program can be instituted to allow for mitigation in other parts of that core area, or in other core areas.

Development of an Energy CCAA for LEPC is under consideration. Tying provisions of an Energy CCAA to the core area plan for Oklahoma will be an important consideration. Similarly, the Great Plains Wind Energy HCP under development by the American Wind Energy Association and the USFWS could be an important conservation tool that should mesh with the OLEPCCP.

ROADS AND FENCE MANAGEMENT OPPORTUNITIES

Roads and fences, as discussed above, have been shown to have the potential to affect LEPC habitat and populations. The type of road appears to make a significant difference in its effect on habitat use by LEPC, with paved roads and those with more traffic expected to have a much stronger influence than smaller and less used secondary roads. Regardless of these differences, the density of roads in LEPC habitat, especially in core areas, should be minimized. In planning development activities, road locations should be planned to minimize their amounts, and to place them in less suitable habitat or adjacent to existing anthropogenic structures. Keeping roads as small as possible consistent with their intended uses, and finding ways to minimize traffic on roads traversing otherwise good quality LEPC habitat should be emphasized. Where possible, roads should be closed and potentially decommissioned if other access can achieve management or development needs. BMP's developed for energy development should include levels of road travel and timing of travel as considerations.

Fences have been shown to cause LEPC mortality, and are a concern especially when located close to LEPC concentration areas such as leks. Fence marking may help reduce collisions with fences in such situations, and should be included as a LEPC management practice.

Desired Management Results For LEPC Habitat

Use of these programs and tools will be combined to maximize incentives within core conservation areas, with particular emphasis on achieving the following results:

- Maintaining and restoring large blocks of native grass and shrub plant communities in core areas connected by linkage zones that allow for dispersal movements of LEPC.
- Returning the natural role of fire especially in sand sagebrush and shinnery oak plant communities.
- Removing red cedar from areas within LEPC range where this plant species has expanded.
- Minimizing energy developments within core conservation areas, and where it occurs, siting development in less sensitive locations.
- Promoting grazing regimes that emphasize light to moderate levels of grass utilization.
- Promoting use of best management practices for energy and other human developments.
- Reducing road density and levels of road use in key habitat areas.
- Minimizing use of herbicides, especially in sand sagebrush and shinnery oak plant communities.
- Reducing density of fences, and marking fences especially near leks.

Education and Outreach Opportunities

Success of LEPC conservation programs will depend upon the support for and receptivity of landowners to engage in LEPC conservation either directly or indirectly. Agencies and organizations involved in LEPC conservation need to make the public, and especially landowners, aware of the reasons why LEPC conservation is needed, the additional benefits that LEPC conservation will produce, and the opportunities that exist through LEPC conservation programs. A coordinated education and outreach

DRAFT

program is needed to provide effective information dissemination and public understanding of LEPC conservation.

Program Coordination

The suite of programs and practices available for LEPC management focus primarily on habitat maintenance and improvement on private lands. Landowner involvement is an essential component to plan success. The array of programs may be confusing to landowners, and obtaining consistent information on which programs (or their combinations) are the best fit for application to a particular parcel of land is important. Information received from landowner focus group discussions varied in terms of what was needed to engage their interest and willingness to participate. Some landowners were willing to improve LEPC habitat because they recognized both the value of improved rangeland on their property as well as the benefits to LEPC, and were willing to sign up for programs including providing any required cost-share match. Other landowners expressed concerns as to why they should need to provide any match to improve habitat for a species that does not provide them any monetary benefits. Others expressed concern about potential impacts to their operations should LEPC be listed under the ESA, making the CCAA a critical part of a landowner incentive package. Others expressed concerns that increases in LEPC populations on or around their land may reduce their likelihood of receiving revenues from energy developments, making development agreements with compensation for foregone opportunities another important tool for some locations.

Agencies and organizations involved in delivery of conservation programs for LEPC expressed enthusiasm for working together to coordinate programs and maximize landowner and industry opportunities and engagement. Specific action steps for coordinated efforts are presented below.

Adaptive Management

Adaptive management refers to a process that evaluates the outcome of a treatment or action compared to the expected or desired outcome, and evaluates the success of the treatment. Adaptive management can either be passive (general observations on success of various treatments), or active, where specific treatments are applied in selected areas so that they can be replicated and evaluated in a manner that can produce scientific results. LEPC habitat improvements and other management programs provide an excellent opportunity for application of adaptive management, including active adaptive management for some important treatments. Coordination of agencies, organizations, and researchers in planning LEPC habitat treatments can provide the framework for an active adaptive management program. Such a program will generate needed information on management effectiveness much more rapidly than passive programs, and help assure that future management will be implemented that is the most effective and efficient in achieving LEPC objectives.

Plan Revision

Because there are many questions about LEPC ecology, responses to habitat improvements, and interactions with various anthropogenic activities, it is expected that some recommendations in this

management plan will need to be changed based on new information. It is recommended that this plan be periodically evaluated and updated. A 3-5 year evaluation is recommended, with an in-depth evaluation and potential revision at 10 years.

New information on LEPC will be continually generated during the implementation of this plan. The plan should be open to revision if substantial new information is generated that identifies changes to recommended actions that should be made. However, changes to the plan should only be made with the generation of substantial new information. Single studies that may suggest new directions should be viewed as potential considerations, but should not trigger a change in the plan until such information is demonstrated to be significant in replicated studies or considered to reach the status of substantial new information by the Oklahoma LEPC science team. Consistency in plan direction and implementation is important to maintain so that frequent changes are not desired, however adjustments should be made if and when substantial new information warrants a review of the plan.

Action Steps, Responsibilities, and Timelines

Achieving the goals of the OLEPCCP requires coordinated actions engaging all parties concerned with conservation of LEPC in Oklahoma. This plan initiates this coordination, describes a number of the action steps, and identifies what needs to be further developed to implement other action steps. To the extent possible, the cooperators involved in each action step and their commitment to implementing that action step with associated timelines are identified. This conservation plan is envisioned to be a working document and adjustments, additions, and improvements to the actions steps are expected.

Develop Habitat Potential Rating for Ecological Sites and Desired Restoration Conditions for each Site

NRCS ecological sites provide a valuable tool for identifying the potential of an area for producing LEPC habitat, and can help identify the specific plant communities that can occur on each site that would maximize LEPC habitat quality. Developing this information and making it available in an easy to obtain source should be done. Responsibility: ODWC, NRCS, others. Timeline: 6 months (December 2012).

Maximizing Habitat Improvement Opportunities In Core Conservation Areas

An essential component to the success of the OLEPCCP is the improvement of habitat quality within the core conservation areas. In certain areas, public lands (ODWC Wildlife Management Areas (WMA's), USFS National Grasslands) or private conservation lands such as those owned by The Nature Conservancy (TNC) can provide some of the required high quality habitat. However, engaging private landowners in the improvement of habitat quality is essential. To achieve maximum delivery of conservation improvements within core areas, available conservation programs should be combined to offer the greatest possible incentive program package for landowners. In addition, within core areas, landowners will receive "bonus points" in sign-ups for LEPC related programs.

Available habitat improvement programs were discussed previous and include the following: NRCS LPCI, NRCS WHIP, FSA CRP, FSA SAFE, ODWC LEPC Program, USFWS Partners Program, OACD Wildlife Credits

Program, and others. Within core areas, a goal is to restore sand sagebrush, shinnery oak, and mixed grass ecological sites to their specified reference conditions. Primary treatments to accomplish this include prescribed burning, prescribed grazing, brush management, control of exotic or invasive species, and fence removal/marking. Packaging these treatments to minimize any economic costs to landowners is desirable.

Payments to landowners should be tiered to preferred ecological sites, with ecological sites with greater habitat potentials receiving the highest priority for payments. Sites with higher quality existing habitat conditions should also be prioritized for payment for practices that maintain the quality of these areas. Within core areas, incentive payments should be offered in addition to funding of specific practices to further encourage landowners to support LEPC conservation efforts.

Agencies (NRCS, USFWS, ODWC, OACD, others) should coordinate their activities so that landowners can obtain a full package of programs coordinated through one technical service provider. This will require training of all TSP's who might deliver LEPC habitat improvement programs to either be able to develop coordinated plans for each property, or to engage appropriate TSP's to work with the landowner to produce a coordinated plan. Different agencies operate under different signup times and may have different rates for practices. Agencies need to work together to provide landowners with information on the different programs and any signup dates and offer assistance in enrolling in all eligible programs. Agencies should coordinate annually on their programs, and attend a field day to assist with this coordination.

A management plan will be developed for each landowner as part the coordinated LEPC conservation program. A management plan is a component of the NRCS LPCI, ODWC LEPC Program, and USFWS Partners Program. This management plan needs to be based on a standard evaluation form and a consistent set of management guidelines for use by all agencies. The management plan may include several programs and require approval and signatures from multiple agencies, but is should be packaged into one agreement for the landowner.

Various practices and their combinations are particularly important for improving and maintaining LEPC habitat. Several practices offer relatively quick returns in terms of LEPC habitat. These include control of red cedar invasions through a combination of brush management and prescribed burning, improvement of sand sagebrush and shinnery oak plant communities through prescribed burning, and improvement of grass and forb compositions and structures through prescribed grazing practices. Maintaining and increasing CRP acres within core areas is also a desirable program which may be enhanced using targeted SAFE programs. CRP in native grass is highly preferred. Established CRP in exotic grasses provides some benefits to LEPC but could be improved through conversion to native grasses. Prescribed grazing is also important and should include opportunities for compensation for grazing reductions especially in areas supporting nesting habitat. Marking fences and removing unneeded fences especially near leks can help reduce LEPC mortalities.

DRAFT

Stacking of programs within core areas should be designed to offer landowners every opportunity to voluntary engage in LEPC conservation efforts at little or no cost to the landowner. It is envisioned that NRCS LPCI would provide a base foundation for funding of LEPC habitat improvement practices. USFWS Partners Program can also provide a base funding foundation or may provide higher rates of cost share for selected LEPC practices. ODWC LEPC Program may be able to provide additional funding support to enhance payments offered by the two federal programs. OACD Wildlife Credits may offer additional incentives for landowners that support a full LEPC management plan on their property.

Coordination of programs, practices, evaluation criteria, management planning guidelines, and stacking criteria are essential steps in implementing an effective LEPC conservation plan. Agencies need to continue efforts to accomplish this coordination as soon as possible to maximize LEPC management efforts. A process of coordination and its details should be agreed to by the various agencies, and a schedule to training for TSP's and coordination established. Responsibility: ODWC and all other agencies. Timeline: 3 months (September 2012).

Development of the Candidate Conservation Agreement with Assurances (CCAA)

The landowner CCAA developed by the USFWS and ODWC is an essential tool for engaging many landowners in voluntary LEPC habitat improvements. This tool needs to be finalized and implemented. Responsibility: USFWS, ODWC. Timeline: 3 months (September 2012).

Definition of Net Conservation Benefits for CCAA Eligibility

For inclusion in assurances provided by the CCAA, a landowner must provide a "net conservation benefit" to LEPC. What is meant by a net conservation benefit, and what is the minimum net conservation benefit that will be acceptable for inclusion need to be identified and described in guidelines. The standardized LEPC evaluation form discussed above is a starting point for identifying specific needs to be addressed in a management plan developed for a landowner. The management plan should identify all of the ways to improve a property for LEPC. Landowners always have the option of implementing some or all of the proposed practices, with incentives offered for implementing multiple practices or the full management plan. For a landowner to qualify for inclusion in the CCAA, a minimum improvement in habitat quality should be expected to be met as a net conservation benefit. In some situations, a parcel that currently supports high quality habitat could be eligible if the landowner agrees to use practices that will maintain this high quality over time. Developments under the control of the landowner that reduce habitat quality could disqualify a property from inclusion. Decisions will be needed regarding whether an entire property of a landowner is included in a CCAA if only part of the property is improved for LEPC, what percentage of property would be deemed acceptable to include the entire property, and if different ecological sites with differing habitat potentials have an influence in these decisions. Responsibility: ODWC, USFWS, other agencies and landowner input. Timeline: 5 months (November 2012)

Develop Opportunities and Criteria for Voluntary Offset Programs

Voluntary offset programs offer an excellent funding opportunity for LEPC mitigation. A framework for a voluntary offset program that considers the variety of development types and locations as well as

opportunities for conservation organizations to contribute should be developed. A clear process for administering these funds should be established. A consistent system of evaluating potential impacts from development, and assigning an impact cost to these developments should be established that places a premium value on impacts occurring within core areas, especially those parts of core areas with existing or potential high quality LEPC habitat. The habitat model for LEPC can be used to consistently quantify expected impacts to LEPC from developments, although avoidance behavior distances need to be established. While generation of funding for LEPC habitat improvements is the goal, the funding needs to tracked and demonstrated to be producing equivalent benefits to compensate for losses for this program to be effective. Responsibility: ODWC working with wind, transmission, oil and gas industries. Timeline: 6 months (December 2012).

Establishing Development Agreement Guidelines

Landowners in core areas whose lands also have high development potential may be economically impacted by the avoidance of these areas by developers. Alternatively, landowners may be encouraged to support LEPC conservation and not allow developments under their control if they receive some compensation for forgoing these development opportunities. Development agreements would compensate landowners for forgoing development opportunities for a set length of time. Guidelines for such agreements need to be developed that consider the probability of development, the existing quality of LEPC habitat/populations in the area, the potential for the area to be high quality LEPC habitat, and its location within a core area. These guidelines should establish the amounts of compensation recommended for different locations considering the mentioned factors, and the process for establishing the agreements. Responsibility: ODWC with input from landowners. Timeline: 9 months (March 2013).

Establishing Off-site Mitigation Guidelines and Conservation Banking Programs

Conservation banks offer the ability for economic incentives to landowners to provide long-term habitat improvements for LEPC. Core areas are logical locations for conservation banks. Mechanisms to establish credits for LEPC through conservation banks that can be used to offset future development impacts should be established. Responsibility: Entrepreneur working with USFWS. Timeline: uncertain.

Identify Additional LEPC Funding Sources

Various programs already exist that provide funding for LEPC conservation. However, the amount of funds needed to meet LEPC conservation needs in establishing high quality habitat in core areas is much greater than the existing sources. Additional funding sources should be identified to address this need. Responsibility: All Timeline: on-going.

Establish "Level Playing Field" for Voluntary Avoidance of Development

The OLEPCCP calls for avoidance or minimization of development within core conservation areas. This is a voluntary program for development interests. Concern exists that if an energy company voluntarily postpones or stops a potential development within a core area that another company could move in and proceed with the development of the resource. Mechanisms are needed to ensure that if a company contributes towards LEPC conservation in this way, that other companies can't undermine

these contributions. Such mechanisms don't currently exist. Possibilities include energy companies working with OCC to create a mechanism for a level playing field, or companies that can exert some control on the sale of products from within core areas working together to restrict such sales. Additional investigation of ways of developing public policy that results in voluntary conservation without the need for regulation could help inform the development of level playing fields. Responsibility: ODWC, energy companies, OK Corporate Commission. Timelines: 9 months (March 2013).

Enhance Opportunities for Conducting Prescribed Burning

Prescribed burning is recognized as one of the important management tools for improving and maintaining LEPC habitat. Use of this tool is constrained by a combination of a lack of available expertise in conducting prescribed burning, and concerns over liability. Several recommendations have been identified to help resolve these needs. One is to promote the development of local prescribed burn associations where local landowners can work together to conduct cost effective prescribed burns. A second recommendation is to investigate how to provide better liability insurance for these burns, whether through the landowner, organizations such as the Oklahoma Prescribed Burn Association, or agencies. A third recommendation would be to explore the possibility of creating a multi-agency prescribed burn team that could provide assistance to landowners through creation of burn plans, coordination of prescribed burning assistance such as through local fire departments, conducting training burns for burn associations, local landowners, and local fire departments, assistance in conducting burns, conduct prescribed burns, and hosting field tours of burn sites. OSU may be a source for setting up training programs for landowners. Responsibility: ODWC, Oklahoma Prescribed Burn Association, Oklahoma Prescribed Fire Council, TNC, other agencies and organizations. Timeline: 9 months (March 2013).

Use of Oil and Gas LEPC Best Management Practices (BMP's)

Energy developments within LEPC range can help minimize potential impacts to the species through the use of BMP's. Oklahoma Independent Petroleum Association (OIPA) and ODWC have developed "Crude oil and natural gas development voluntary best practices for Oklahoma", and have signed a memorandum of understanding to promote use of such practices. Specific steps for promotion of BMP's should be identified by both parties. Responsibility: ODWC, OIPA, and other oil and gas interests. Timeline: 6 months (December 2012).

Establish Wind Energy and Transmission Line BMP's

As with oil and gas developments, wind energy and transmission line developments can help minimize impacts to LEPC and LEPC habitat through use of BMP's. Various wind energy programs are being developed including a Habitat Conservation Plan (HCP) for whooping cranes (*Grus americana*) and LEPC, (Great Plains Wind Energy HCP) and recommendations for BMP's including the USFWS (2012) Land Based Wind Energy Guidelines. The National Wind Coordinating Committee and the American Wind and Wildlife Institute have been promoting efforts to develop better understanding of wind and wildlife interactions, and to promote research to expand this understanding. Specific guidelines for wind energy

DRAFT

and transmission line development can be developed for LEPC, and agreements between appropriate parties established to promote their use. The relationship between on-going general BMP's and range-wide initiatives and Oklahoma LEPC conservation efforts needs to be further examined and recommendations for coordination developed. Responsibility: ODWC, American Wind Energy Association, wind and transmission companies. Timeline: 9 months (March 2013).

Develop Energy CCAA (s)

Landowners will be provided with assurances associated with voluntary conservation actions should LEPC be listed in the future through the landowner CCAA discussed above. Energy industries might also be provided opportunities for assurances for voluntary conservation actions through similar CCAA's. As mentioned above, the Great Plains Wind Energy HCP is under development. Additional CCAA's or HCP's may well extend beyond Oklahoma, but will Oklahoma could take a lead in developing their content. Responsibility: Energy industries, USFWS, ODWC. Timeline: Continuing activity.

Develop an Education and Outreach Program for LEPC

Conservation of LEPC will depend on landowners, industries, and others having a good knowledge of the species, its habitat needs, conservation opportunities, and available programs. While various education and outreach programs already exist, additional opportunities should be considered. A coordinated program for education and outreach on this species should be established and implemented. OACD has been developing an outreach program to landowners as part of its Wildlife Credits CIG project. They have been working on coordinating agencies in this effort. This effort should be continued and expanded as appropriate. Responsibility: OACD, ODWC, OSU Extension, Audubon, TNC, USFWS, NRCS, others. Timeline: 9 months (March 2013).

Additional outreach and educational programs can also be developed. Field visits to demonstration sites that highlight various LEPC habitat improvement practices can be planned. One possibility is to visit the site of the landowner who received the previous year's LEPC stewardship award (see below) so landowners can see effective habitat management practices. In addition, a one page fact sheet that lists benefits to landowners associated with LEPC habitat conservation should be developed. Responsibility: ODWC, NRCS. Timeline: 3 months (September 2012).

Develop Recognition Awards

In addition to incentive programs that compensate for or reduce costs of LEPC conservation efforts, landowners or industries initiating stellar LEPC conservation actions should be recognized for these efforts. Two awards that might be developed are a LEPC landowner stewardship award, and an LEPC industry stewardship award. The specifics of such an award program need to be developed and implemented. Responsibility: ODWC, USFWS, NRCS, conservation organizations, industry. Timeline: 9 months (March 2013).

Develop LEPC Habitat Demonstration Areas on ODWC WMA's

ODWC owns several WMA's within LEPC range. These should be managed to maximize habitat quality for LEPC. Doing so will not only provide important habitat, but can be used as demonstration areas for

DRAFT

other landowners to see what high quality habitat looks like. Management plans targeted specifically at providing maximum quality LEPC habitat should be developed for each WMA, and specific treatments implemented. Responsibility: ODWC. Timeline: 1 year (June 2013).

Establish LEPC Management Agreements with USFS and TNC

The U.S. Forest Service has national grasslands within Oklahoma that can contribute to LEPC habitat needs. This agency recognizes the needs of this species, and incorporates these needs into its management plans. Similarly, TNC owns property within Oklahoma that can contribute to LEPC habitat. The value of these grasslands to the overall conservation of the species and their contribution to core conservation areas or linkage zones should be recognized through agreements. Both of these can also serve as additional demonstration areas for LEPC conservation. Responsibility: ODWC, USFS, and TNC. Timeline: 6 months (December 2012).

Set up CRP Guidelines for LEPC in Oklahoma

Many of the CRP lands in Oklahoma were established with old world bluestems or other nonnative species that have lower value for LEPC than native grasslands. While new CRP enrollments emphasize planting of native species, restoring non-native CRP fields within core conservation areas to native species could contribute to LEPC habitat. New rules or incentives to make such conversions possible should be developed. Responsibility: FSA, NRCS, ODWC. Timeline: 9 months (March 2013).

Establish Tax Incentives for Voluntary LEPC Management

In addition to incentive payments to landowners who voluntarily improve LEPC habitat, another possible incentive may be possible through tax incentives. The possibility of this and how it could be done needs to be explored, and appropriate recommendations for implementation developed. Responsibility: ODWC. Timeline: 9 months (March 2013).

Restore Abandoned Development Sites

Oklahoma Energy Resources Board is responsible for the restoration of abandoned energy development sites. Those sites occurring within core conservation areas could be targeted as priority restoration areas. Establishing this priority through an MOU or other mechanism is desirable. Responsibility: ODWC, OERB. Timeline: 9 months (March 2013).

Development of LEPC Management Plans for Each Core Conservation Area

Core conservation areas need to be the focus of habitat improvement activities. For each core area, an assessment should be conducted of the areas where the greatest gains in habitat quality can be produced, and management plans that have the goal of producing these gains developed. While on-the-ground treatments with landowners are voluntary, a management plan for each core conservation area should help identify where and what types of LEPC cost share and incentive programs would provide the greatest returns in LEPC habitat, and help technical service providers prioritize their management efforts. Responsibility: ODWC, NRCS, USFWS, other partners. Timeline: Initiate planning within 6 months (December 2012).

DRAFT

Implement Key Research Projects

As indicated in the OLEPCCP, much remains unknown concerning LEPC. Sources of funding should be sought to support key research needs. An analysis of funding priorities recognizing the needs for habitat restoration, habitat protection, and research is needed. Research should be supported that addresses the highest priority information needs. Coordination of efforts can maximize the efficiencies in generating the needed research. A specific multi-party research plan that identifies the most important research questions and recommends specific projects to investigate these questions should be developed. Responsibility: ODWC, NRCS, Universities, other partners. Timeline: on-going, with an annual report describing on-going research projects, recommended additional projects, and any identified new research priorities- 6 months (December 2012).

Conduct Monitoring of LEPC and LEPC Habitat

Monitoring programs for LEPC are critical to understanding its status and responses to management actions. A monitoring program for LEPC leks has been established and needs to be continued. In addition, a consolidated tracking of LEPC habitat conditions should also be maintained. An adaptive management framework should be incorporated as part of monitoring. Specific LEPC habitat treatments should be monitored to determine which specific treatments produced the best results in terms of habitat conditions. LEPC population responses to improvements in core areas should be monitored to assess the habitat amounts, sizes, and distributions recommended in this plan. As significant new information is generated, plan recommendations should be adjusted to incorporate the new results. A specific monitoring plan that includes an adaptive management design should be prepared and endorsed by the various research contributors. Responsibility: ODWC and other research and management partners. Timeline: 9 months (March 2013).

Conduct LEPC Population Sensitivity Analysis

Once core areas are established and existing and potential habitat quality within these areas assessed, the likely response of LEPC populations to projected conditions should be evaluated. This could be conducted through a habitat-based species viability analysis to determine the long term probability of persistence of LEPC in Oklahoma. Responsibility: ODWD, USFWS, NRCS and other partners. Timeline: 2014.

Risk Assessment

Evaluation of the 5 ESA listing criteria based on outcomes of the OLEPCCP – To be added in the final plan.

Acknowledgements

To be added in the final plan.

DRAFT

LITERATURE CITED

Addison, E. M., and R. C. Anderson. 1969. *Oxyspirura lumdsdeni* n. sp. (Nematoda: Thelaziidae) from Tetraonidae in North America. Canadian Journal of Zoology 47:1223-1227.

Ahlborn, G. G. 1980. Brood-rearing habitat and fall-winter movements of lesser prairie chickens in eastern New Mexico. Thesis. New Mexico State University, Las Cruces, New Mexico, USA.

Aldrich, J. W. 1963. Geographic orientation of American Tetraonidae. Journal of Wildlife Management 27:529:545.

Applegate, R. D, and T. Z. Riley. 1998. Lesser prairie-chicken management. Rangelands 20:13-15.

Baker, M. F. 1953. Prairie chickens of Kansas. University of Kansas Museum of Natural History and Biological Survey of Kansas. Miscellaneous Publication 5, Lawrence, Kansas, USA.

Bailey, F. M. 1928. Birds of New Mexico. Judd and Detweiler, Inc., Washington D.C.

Bailey, J. A., and S. O. Williams. 2000. Status of the lesser prairie-chicken in New Mexico, 1999. Prairie Naturalist 32:157-168.

_____, J. Kline, and C. A. Davis. 2000. Status of nesting habitat for lesser prairie-chicken in New Mexico. Prairie Naturalist 32:149-156.

Beck, J. L. 2006. Summary of oil and natural gas development impacts on prairie grouse. Unpublished Report, Colorado Division of Wildlife, Grand Junction, Colorado, USA.

Beck, J. L. 2009. Impacts of oil and natural gas on prairie grouse: current knowledge and research needs. Proceedings of the 2009 National Meeting - American Society of Mining and Reclamation. 26th Conference, Vol. 1, pp. 66-87.

Behney, A. C. 2009. Predation and reproductive behavior of Lesser Prairie-Chickens at leks in the Texas Southern Great Plains. Thesis. Texas Tech University, Lubbock, Texas, USA.

Bell, L. A. 2005. Habitat use and growth and development of juvenile lesser prairie chickens in southeast New Mexico. Thesis. Oklahoma State University, Stillwater, Oklahoma, USA.

Bell, L. A., S. D. Fuhlendorf, M. A. Patten, D. H. Wolfe, and S. K. Sherrod. 2010. Lesser Prairie Chicken hen and brood habitat use on sand shinnery oak. Rangeland Ecology and Management 63:478-486.

Bellinger, R., J. Johnson, J. Toepfer, and P. Dunn. 2003. Loss of genetic variation in greater prairie-chickens following a population bottleneck in Wisconsin, U.S.A. Conservation Biology 17:717-724.

Bent, A. C. 1932. Life histories of North American gallinaceous birds. U.S. National Museum Bulletin 162.

Berg, W. A., J. A. Bradford, and P. L. Sims. 1997. Long-term soil nitrogen and vegetation change on sandhill rangeland. Journal of Range Management 50: 482-486.

Bidwell, T., and A. Peoples. 1991. Habitat management for Oklahoma's prairie chickens. Bulletin Number 9004, Cooperative Extension Service, Division of Agriculture, Oklahoma State University, Oklahoma, USA.

Bidwell, T. G., C. B. Green, A. D. Peoples, and R. E. Masters. 1995. Prairie chicken management in Oklahoma. Oklahoma State University Extension Circular E-945, Oklahoma Cooperative Extension Unit, Stillwater, Oklahoma, USA.

DRAFT

_____, S. Fuhlendorf, B. Gillen, S. Harmon, R. Horton, R. Manes, R. Rodgers, S. Sherrod, and D. Wolfe. 2003. Ecology and management of the lesser prairie-chicken in Oklahoma. Oklahoma State University Extension Circular E-970, Oklahoma Cooperative Extension Unit, Stillwater, Oklahoma, USA.

_____, R. E. Masters, and M. Sams. 2009. Bobwhite quail habitat evaluation and management guide. Oklahoma State University Extension Circular E-904, Oklahoma Cooperative Extension Unit, Stillwater, Oklahoma, USA.

Boal, C., D. Haukos, and B. Grisham. 2010. Understanding the ecology, habitat use, phenology and thermal tolerance of nesting Lesser Prairie-Chickens to predict population level influences of climate change. Final Report – Phase 1. Submitted to U. S. Fish and Wildlife Service / GPLCC, Region 2, Albuquerque, New Mexico, USA.

Bouzat, J. L., H. H. Cheng, H. A. Lewin, R. I. Westemeier, J. D. Brawn, and K. N. Paige. 1998a. Genetic evaluation of a demographic bottleneck in the greater prairie-chicken. Conservation Biology 12:836-849.

_____, H. A. Lewin, and K. N. Paige. 1998b. The ghost of genetic diversity past: historical DNA analysis of the greater prairie-chicken. American Naturalist 152:1-6.

_____, and K. Johnson. 2004. Genetic structure among closely spaced leks in a peripheral population of lesser prairie-chickens. Molecular Ecology 13:499-505.

Bragg, T. B., and A. A. Steuter. 1996. Prairie ecology – the mixed prairie. Pages 53-65 *in* F. B. Sampson and F. L. Knopf, editors. Prairie conservation: preserving North America's most endangered ecosystem. Island Press, Washington D.C.

Braun, C. E., K. Martin, T. E. Remington, and J. R. Young. 1994. North American grouse: issues and strategies for the 21st century. Transactions of the North American Wildlife and Natural Resource Conference 59:428-437.

Breininger, D. R., M. A. Burgman, and B. M. Stith. 1999. Influence of habitat quality, catastrophes, and population size on extinction risk of the Florida scrub-jay. Wildlife Society Bulletin 27:812-822.

Campbell, H. 1972. A population study of lesser prairie chickens in New Mexico. Journal of Wildlife Management 36:689-699.

Cannon, R. W. 1980. Density and distribution of prairie chicken in Oklahoma: final report. Oklahoma Cooperative Wildlife Research Unit and Oklahoma Department of Wildlife Conservation. Project no. W-125-R, Study 2, Job 1. 64pp.

Cannon, R. W, and F. L. Knopf. 1979. Lesser prairie-chicken responses to range fires at the booming ground. Wildlife Society Bulletin 7:44-46.

Copelin, F. F. 1963. The lesser prairie-chicken in Oklahoma. Oklahoma Department of Wildlife Technical Bulletin 6, Oklahoma City, Oklahoma, USA.

Crawford, J. A. 1974. The effects of land use on lesser prairie chicken populations in west Texas. Dissertation. Texas Tech University, Lubbock, Texas, USA.

_____. 1980. Status, problems, and research needs of the lesser prairie chicken. Pages 1-7 *in* Proceedings Prairie Grouse Symposium (P. A. Vows and F. L. Knopf, editors). Oklahoma State University, Stillwater, Oklahoma, USA.

DRAFT

_____, and E. G. Bolen. 1976a. Effects of land use on lesser prairie-chickens in Texas. Journal of Wildlife Management 40:96-104.

_____, and _____. 1976b. Effects of lek disturbance on lesser prairie-chickens. Southwestern Naturalist 21:238-240.

_____, and _____. 1976c. Fall diet of lesser prairie chickens in west Texas. Condor 78:142-144.

Davies, B. 1992. Lesser prairie chicken recovery plan. Colorado Division of Wildlife, Colorado Springs, Colorado, USA.

Davis, C. A., T. Z. Riley, R. A. Smith, H. R. Suminski, and M. J. Wisdom. 1979. Habitat evaluation of lesser prairie chickens in eastern Chaves County, New Mexico. Department of Fish and Wildlife Science, New Mexico Agriculture Experiment Station, Las Cruces, New Mexico, USA.

_____, C. G. Ahlborn, S. S. Merchant, and D. L. Wilson. 1981. Evaluation of lesser prairie chicken habitat in Roosevelt County, New Mexico. Final report to New Mexico Department of Game and Fish, Contract 516-67-05. New Mexico State University, Las Cruces, New Mexico, USA.

Davis, D. M. 2006. Final investigation report: the lesser prairie-chicken in New Mexico. New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.

Davis, D. M. 2009. Nesting ecology and reproductive success of Lesser Prairie-Chickens in

shinnery oak-dominated rangelands. Wilson Journal of Ornithology 121:322-327.

Davis, D. M., R. E. Horton, E. A. Odell, R. D. Rodgers, and H. A. Whitlaw. 2008. Lesser Prairie Chicken Conservation Initiative. Lesser Prairie-Chicken Interstate Working Group. Unpublished Report, Colorado Division of Wildlife, Fort Collins, CO. 121pp.

Davison, V. E. 1940. An 8 year census of lesser prairie-chickens. Journal of Wildlife Management 4:55-62.

Dixon, C. E. 2011. A spring without moisture, how did it effect lesser prairie chickens and their habitat in eastern New Mexico? Abstract in: Prairie Grouse Technical Council 29th meeting.

Doerr, T. B., and F. S. Guthery. 1983. Effects of tebuthiuron on lesser prairie-chicken habitat and foods. Journal of Wildlife Management 47:1138-1142.

Donaldson, D. D. 1969. Effect on lesser prairie chickens of brush control in western Oklahoma. Dissertation. Oklahoma State University, Stillwater, Oklahoma, USA.

Duck, L. G., and J. B. Fletcher. 1944. A survey of the game and furbearing animals of Oklahoma. State Bulletin 3, Oklahoma Game and Fish Department, Oklahoma City, Oklahoma, USA.

Elmore, D., T. Bidwell, R. Ranft, and D. Wolfe. 2009. Habitat evaluation guide for the Lesser Prairie-Chicken. E-1014. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University, Stillwater, Oklahoma. 26pp.

Fields, T. L. 2004. Breeding season habitat use of Conservation Reserve Program (CRP) land by lesser prairie chickens in west central Kansas. Thesis. Colorado State University, Fort Collins, Colorado, USA.

Fields, T. L., G. C. White, W. C. Gilgert, and R. D. Rodgers. 2006. Nest and brood survival of Lesser Prairie-Chickens in west central Kansas. Journal of Wildlife Management 70:931-938.

Fuhlendorf, S. D., and D. M. Engle. 2001. Restoring heterogeneity on rangelands: ecosystem management based on evolutionary grazing patterns. BioScience 51:625-632.

DRAFT

_____, W.C. Harrell, D.M. Engle, R.G. Hamilton, C.A. Davis, and D.M. Leslie Jr. 2006. Should heterogeneity be the basis for conservation? Grassland bird response to fire and grazing. Ecological Applications 16: 1706-1716.

_____, A. J. Woodward, D. M. Leslie Jr., and J. S. Shackford. 2002. Multiscale effects of habitat loss and fragmentation on lesser prairie-chicken populations. Landscape Ecology 17:601-615.

Giesen, K. M. 1991. Population inventory and habitat use by lesser prairie-chickens in southeast Colorado. Federal Aid in Wildlife Restoration Report W-152-R, Colorado Division of Wildlife, Colorado, USA.

_____. 1994a Breeding range and population status of lesser prairie-chickens in Colorado. Prairie Naturalist 26: 175-182.

_____. 1994b. Movements and nesting habitat of lesser prairie-chicken hens in Colorado. Southwestern Naturalist 39:96-98.

_____. 1998. Lesser prairie-chicken. *In* The birds of North America, No. 364 (A. Poole and F. Gills, editors). The Birds of North America, Inc., Philadelphia, Pennsylvania, USA.

_____. 2000. Population status and management of lesser prairie-chicken in Colorado. Prairie Naturalist 32: 137-148.

Grisham, B., and D. Haukos. 2011. A ten year assessment of herbicide treatment and grazing on nest site selection and daily nest survival of lesser prairie chickens in New Mexico. Abstract in: Prairie Grouse Technical Council 29th meeting.

Hagen, C. A. 2003. A demographic evaluation of lesser prairie-chicken populations in southwest Kansas: survival, population viability, and habitat use. Dissertation. Kansas State University, Manhattan, Kansas, USA.

Hagen, C. A. 2010. Impacts of energy development on prairie grouse ecology: a research synthesis. Transactions of the 75th North American Wildlife and Natural Resources Conference 75:96-103.

_____, and K. M. Giesen. 2005. Lesser Prairie-Chicken (Tympanuchus pallidicinctus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/364

_____, B. E. Jamison, K. M. Giesen, and T. Z. Riley. 2004. Guidelines for managing lesser prairie-chicken populations and their habitats. Wildlife Society Bulletin 32:69-82.

_____, J. C. Pitman, T. M. Loughin, B. K. Sandercock, R. J. Robel, and R. D. Applegate. 2011. Impacts of anthropogenic features on habitat use by Lesser Prairie-Chickens. Pages 63-76 *in* B. K. Sandercock, K. Martin, and G. Segelbacher (editors). Ecology, conservation, and management of grouse. Studies In Avian Biology (no. 39), University of California Press, Berkeley, California, USA.

_____, _____, B. K. Sandercock, R. J. Robel, and R. D. Applegate. 2007. Age-specific survival and probable causes of mortality in female Lesser Prairie-Chickens. Journal of Wildlife Management 71:518-525.

_____, _____, _____, D. H. Wolfe, R. J. Robel, R. D. Applegate, and S. J. Oyler-McCance. 2010. Regional variation in mtDNA of the Lesser Prairie-Chicken. Condor 112:29-37.

DRAFT

_____, G. C. Salter, J. C. Pitman, R. J. Robel, and R. D. Applegate. 2005. Lesser prairie-chicken brood habitat in sand sagebrush: invertebrate biomass and vegetation. Wildlife Society Bulletin 33:1080-1091.

Hagen, C. A., B. K. Sandercock, J. C. Pitman, R. J. Robel, and R. D. Applegate. 2009. Spatial variation in Lesser Prairie-Chicken demography: a sensitivity analysis of population dynamics and management alternatives. Journal of Wildlife Management 73:1325-1332.

Hamerstrom, F. N. Jr., and F. Hamerstrom. 1961. Status and problems of North American grouse. Wilson Bulletin 73:284-294.

Hann, W. 2003. Reference conditions for Desert Grassland. *In*:Interagency and The Nature Conservancy fire regimes condition class website (http://www.frcc.gov). USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management.

Hartnet, D. C., K. R. Hickman, L. E. Fischer-Walter. 1996. Effects of bison grazing, fire, and Topography on floristic diversity in tallgrass prairie. Journal of Range Management 49:413–420.

Haukos, D. A. 1988. Reproductive ecology of lesser prairie-chickens in west Texas. Thesis. Texas Tech University, Lubbock, Texas, USA.

_____, and L. M. Smith. 1989. Lesser prairie chicken nest site selection and vegetation characteristics in tebuthiuron-treated and untreated sand shinnery oak in Texas. Great Basin Naturalist 49:624-626.

Henika, F. S. 1940. Present status and future management of the prairie chicken in Region 5. Special Report: Texas Game, Fish, and Oyster Commission, Division of Wildlife Restoration, Project 1-R.

Hoffman, D. M. 1963. The lesser prairie chicken in Colorado. Journal of Wildlife Management 27:726-732.

Horak, G. J. 1985. Kansas prairie chickens. Wildlife Bulletin 3, Kansas Fish and Game Commission, Pratt, Kansas, USA.

Horton, R. E. 2000. Distribution and abundance of lesser prairie-chicken in Oklahoma. Prairie Naturalist 32:189-195.

Horton, R., L. Bell, C. M. O'Meilia, M. McLachlan, C. Hise, D. Wolfe, D. Elmore and J.D. Strong. 2010. A spatially-based planning tool designed to reduce negative effects of development on the Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) in Oklahoma: A multi-entity collaboration to promote Lesser Prairie-Chicken voluntary habitat conservation and prioritized management actions. Oklahoma Department of Wildlife Conservation. Oklahoma City, Oklahoma. 79pp. Available online at: http://www.wildlifedepartment.com/lepcdevelopmentplanning.htm

Hubbard, J. P. 1978. Revised check-list of the birds of New Mexico. New Mexico Ornithological Society Publication Number 6, Albuquerque, New Mexico, USA.

Hunt, J. L. 2004. Investigation into the decline of the lesser prairie-chicken (*Tympanuchus pallidicinctus* Ridgway) in southeastern New Mexico.Dissertation. Auburn University, Auburn, Alabama, USA.

Hunt, J. L., and T. L. Best. 2010. Vegetative characteristics of active and abandoned leks of Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*) in southeastern New Mexico. Southwestern Naturalist 55:477-487.

DRAFT

Inkley, D. B., M. G. Anderson, A. R. Blaustein, V. R. Burkett, B. Felzer, B. Griffith, J. Price, and T. L. Root. 2004. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-2. The Wildlife Society, Bethesda, Maryland, USA. 26pp.

Jackson, A. S., and R. DeArment. 1963. The lesser prairie chicken in the Texas Panhandle. Journal of Wildlife Management 27:733-737.

Jamison, B. E. 2000. Lesser prairie-chicken chick survival, adult survival, and habitat selection and movements of males in fragmented rangelands of southwestern Kansas. Thesis. Kansas State University, Manhattan, Kansas, USA.

_____, J. A. Dechant, D. H. Johnson, L. D. Igle, C. M. Goldade, and B. R. Eulis. 2002a. Effects of management practices on grassland birds: lesser prairie-chicken. Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.

_____, R. J. Robel, J. S. Pontius, and R. D. Applegate. 2002b. Invertebrate biomass: associations with lesser prairie-chicken habitat use and sand sagebrush density in southwestern Kansas. Wildlife Society Bulletin 30:517-526.

Jarnevich, C. S., and M. K. Laubhan. 2011. Balancing energy development and conservation: a method utilizing species distribution models. Environmental Management 47:926-936.

Jensen, W. E., D. G. Robinson, Jr., and R. D. Applegate. 2000. Distribution and population trend of lesser prairie-chicken in Kansas. Prairie Naturalist 32:169-175.

Johnson, J. A., J. E. Toepfer, and P. O. Dunn. 2003. Contrasting patterns of mitochondrial and microsatellite population structure in fragmented populations of greater prairie-chickens. Molecular Ecology 12:3335-3347.

_____, M. R. Bellinger, J. E. Toepfer, and P. Dunn. 2004. Temporal changes in allele frequencies and low effective population size in greater prairie-chickens. Molecular Ecology 13:2617-2630.

Johnson, K., B. H. Smith, G. Sabot, T. B. Neville, and P. Neville. 2004. Habitat use and nest site selection by nesting lesser prairie-chickens in southeastern New Mexico. 49:334-343.

Jones, R. E. 1963. Identification and analysis of lesser and greater prairie chicken habitat. Journal of Wildlife Management 27:757-778.

_____. 1964. Habitat used by lesser prairie chicken for feeding related to seasonal behavior of plants in Beaver County, Oklahoma. Southwestern Naturalist 9:111-117.

Jones, R. S. 2009. Seasonal survival, reproduction, and use of wildfire areas by Lesser PrairieChickens in the northeastern Texas Panhandle. Thesis. Texas A&M University, College Station, Texas, USA.

Karl, T. R., J. M. Melillo, and T. C. Peterson, editors. 2009. Global Climate Change Impacts in the United States. Cambridge University Press, Cambridge, England.

Knopf, F. L. 1996. Prairie legacies – birds. Pages 135-148 *in* F. B. Samson and F. L. Knopf, editors. Prairie conservation: Preserving North America's most endangered ecosystem. Island Press, Washington D.C.

_____, and F. B. Samson. 1997. Conservation of grassland vertebrates. Ecological Studies 125:273-289.

Lacy, R. C. 1997. Importance of genetic variation to the viability of mammalian populations. Journal of Mammology 78:320-335.

DRAFT

Larsson, L. C., C. L. Pruett, D. H. Wolfe, and M. A. Patten. 2012. Fine-scale habitat selection by the lesser prairie-chicken. Southwestern Naturalist: in press.

Leslie, D. M. Jr., J. S. Shackford, A. Woodward, S. Fuhlendorf, and C. B. Green. 1999. Landscape-level evaluation of the decline of the lesser prairie chicken in Oklahoma, Texas, and New Mexico. Oklahoma Department of Wildlife Conservation, Oklahoma City, Oklahoma, USA.

Ligon, J. S. 1927. Wildlife in New Mexico. Its conservation and management. New Mexico State Game Commission, Santa Fe, New Mexico, USA.

_____. 1951. Prairie chickens, highways, and power lines. New Mexico Magazine 29:29.

_____. 1961. New Mexico birds and where to find them. University of New Mexico Press, Albuquerque, New Mexico, USA.

Litton, R. L., R. L. West, D. F. Dvorak, and G. T. Miller. 1994. The lesser prairie-chicken and its management in Texas. Federal Aid Report Series No. 33. Contribution of Federal Aid Project W-129-M. Texas Parks and Wildlife Department, Austin, Texas, USA.

Locke, B. A. 1992. Lek hypothesis and the location, dispersion, and size of lesser prairie chicken leks. Dissertation. New Mexico State University, Las Cruces, New Mexico, USA.

Lyons, E. K., R. S. Jones, J. P. Leonard, B. E. Toole, R. A. McCleery, R. R. Lopez, M. J. Peterson, and N. J. Silvy. 2011. Regional variation in nesting success of Lesser Prairie-Chickens. Pages 223-232 *in* B. K. Sandercock, K. Martin, and G. Segelbacher (editors). Ecology, conservation, and management of grouse. Studies In Avian Biology (no. 39), University of California Press, Berkeley, California, USA.

Manes, R., S. A. Harmon, B. K. Overseer, and R. D. Applegate. 2004. Wind energy and wildlife in the Great Plains: identification of concerns an ways to alleviate them. Proceedings of the Great Plains Wind Power and Wildlife Workshop, March 19-20, 2003, Kansas City, Missouri, USA.

Manville, A. M. II. 2004. Prairie grouse leks and wind turbines: U. S. Fish and Wildlife Service justification for a 5-mile buffer from leks; additional grassland songbird recommendations. Division of Migratory Bird Management. USFWS, Arlington, VA, peer- reviewed briefing paper. 17pp.

Massey, M. 2001. Long-range plan for the management of lesser prairie chickens in New Mexico 2002-2006. New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.

Masters, R. 2004. Reference conditions for bluestem prairie, mixed, and tallgrass prairie. *In*: Interagency and The Nature Conservancy fire regimes condition class website (http://www.frcc.gov). USDA Forest Service, US Department of the Interior, The Nature Conservancy, and Systems for Environmental Management.

Mathews, J. H. 2008. Anthropogenic Climate Change in the Playa Lakes Joint Venture Region: Understanding Impacts, Discerning Trends, and Developing Resources. World Wildlife Fund, Corvallis, OR, USA.

McLachlan, M., A. Bartuszevige, and D. Poole. 2011. Evaluating the potential of the Conservation Reserve Program to offset projected impacts of climate change on the Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) - A conservation effects assessment project. Submitted to the USDA Natural Resources Conservation Service and the USDA Farm Service Agency. 44pp.

DRAFT

McRoberts, J. T., M. J. Butler, W. B. Ballard, M. C. Wallace, H. A. Whitlaw, and D. A. Haukos. 2011a. Response of Lesser Prairie-Chickens on leks to aerial surveys. Wildlife Society Bulletin 35:27-31.

McRoberts, J. T., M. J. Butler, W. B. Ballard, H. A. Whitlaw, D. A. Haukos, and M. C. Wallace. 2011b. Detectability of Lesser Prairie-Chicken leks: A comparison of surveys from aircraft. Journal of Wildlife Management 75:771-778.

Merchant, S. S. 1982. Habitat-use, reproductive success, and survival of female lesser prairie chickens in two years of contrasting weather. Thesis. New Mexico State University, Las Cruces, New Mexico, USA.

Milchunas, D.G., O.E. Sala, and W.K. Lauenroth. 1988. A generalized model of the effects of Grazing by large herbivores on grassland community stucture. American Naturalist 132:87–106.

Morrow, M. E. 1986. Ecology of Attwater's prairie chicken in relation to land management practices on the Attwater Prairie Chicken National Wildlife Refuge. Dissertation. Texas A&M University, College Station, Texas, USA.

_____, R. A. Adamcik, J. D. Friday, and L. B. McKinney. 1996. Factors affecting Attwater's prairie-chicken decline on the Attwater Prairie Chicken National Wildlife Refuge. Wildlife Society Bulletin 24:593-601.

Mote, K. D., R. D. Applegate, J. A. Bailey, K. M. Giesen, R. Horton, and J. L. Sheppard. 1998. Assessment and conservation strategy for the lesser prairie-chicken (*Tympanuchus pallidicinctus*). Kansas Department of Wildlife and Parks, Emporia, Kansas, USA.

Neville, P., T. Neville, and K. Johnson. 2005. Lesser prairie-chicken habitat map for portions of Eastern New Mexico. Publication No. 05-GTR-285. Natural Heritage New Mexico, Museum of Southwestern Biology, University of New Mexico. Albuquerque, New Mexico, USA.

Oberholser, H. C. 1974. The birdlife of Texas. Volume 1. University of Texas Press, Austin, Texas, USA.

Olawsky, C. D., and L. M. Smith. 1991. Lesser prairie-chicken densities on tebuthiuron-treated and untreated sand shinnery oak rangelands. Journal of Range Management 44:364-368.

Ostlie, W. 2003. Untilled Landscapes of the Great Plains. The Nature Conservancy, Midwest Science Center.

Patten, M. A., and J. F. Kelly. 2010. Habitat selection and the perceptual trap. Ecological Applications 20:2148-2156.

Patten, M. A., D. H. Wolfe, E. Shochat, and S. K. Sherrod. 2005. Habitat fragmentation, rapid evolution, and population persistence. Evolutionary Ecology Research 7:1-15.

Peterjohn, B. G. 2003. Agricultural landscapes: can they support healthy bird populations as well as farm products? Auk 120:14–19.

Peterson, M. J., and N. J. Silvy. 1994. Spring precipitation and fluctuations in Attwater's prairie-chicken numbers: hypothesis revisited. Journal of Wildlife Management 58:222-229.

Peterson, R. S. and C. S. Boyd. 1998. Ecology and management of sand shinnery communities: a literature review. USDA, Forest Service, General Technical Report RMRS-GTR-16.

Pitman, J. C. 2003. Lesser prairie-chicken nest site selection and nest success, juvenile gender determination and growth, and juvenile survival and dispersal in southwestern Kansas. Thesis. Kansas State University, Manhattan, Kansas, USA.

DRAFT

_____, C. A. Hagen, R. J. Robel, T. M. Loughin, and R. D. Applegate. 2005. Location and success of lesser prairie-chicken nests in relation to vegetation and human disturbance. Journal of Wildlife Management 69:1259-1269.

_____, C. A. Hagen, B. E. Jamison, R. J. Robel, T. M. Loughin, and R. D. Applegate. 2006. Nesting ecology of lesser prairie-chickens in sand sagebrush prairie of southwestern Kansas. Wilson Journal of Ornithology 118:23-35.

Pruett, C. L., J. A. Johnson, L. C. Larsson, D. H. Wolfe, and M. A. Patten. 2011. Low effective population size and survivorship in a grassland grouse. Conservation Genetics 12:1205-1214.

Pruett, C. L., M. A. Patten, and D. H. Wolfe. 2009a. It's not easy being green: wind energy and a declining grassland bird. BioScience 58:257-262.

Pruett, C. L., M. A. Patten, and D. H. Wolfe. 2009b. Avoidance behavior of prairie grouse: implications for wind and energy development. Conservation Biology 23:1253-1259.

Quinn, M. A., and D. D. Walgenbach. 1990. Influence of grazing history on the community structure of grasshoppers of a mixed-grass prairie. Environmental Entomology 90: 1756-1766.

Riley, T. Z. 1978. Nesting and brood rearing habitat of lesser prairie chickens in southeastern New Mexico. Thesis. New Mexico State University, Las Cruces, New Mexico, USA.

_____, C. A. Davis, M. Ortiz, and M. J. Wisdom. 1992. Vegetative characteristics of successful and unsuccessful nests of lesser prairie chickens. Journal of Wildlife Management 56:383-387.

_____, and _____. 1993. Vegetative characteristics of lesser prairie-chicken brood foraging sites. The Prairie Naturalist 25:243-248.

_____, _____, M. A. Candelaria, and H. R. Suminski. 1994. Lesser Prairie-Chicken movements and home ranges in New Mexico. Prairie Naturalist 26:183-186.

_____, _____, and R. A. Smith. 1993. Autumn-winter foods of the lesser prairie-chicken (*Tympanuchus pallidicinctus*) (Galliformes: Tetraonidae). Great Basin Naturalist 53:186-189.

Ripper, D., M. McLachlan, T. Toombs, and T. VerCauteren. 2008. Assessment of Conservation Reserve Program fields within the current distribution of Lesser Prairie-Chicken. Great Plains Research 18:205-218.

Robb, L. A. and M. A. Schroeder. 2005. Lesser prairie-chicken (*Tympanuchus pallidicinctus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/lesserprairiechicken/pdf.

Robel, R. J., J. A. Harrington, Jr., C. A. Hagen, J. C. Pitman, and R. R. Reker. 2004. Effect of energy development and human activity on the use of sand sagebrush habitat by lesser prairie-chickens in southwest Kansas. Transactions of the North American Wildlife and Natural Resources Conference 68: *in press*.

Rodgers, R. D. 2005. Conservation reserve program successes, failures, and management needs for open-land birds. Pages 123-134 *in* A. W. Allen and M. W. Vandever, editors. The Conservation Reserve Program – Planting for the Future: Proceedings of a National Conference, Fort Collins, Colorado, June 6-9, 2004. USGS, Biological Resources Division, Scientific Investigation Report 2005-5145. 248 pp.

DRAFT

_____, and R. W. Hoffman. 2005. Prairie grouse population response to conservation reserve grasslands: an overview. Pages 120-128 *in* A. W. Allen and M. W. Vandever, editors. The Conservation Reserve Program – Planting for the Future: Proceedings of a National Conference, Fort Collins, Colorado, June 6-9, 2004.

Root, T. L., J. T. Price, K. R. Hall, S. H. Schneider, C. Rosenszweig, and J. A. Pounds. 2003. Fingerprints of global warming on animals and plants. Nature 421:57–60.

Sands, J. L. 1968. Status of the lesser prairie chicken. Audubon Field Notes 22:454-456.

Schwilling, M.D. 1955. A study of the lesser prairie chicken in Kansas. Job completion report, Kansas Forestry, Fish and Came Commission, Pratt, Kansas, USA.

Sell, D. L. 1979. Spring and summer movements and habitat use by lesser prairie chickens in Yoakum County, Texas. Thesis. Texas Tech University, Lubbock, Texas, USA.

Sims, P. L., and R. L. Gillen. 1999. Rangeland and steer responses to grazing in the southern Plains. Journal of Range Management 52: 651-660.

Snyder, W. A. 1967. Lesser prairie chicken. Pages 121-128 *in* New Mexico Wildlife Management. New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.

Stevens, B.S., K. P. Reese, and J. W. Connelly. 2011. Estimating greater sage-grouse fence collision rates in breeding areas: Preliminary results. Grouse news 38:24-29.

Suminski, H. R. 1977. Habitat evaluation for lesser prairie chickens in eastern Chaves County, New Mexico. Thesis. New Mexico State University, Las Cruces, New Mexico, USA.

Sullivan, R. M., J. P. Hughes, and J. E. Lionberger. 2000. Review of the historical and present status of the lesser prairie-chicken (*Tympanuchus pallidicinctus*) in Texas. Prairie Naturalist 32:177-188.

Taylor, M. A. 1979. Lesser prairie chicken use of man-made leks. Southwest Naturalist 24:706-707.

_____, and F. S. Guthery. 1980a. Status, ecology, and management of the lesser prairie chicken. USDA Forest Service General Technical Report RM-77, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

_____, and _____. 1980b. Fall-winter movements, ranges, and habitat use of lesser prairie-chickens. Journal of Wildlife Management 44:521-524.

_____,and _____. 1980c. Fall-winter movements, ranges, and habitat use of Lesser Prairie-chickens. Journal of Wildlife Management 44:521-524.

Thacker, E., R. Gillen, S. Gunter, and T. Springer. 2011. Chemical control of sand sagebrush: implications for lesser prairie chicken habitat. Abstract in: Prairie Grouse Technical Council 29th meeting.

Thompson, M. C., and C. Ely. 1989. Birds in Kansas. Volume 1. University of Kansas Museum of Natural History. Public Education Service Number 11.

U.S. Fish and Wildlife Service. 2012. U.S. Fish and Wildlife Service Land Based Wind Energy Guidelines. OMB Control No, 1018-0148. U.S. Fish and Wildlife Service, Washington, D.C.

Van Den Bussche, R. A., S. R. Hoofer, D. A. Wiedenfeld, D. H. Wolfe, and S. K. Sherrod. 2003. Genetic variation within and among fragmented populations of Lesser Prairie-Chickens (*Tympanuchus pallidicinctus*). Molecular Ecology 12:675-683.

DRAFT

Vinton, M. A., D. C. Hartnett, E. J. Finck, and J. M. Briggs. 1993. Interactive effects of fire, bison (*Bison bison*) grazing, and plant community composition in tallgrass prairie. American Midland Naturalist 129:10–18.

Vodehnal, W. L., and J. B. Haufler. 2008. A Grassland Conservation Plan for Prairie Grouse. North American Grouse Partnership. Fruita, Colorado, USA.

Wilcove, D. S., C. H. McLellen, and A. P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pages 237-256 *in* M. E. Soule, editor. Conservation Biology. Sinauer Associates, Sunderland, Massachusetts, USA.

Wildlife Management Institute. 1999. Lesser prairie-chicken (*Tympanuchus pallidicinctus*). Fish and Wildlife Management Leaflet No. 6. Natural Resources Conservation Service, Wildlife Habitat Management Institute, Madison, Mississippi, USA.

Wisdom, M. J. 1980. Nesting habitat of lesser prairie chickens in eastern New Mexico. Thesis. New Mexico State University, Las Cruces, New Mexico, USA.

Wolfe, D. H., M. A. Patten, and S. K. Sherrod. 2003. Factors affecting nesting success and mortality of Lesser Prairie-Chickens in Oklahoma. ODWC Federal Aid In Wildlife Restoration Project W-146-R Final Report. 23pp.

Wolfe, D. H., M. A. Patten, E. Shochat, C. L. Pruett, and S. K. Sherrod. 2007. Causes and patterns of mortality in lesser prairie-chickens *Tympanuchus pallidicinctus* and implications for management. Wildlife Biology 13 (Suppl 1): 95-104.

Woodward, A. J., S. D. Fuhlendorf, D. M. Leslie Jr., and J. Shackford. 2001. Influence of landscape composition and change on lesser prairie-chicken (*Tympanuchus pallidicinctus*) populations. American Midland Naturalist 145:261-274.

DRAFT

APPENDIX A

ECOLOGICAL SITE CHARACTERISTICS

Table A-1. An example (actual results still under development) of using ecological sites within the range of lesser prairie chickens (LEPC) in Oklahoma (see A-1 for the included area), listed by the 4 Major Land Resource Areas (MLRA's) occurring within this range. Habitat values are for potential quality for LEPC based on historical conditions of the highest quality plant communities for LEPC nesting or brood-rearing habitat that occurred under historical disturbance processes. Potential habitat values are rated from 1 (very low quality habitat), to 10 (excellent quality habitat). Conversion is the percent (%) of an ecological site that has been converted to agriculture, urban/suburban development, and other land uses as indicated by tilled versus untilled areas (Ostlie 2003). Unconverted lands may not support quality habitat, but should have greater restoration potential than tilled or otherwise converted sites.

MLRA	ECOLOGICAL SITE	PRECIP. ZONE-(IN)	PRODUCTIVITY (LBS/AC)	NESTING VALUE 1-10	BROOD VALUE 1-10	ACRES IN LEPC AREA	% CONVERSION
70A	Shallow upland	14-16	376-1034	3	4	2,112	<1
70A	Deep hardland	14-16	1500-3000	2	2	67,434	<1
70A	Shallow sandstone	14-16	424-1504	5	5	56,781	<1
70A	Malpais upland	14-16	650-1500	5	5	817	<1
70A	Malpais breaks	14-16	612-1316	5	5	46,054	<1
77A	Deep hardland	16-22	885-1890	3	4	1,445,363	74
77A	Draw	16-22	2765-4530	5	5	41,567	9
77A	Subirrigated	16-22	2000-5500			20,359	12
77A	Playa	16-22	1400-3000	1	4	10,303	98
77A	Limy upland	16-22	1085-1905	3	3	258,800	89
77A	Dunes	16-22	1260-1760	10	9	8,488	<1
77A	Sandy plains	16-22	1400-1800	7	7	418,179	89
77A	Very shallow	16-22	590-1180	4	4	75,549	9
77A	Deep Sand	16-22	1400-1700	10	10	405,265	31
77E	Loamy prairie	16-24	1800-4200	5	7	25,794	86
77E	Limy upland	16-24	1201-2201	3	4	586,443	60

DRAFT

MLRA	Ecological Site	Precip. Zone-(in)	Productivity (lbs/ac)	Nesting Value 1-10	Brood Value 1-10	Acres in LEPC Area	% Conversion
77E	Deep hardland	16-24	1500-3000	2	2	8,572	45
77E	Loamy bottomland	16-24	1680-3591	5	6	30,813	23
77E	Limy sandy plains	16-24	1580-3000	9	9	326,510	27
77E	Sandy	16-24	1740-3450	10	10	28,719	44
77E	Shallow	16-24	1100-1800	3	4	4,997	37
77E	Playa	16-24	1400-3000	1	4	779	97
77E	Very shallow	16-24	610-1066	4	4	17,239	14
78C	Loamy breaks	23-30	950-2000	5	5	155,361	11
78C	Clayey breaks	23-30		3	3	38,956	19
78C	Deep Sand	23-30	200-4000	8	8	516,836	62
78C	Shinnery oak grassland	23-30	1600-3900	10	10	408,099	63
78C	Gyp	23-30	730-1645	3	7	19,966	9
78C	Loamy prairie	23-30	2525-6037	5	7	677,376	63
78C	Deep hardland	23-30	1500-3000	2	2	28,447	94
78C	Saline Subirrigated	23-30		2	2	2,016	66
78C	Clay prairie	23-30	1000-2200	5	5	122,955	40
78C	Red shale	23-30	500-1000	4	5	73,091	62
78C	Sandy bottomland	23-30	2500-6500	7	8	105,886	31
78C	Shallow prairie	23-30	900-2500	4	5	368,422	6
78C	Clayey bottomland	23-30	700-2710	3	3	1,056	35
78C	Subirrigated (all)	23-30	4500-10000	5	5	318,530	53
78C	Clay loam	23-30	1010-3060	3	4	6,940	75
78C	Playa	23-30	1300-300	1	4	28,271	81

DRAFT

MLRA	Ecological Site	Precip. Zone-(in)	Productivity (lbs/ac)	Nesting Value 1-10	Brood Value 1-10	Acres in LEPC Area	% Conversion
78C	Very shallow	23-30	400-840	4	4	3,226	5
78C	Dunes	23-30	1500-4000	9	8	175,782	13
78C	Shallow clay	23-30	1000-2600	3	4	15,043	53
78C	Sandy plains	23-30	1800-3600	5	5	469,537	66
78C	Very shallow clay	23-30	400-1300	3	3	49,013	16
78C	Loamy sandy prairie	23-30	3000-6000			32,765	67

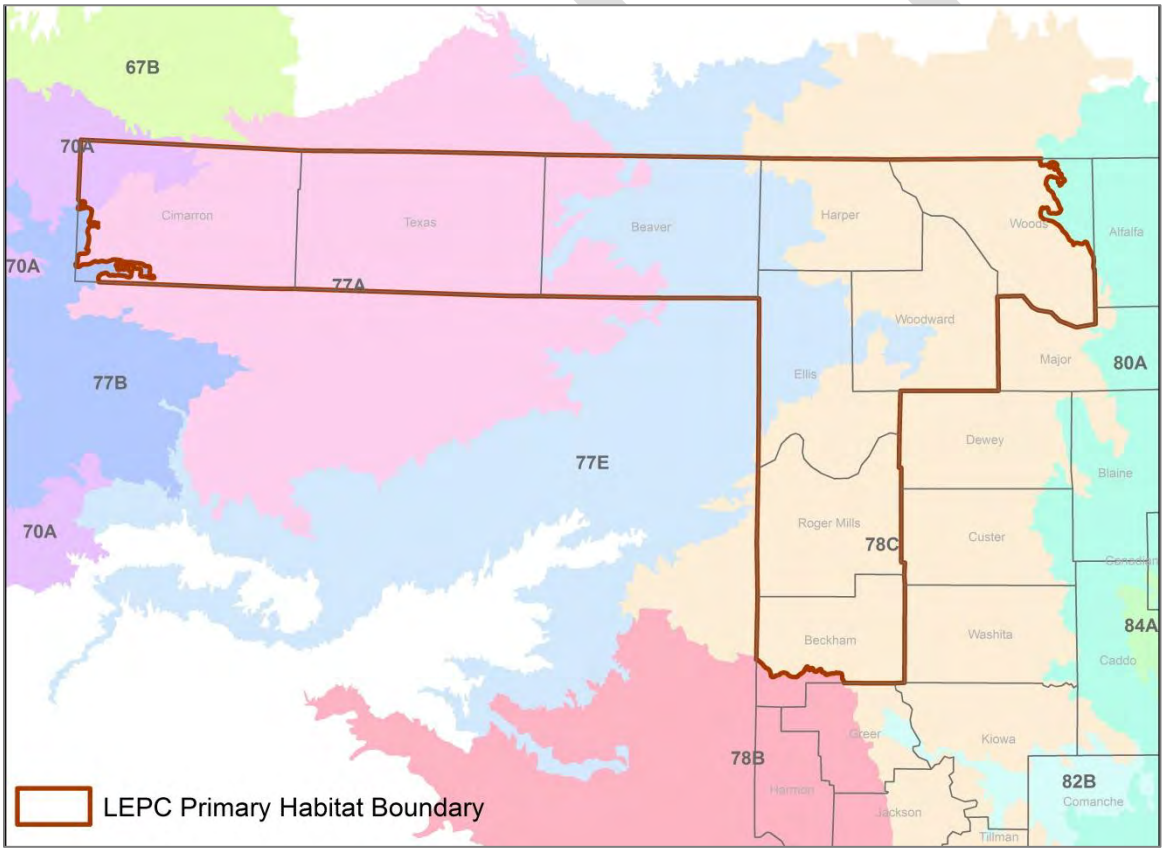


Figure A-1. Map of MLRA's and the area included in the compilation of ecological site information included in Table A-1.

Oklahoma Lek Surveys

Table A-2. Lek survey results by county in Oklahoma, April 1996-2011. Lek density (in parenthesis) is the number of leks observed divided by the square miles surveyed in a county. * indicates that no survey was conducted.

COUNTY	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BEAVER	3/20 (0.15)	2/20 (0.10)	1/20 (0.05)	2/20 (0.10)	3/20 (0.15)	2/20 (0.10)	1/20 (0.05)	1/20 (0.05)	3/20 (0.15)	3/20 (0.15)	3/20 (0.15)	3/20 (0.15)	2/20 (0.10)	1/20 (0.05)	1/20 (0.05)	0/20 (0.00)
ELLIS	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)	1/20 (0.05)	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)	*	0/20 (0.00)	1/20 (0.05)	*	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)
HARPER	6/20 (0.30)	1/20 (0.05)	1/20 (0.05)	2/20 (0.10)	1/20 (0.05)	1/20 (0.05)	3/20 (0.15)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	0/20 (0.00)	0/20 (0.00)	0/20 0.00)	0/20 (0.00)	0/20 (0.00)
TEXAS	3/20 (0.15)	2/20 (0.10**)	2/20 (0.10)	2/20 (0.10)	2/20 (0.10)	2/20 (0.10)	3/20 (0.15)	3/20 (0.15)	0/20 (0.00)	4/20 (0.20)	*	4/20 (0.20)	4/20 (0.20)	2/20 (0.10)	2/20 (0.10)	2/20 (0.10)
WOODS	-	-	-	-	-	3/20 (0.15)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	2/20 (0.10)	3/20 (0.15)	3/20 (0.15)
WOOD-WARD	2/20 (0.10)	1/20 (0.05)	2/20 (0.10)	2/20 (0.10)	1/20 (0.05)	1/20 (0.05)	1/20 (0.05)	2/20 (0.10)	1/20 (0.05)	0/20 (0.00)	0/20 (0.00)	*	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)	0/20 (0.00)
TOTAL	**13/100 (0.13)**	**6/100 (0.06)**	**6/100 (0.06)**	**8/100 (0.08)**	**8/100 (0.08)**	**9/120 (0.075)**	**9/120 (0.075)**	**8/120 (0.067)**	**6/120 (0.050)**	**9/100 (0.090)**	**5/100 (0.050)**	**9/100 (0.09)**	**7/100 (0.07)**	**6/120 (0.05)**	**7/120 (0.06)**	**6/120 (0.05)**

DRAFT

APPENDIX B

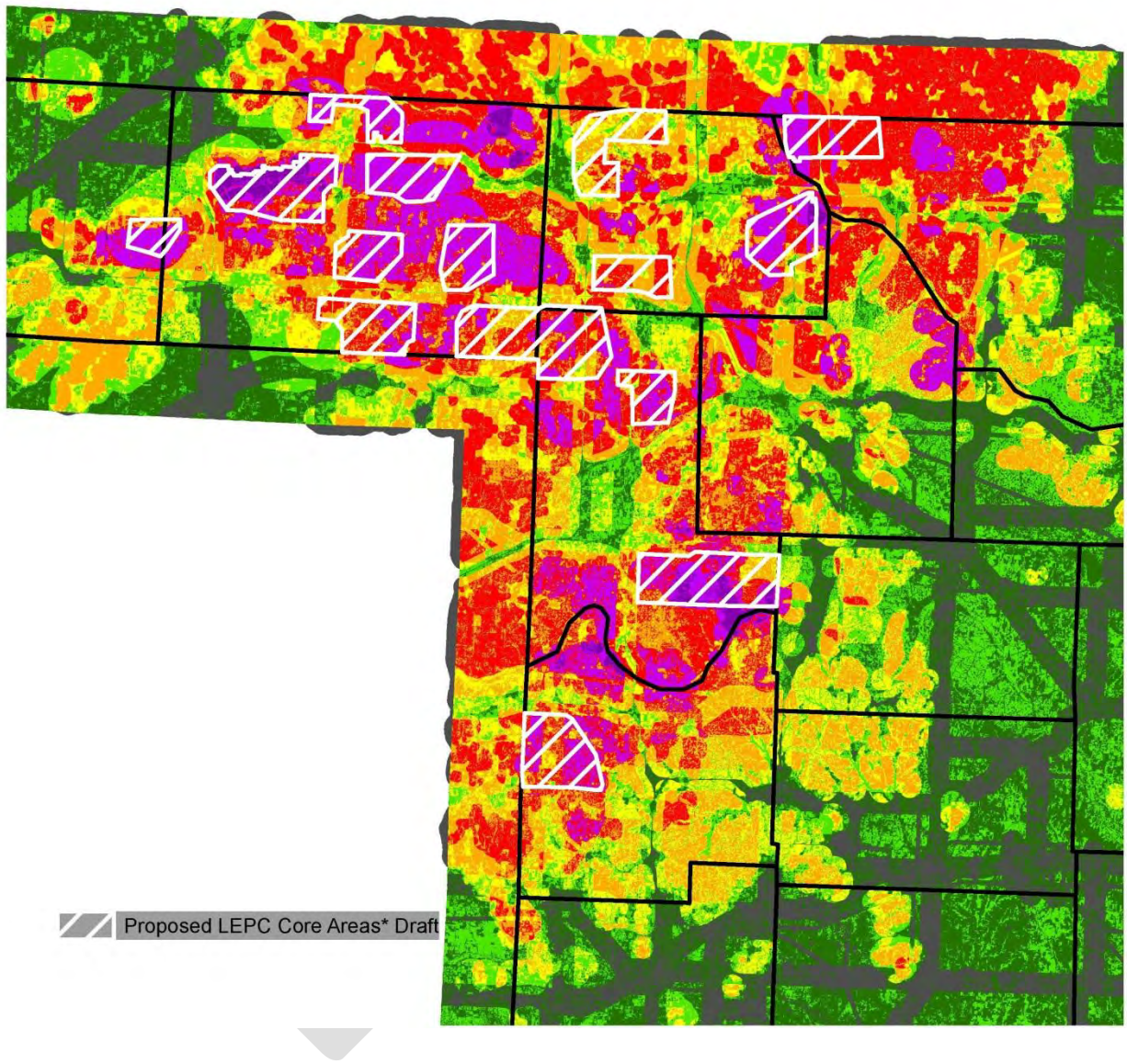


Figure B-1. Map of core areas overlaid with the results of the Oklahoma LEPC Spatial Planning Tool designation of LEPC habitat areas.

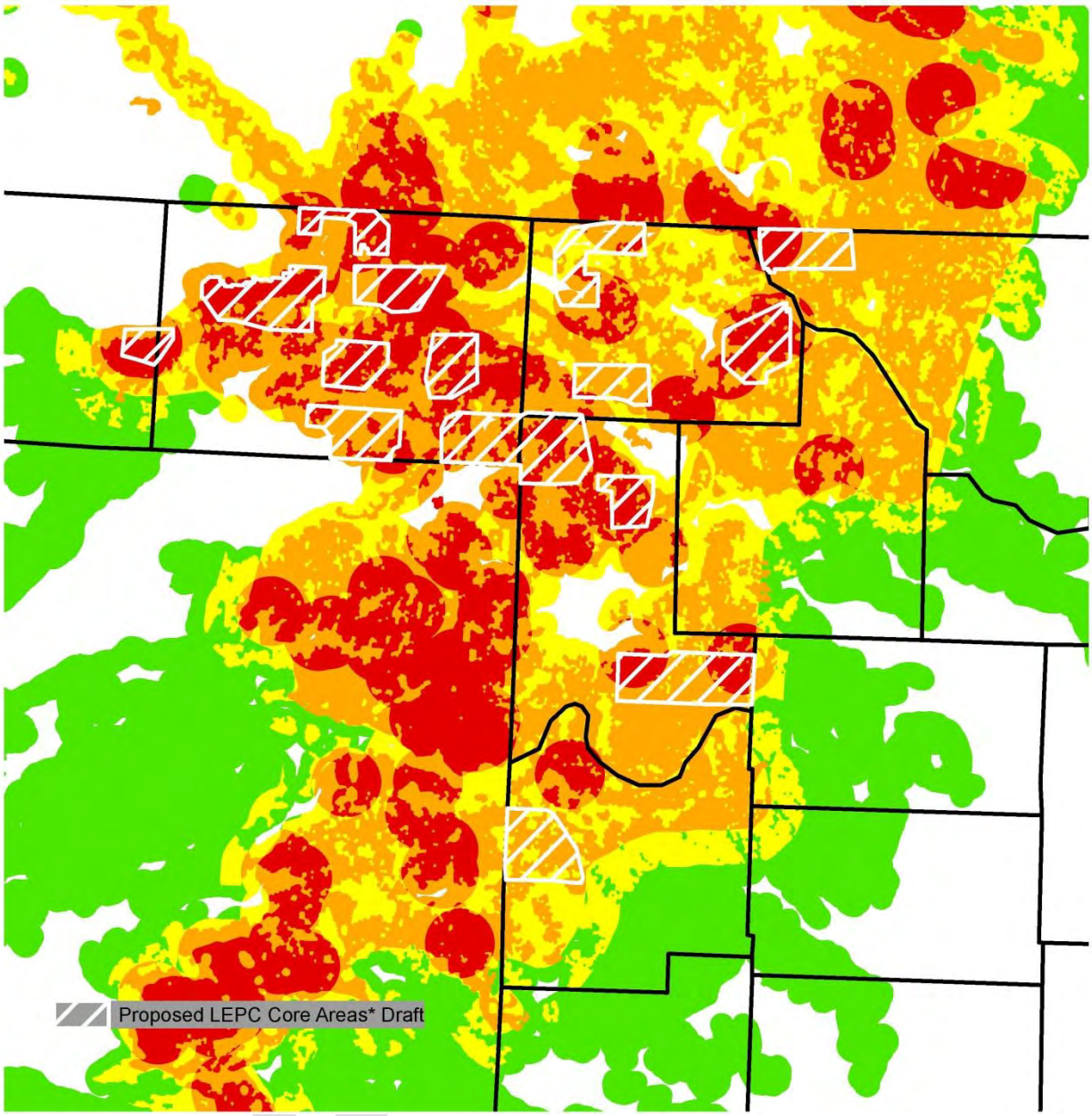
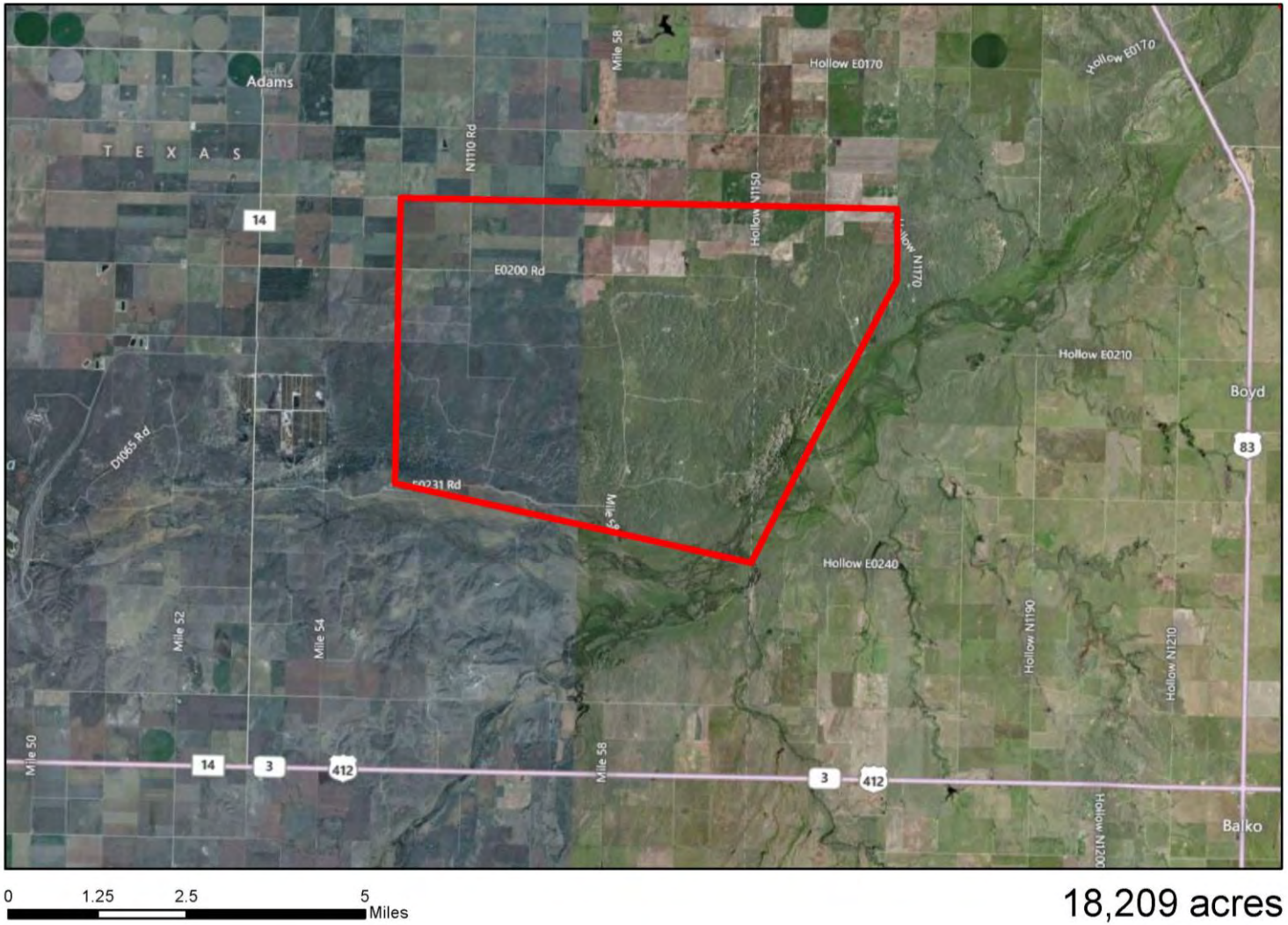


Figure B-2. Map of LEPC core areas overlaid on the maps of LEPC habitat from the CHAT.

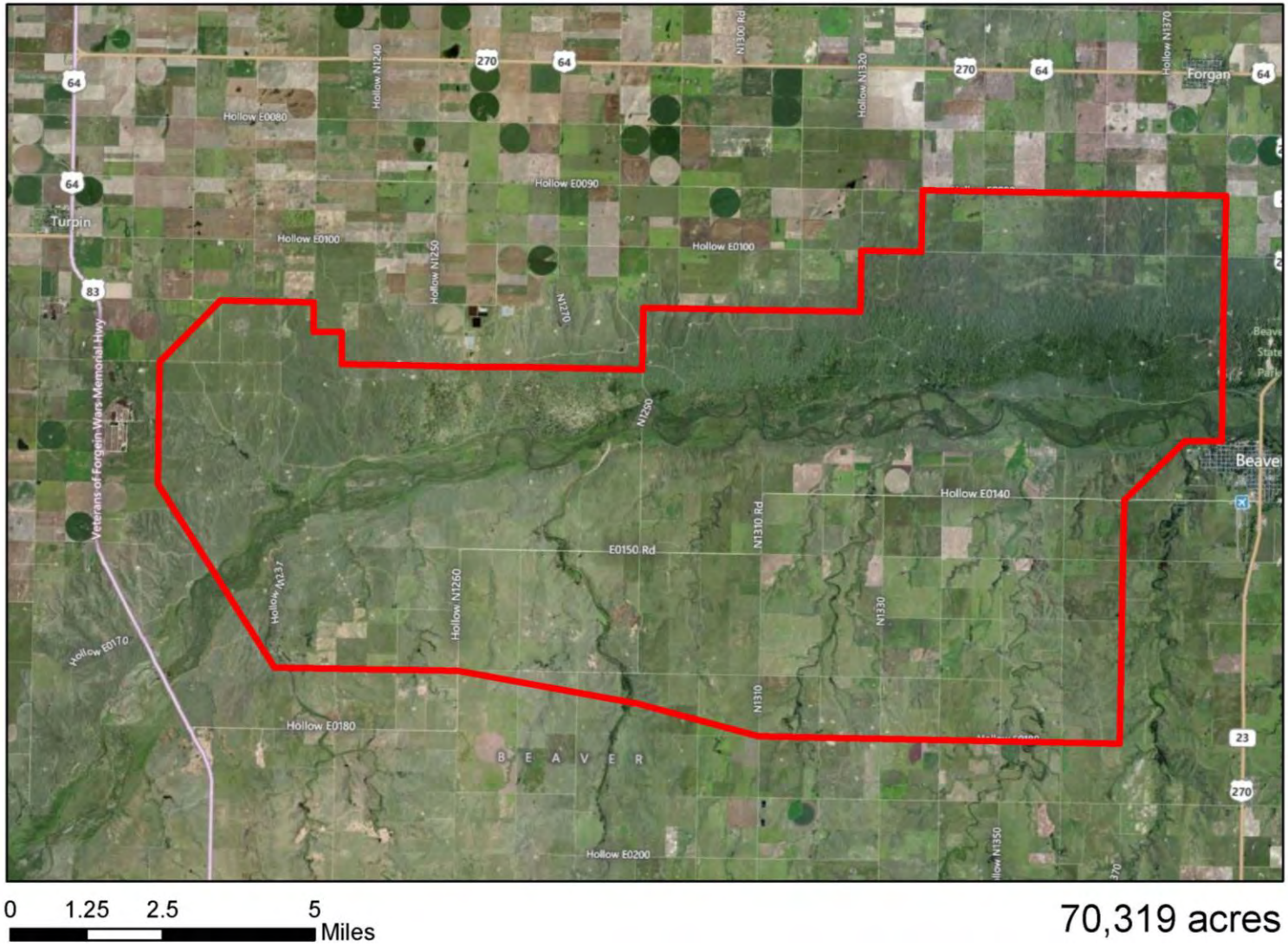
Draft LEPC Core Conservation Area #1



18,209 acres

Figure B-3. Boundary of core conservation area number 1.

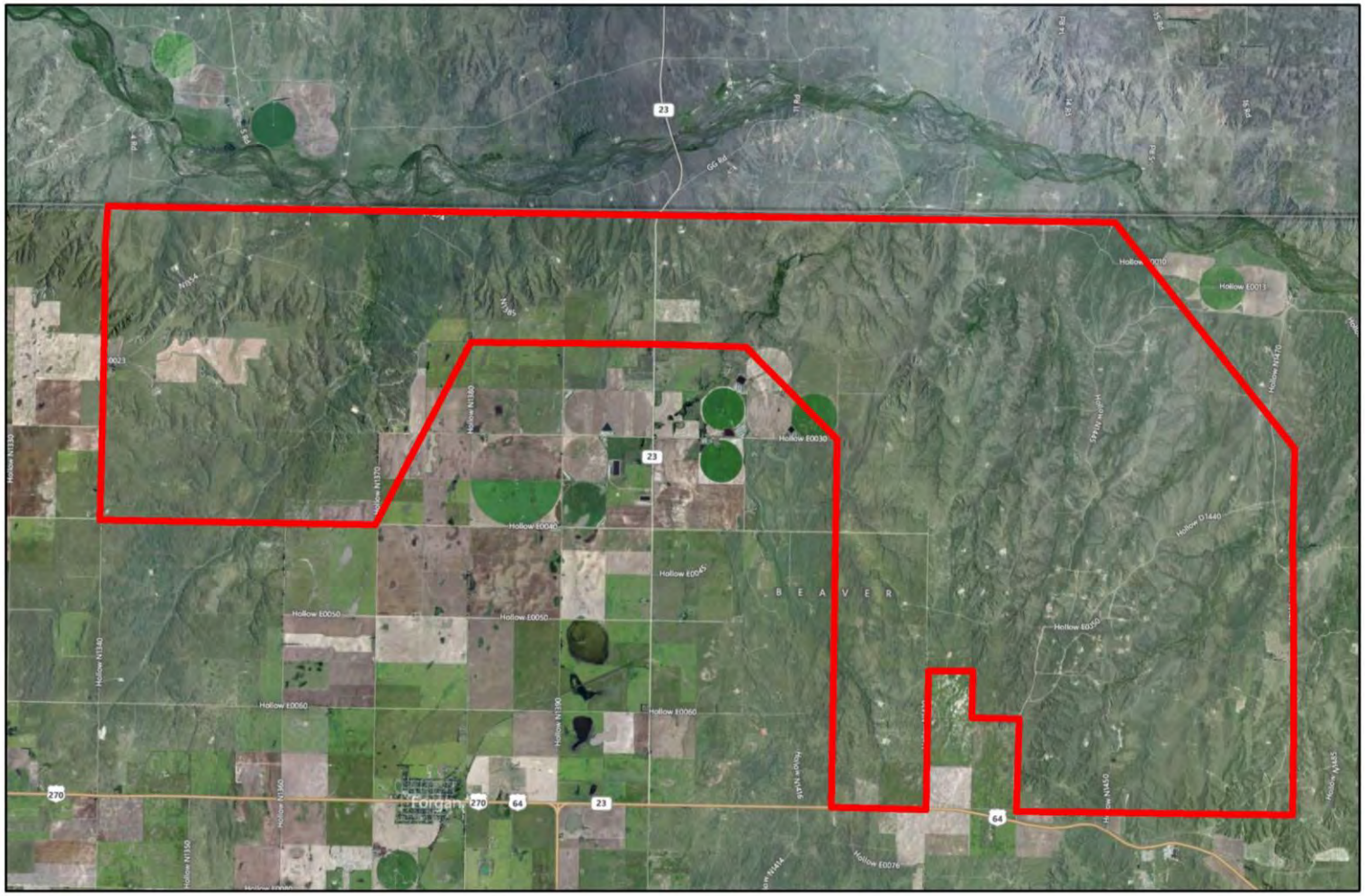
Draft LEPC Core Conservation Area #2



70,319 acres

Figure B-4. Boundary of core conservation area number 2.

Draft LEPC Core Conservation Area #3

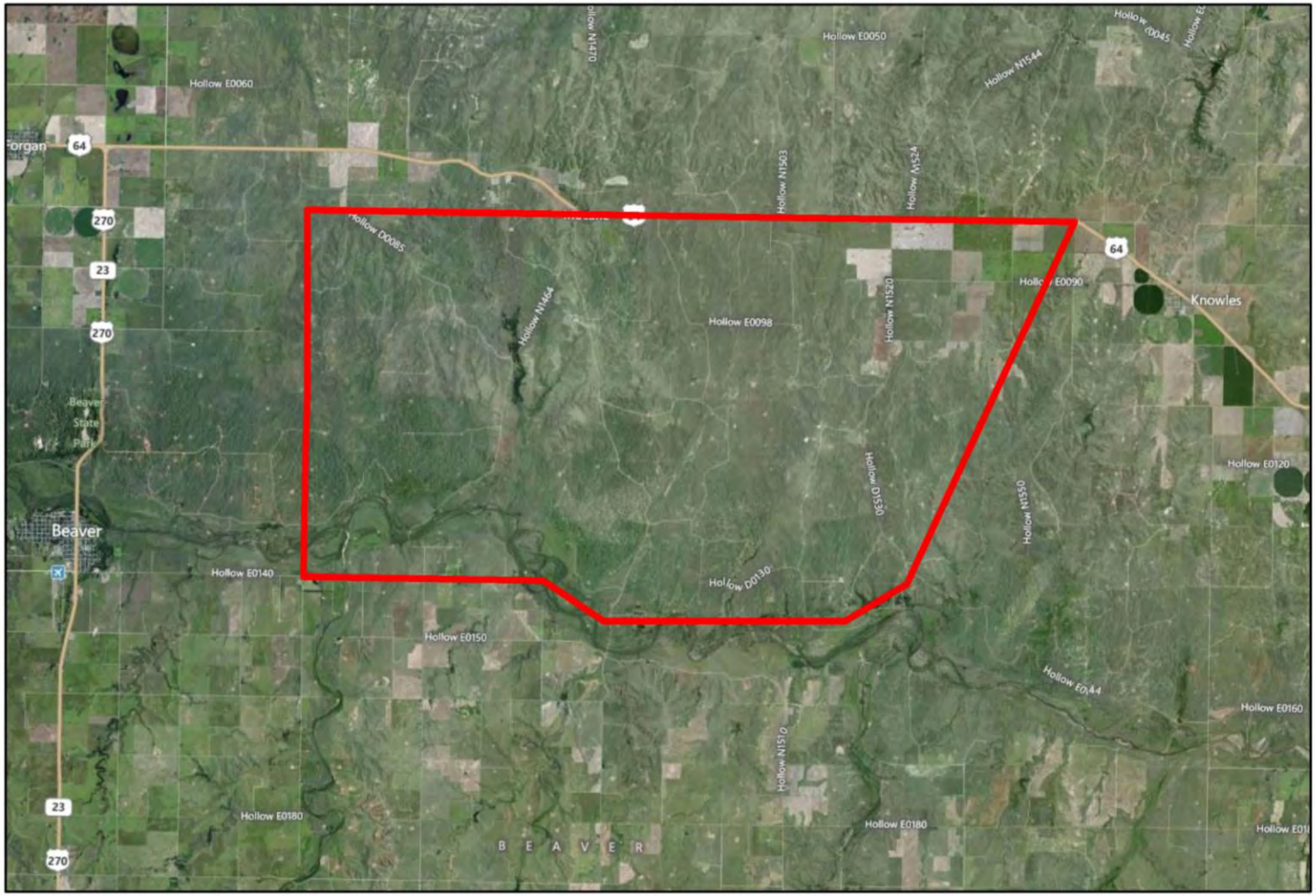


0 1.25 2.5 5 Miles

30,245 acres

Figure B-5. Boundary of core conservation area number 3.

Draft LEPC Core Conservation Area #4

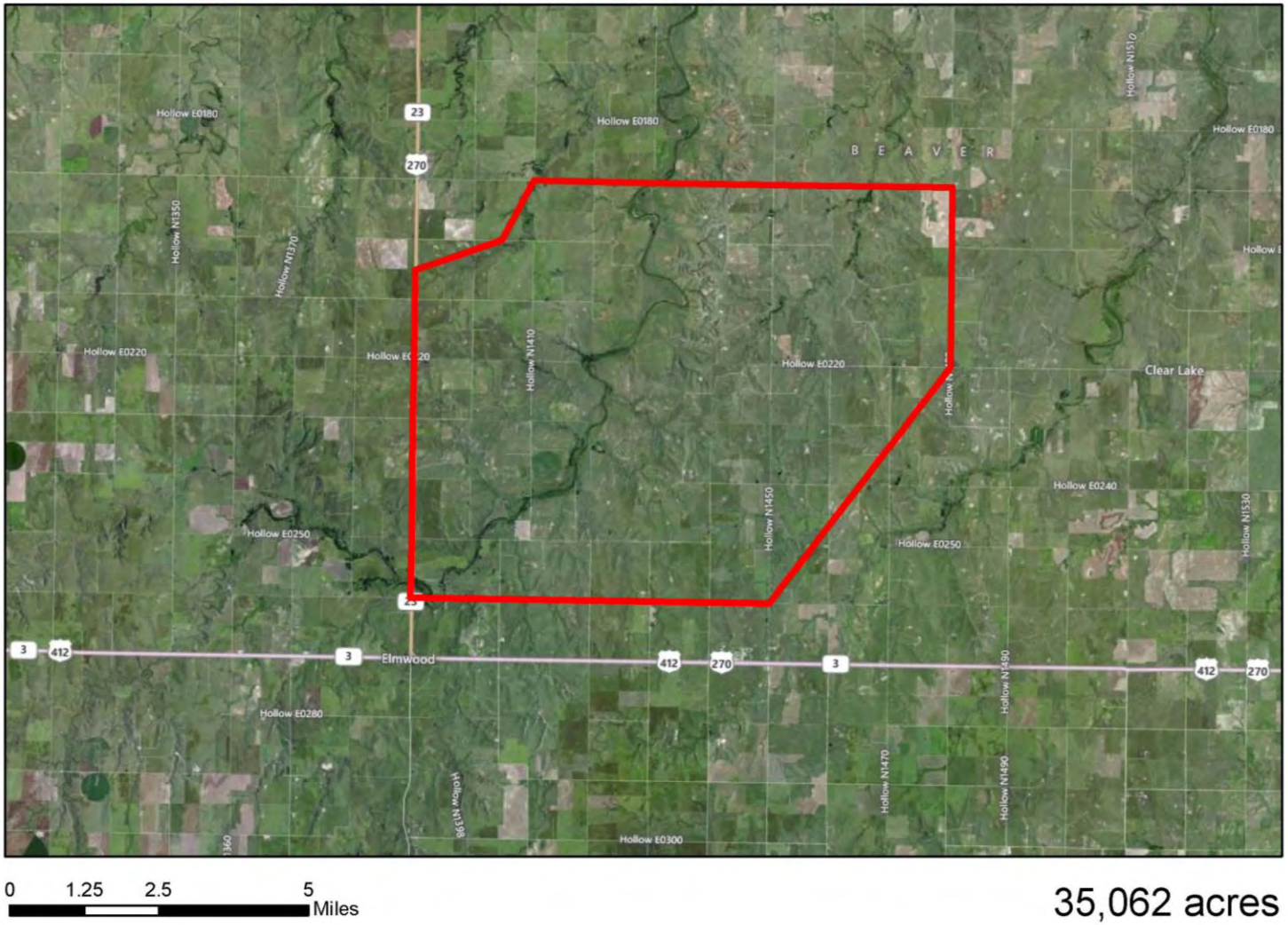


0 1.25 2.5 5 Miles

45,690 acres

Figure B-6. Boundary of core conservation area number 4.

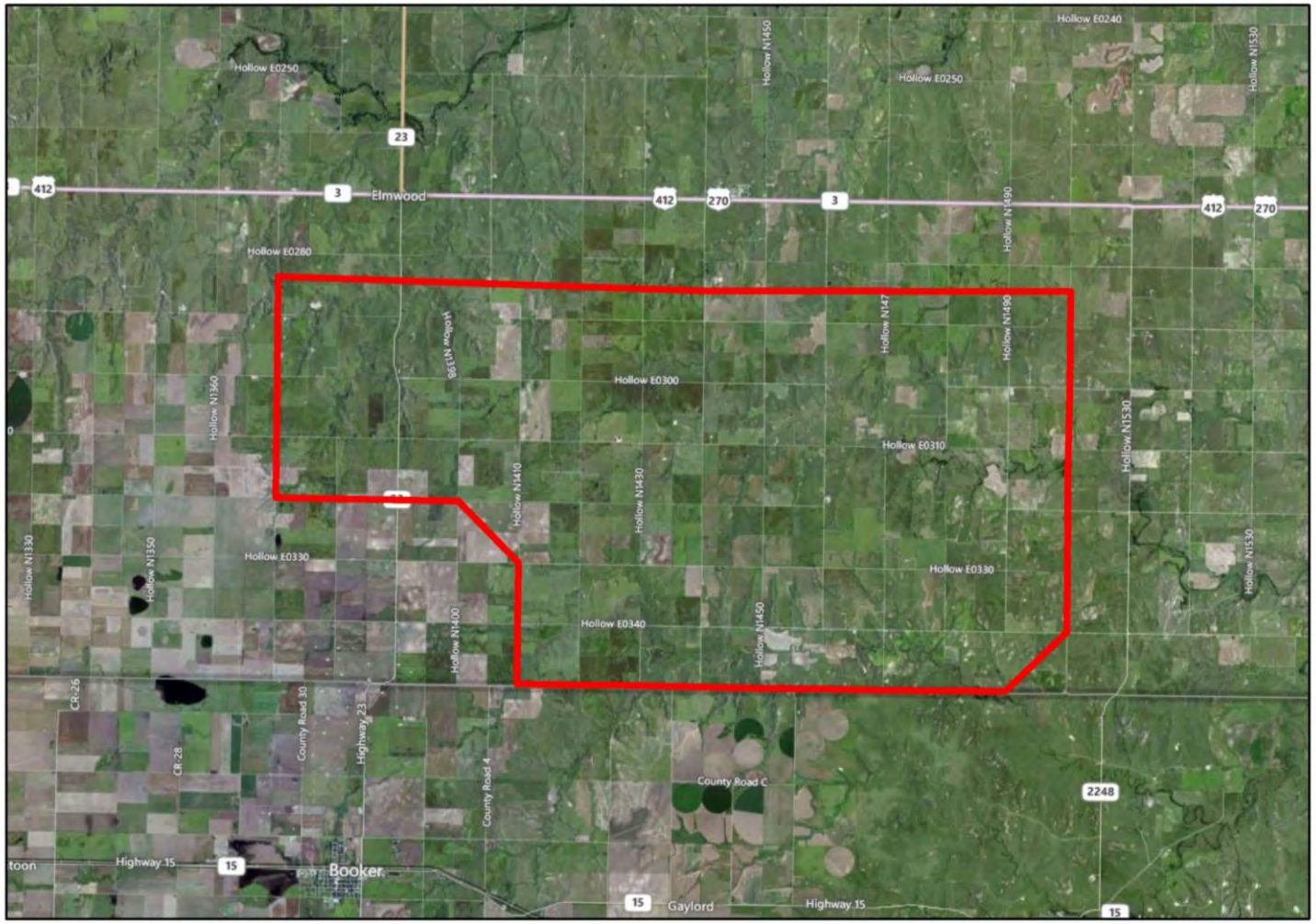
Draft LEPC Core Conservation Area #5



35,062 acres

Figure B-7. Boundary of core conservation area number 5.

Draft LEPC Core Conservation Area #6

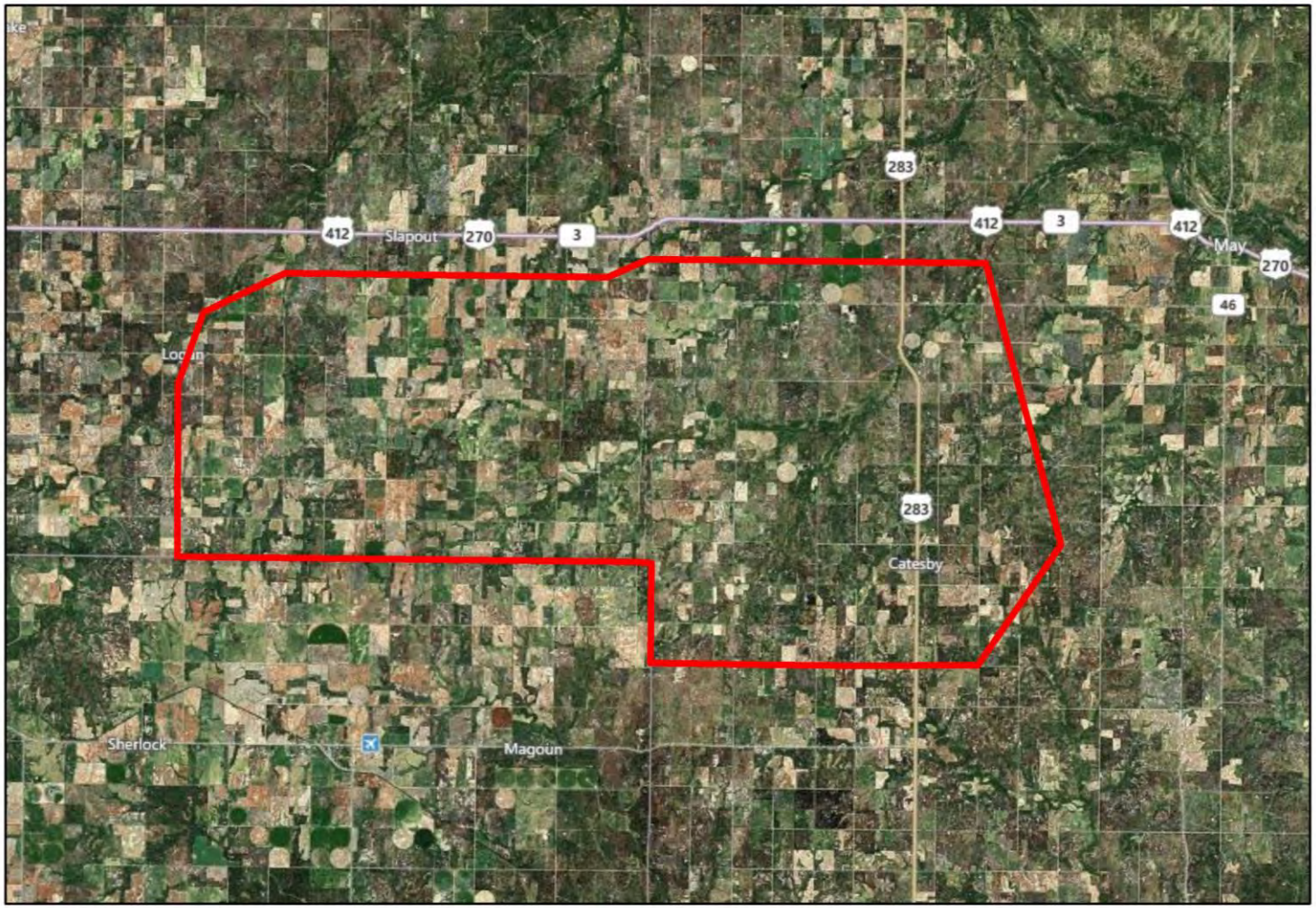


0 1.25 2.5 5 Miles

46,763 acres

Figure B-8. Boundary of core conservation area number 6.

Draft LEPC Core Conservation Area #7

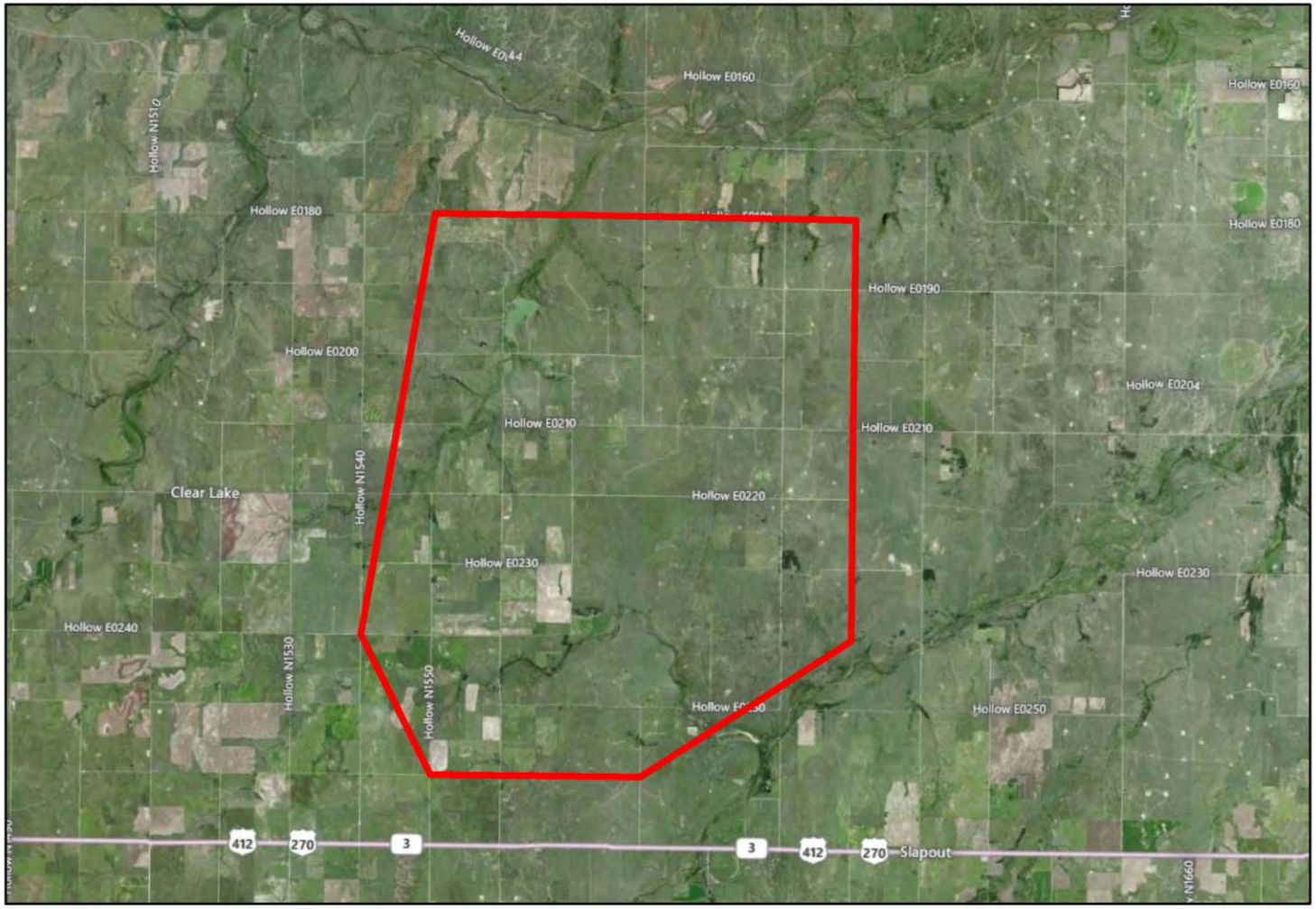


0 1.25 2.5 5 Miles

108,400 acres

Figure B-9. Boundary of core conservation area number 7.

Draft LEPC Core Conservation Area #8

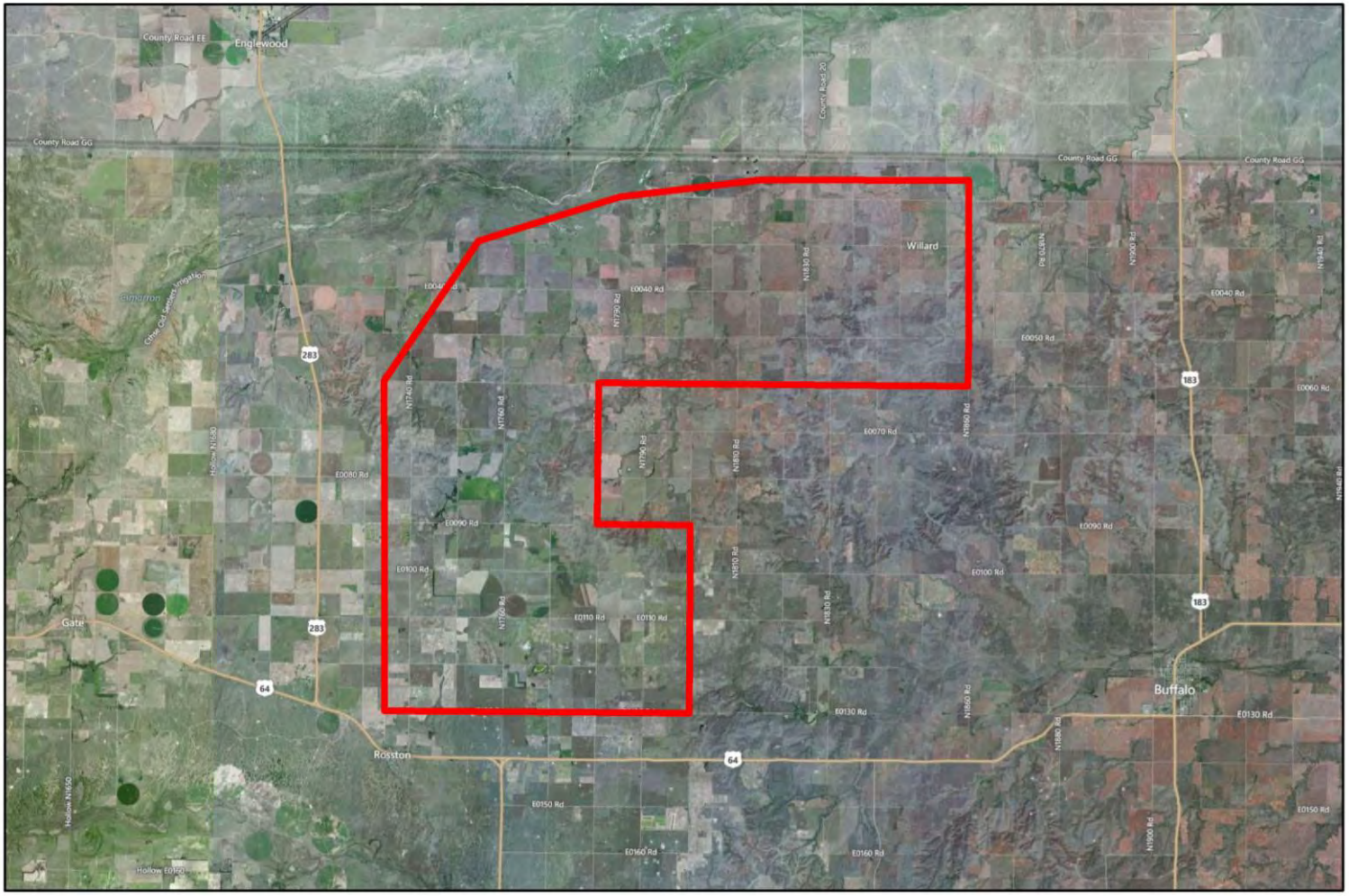


0 1.25 2.5 5 Miles

31,541 acres

Figure B-10. Boundary of core conservation area number 8.

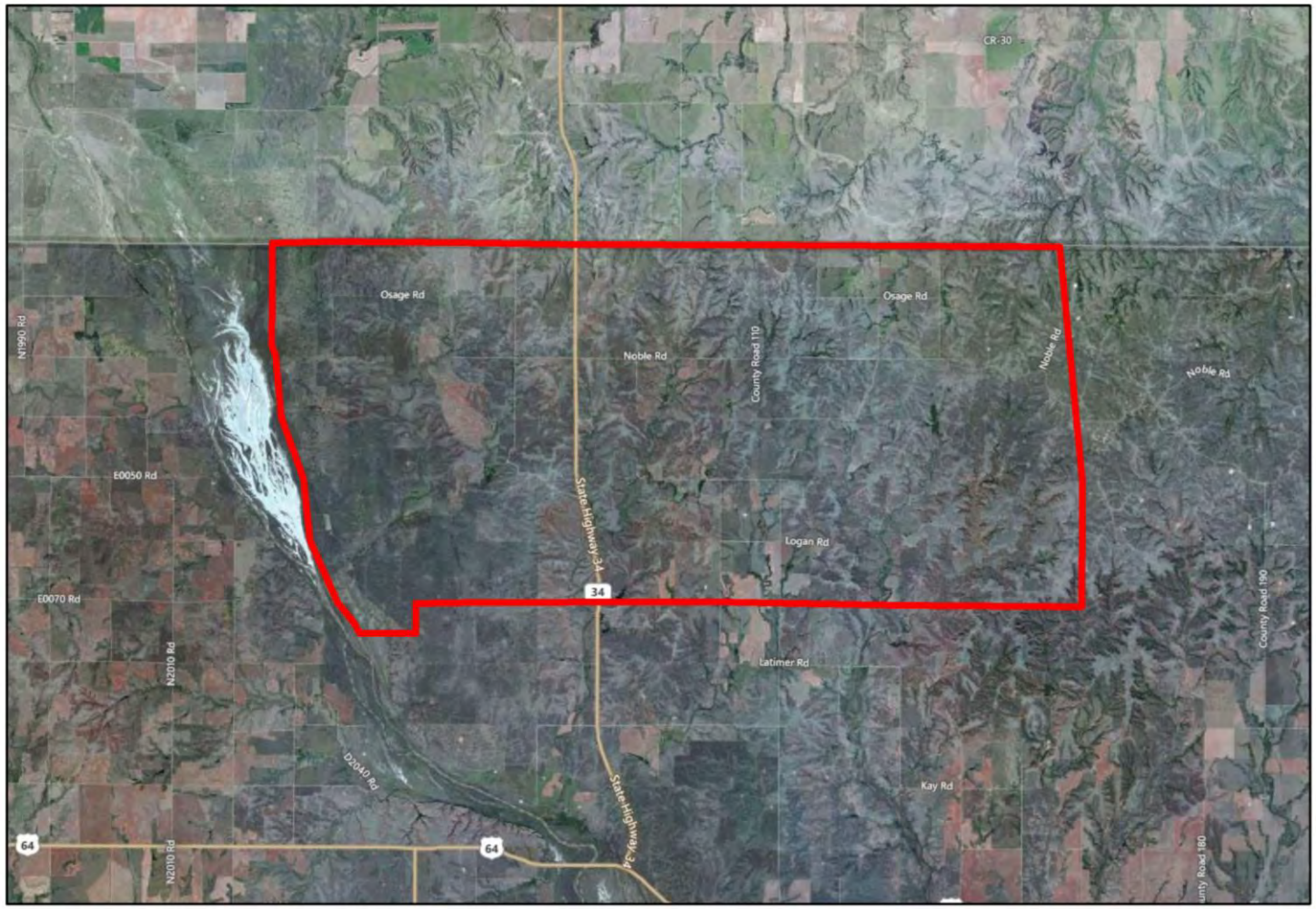
Draft LEPC Core Conservation Area #9



55,354 acres

Figure B-11. Boundary of core conservation area number 9.

Draft LEPC Core Conservation Area #10

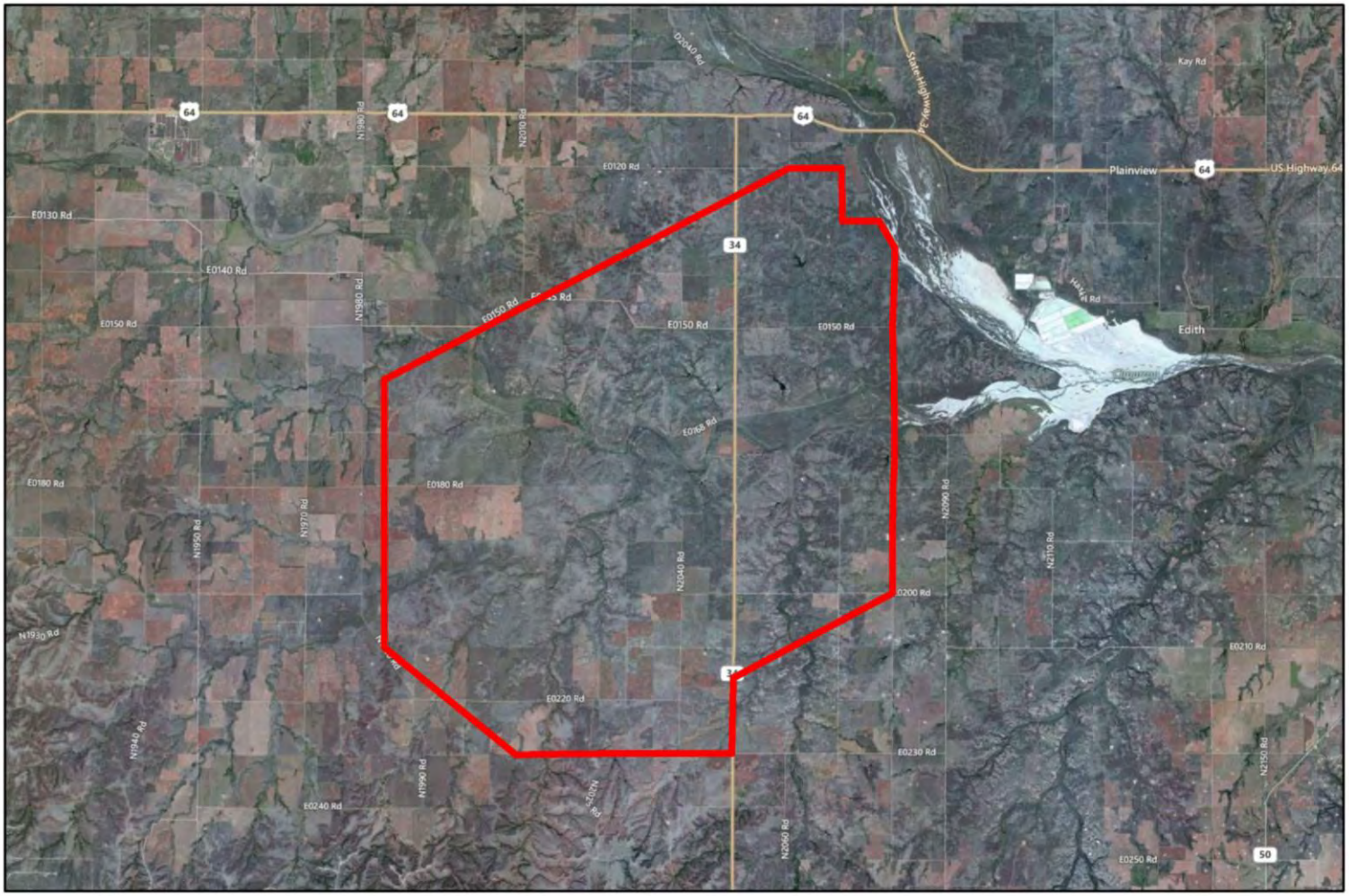


0 1.25 2.5 5 Miles

48,903 acres

Figure B-12. Boundary of core conservation area number 10.

Draft LEPC Core Conservation Area #11

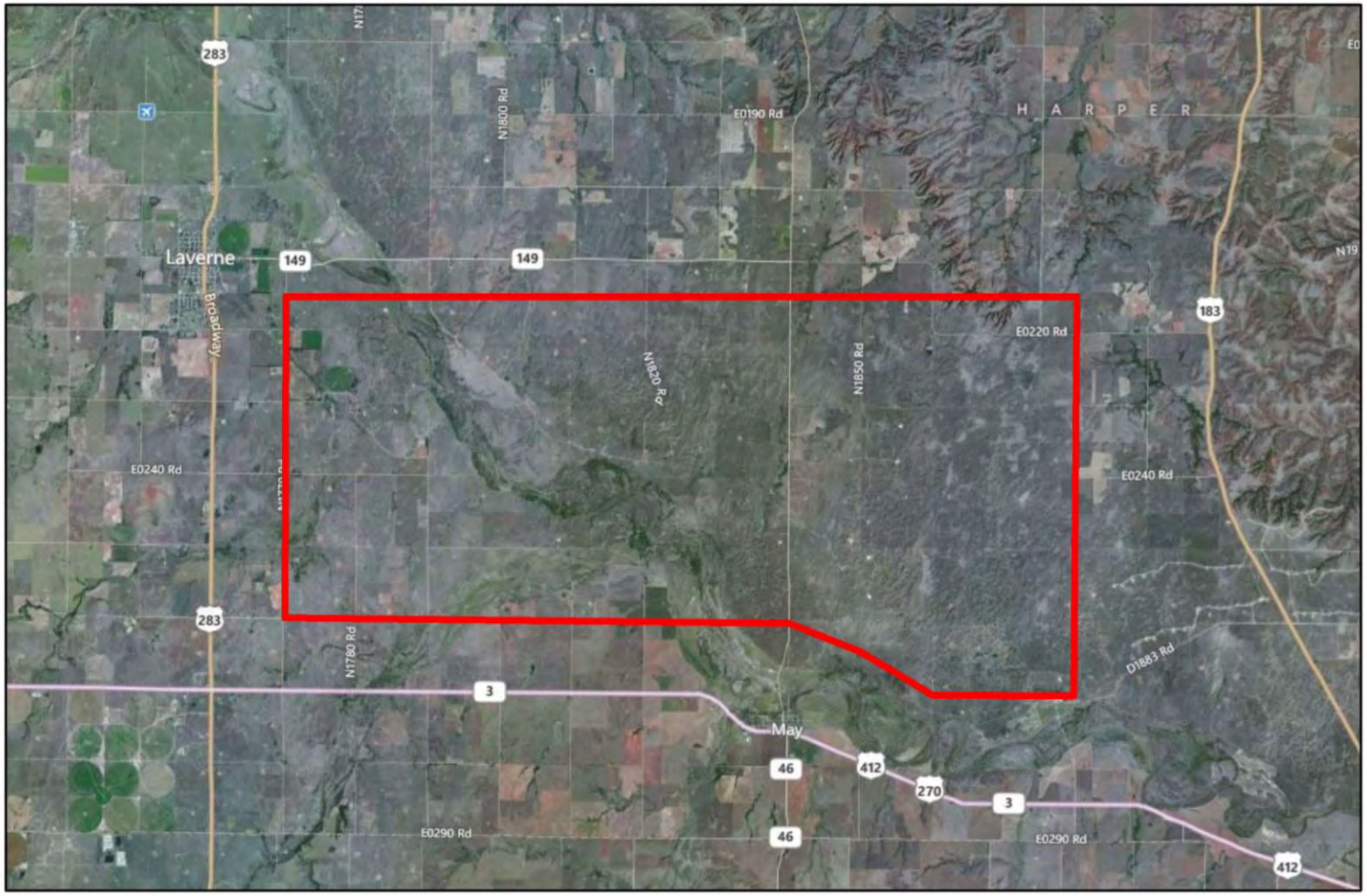


0 1.25 2.5 5 Miles

51,261 acres

Figure B-13. Boundary of core conservation area number 11.

Draft LEPC Core Conservation Area #12

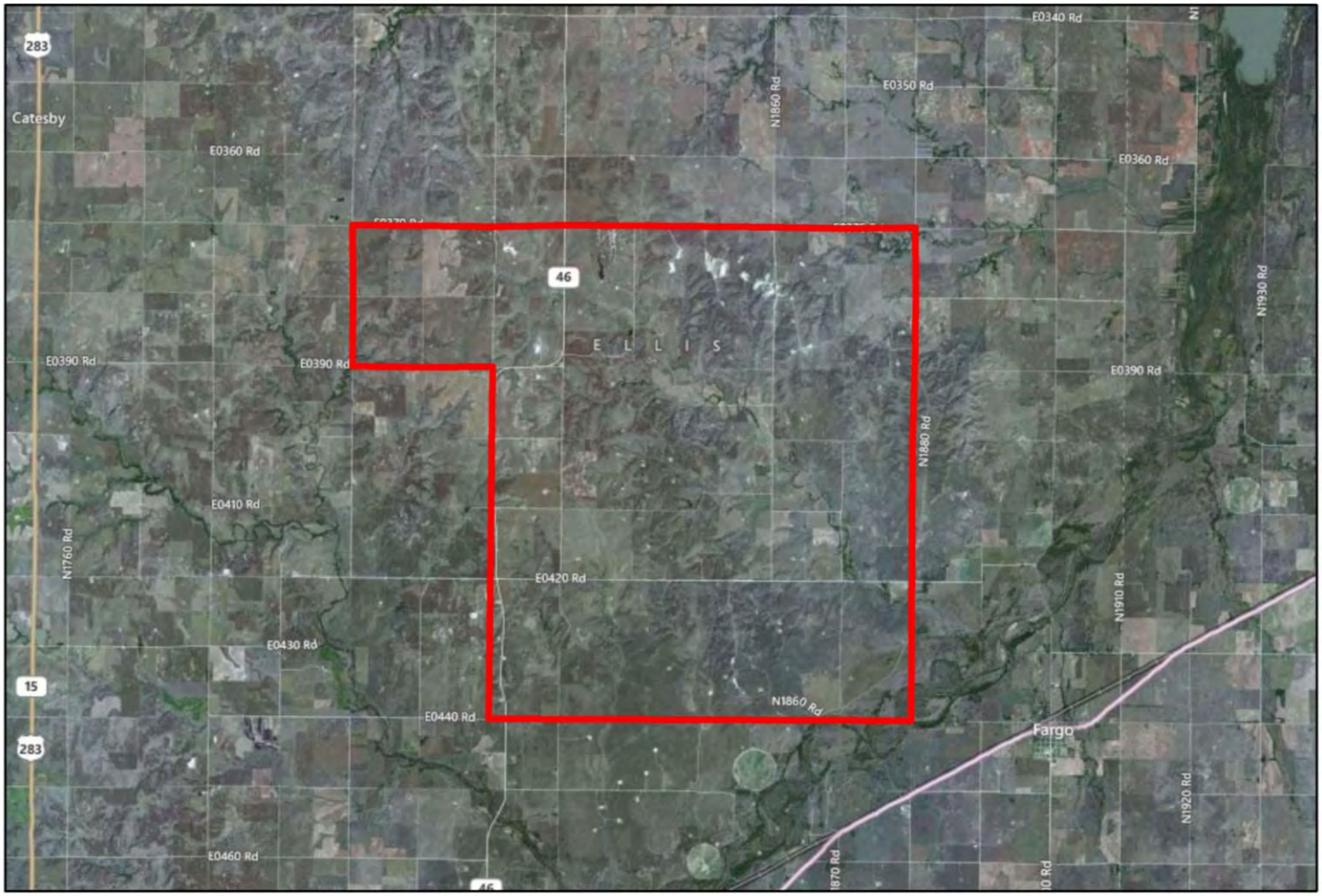


0 1.25 2.5 5 Miles

33,788 acres

Figure B-14. Boundary of core conservation area number 12.

Draft LEPC Core Conservation Area #13

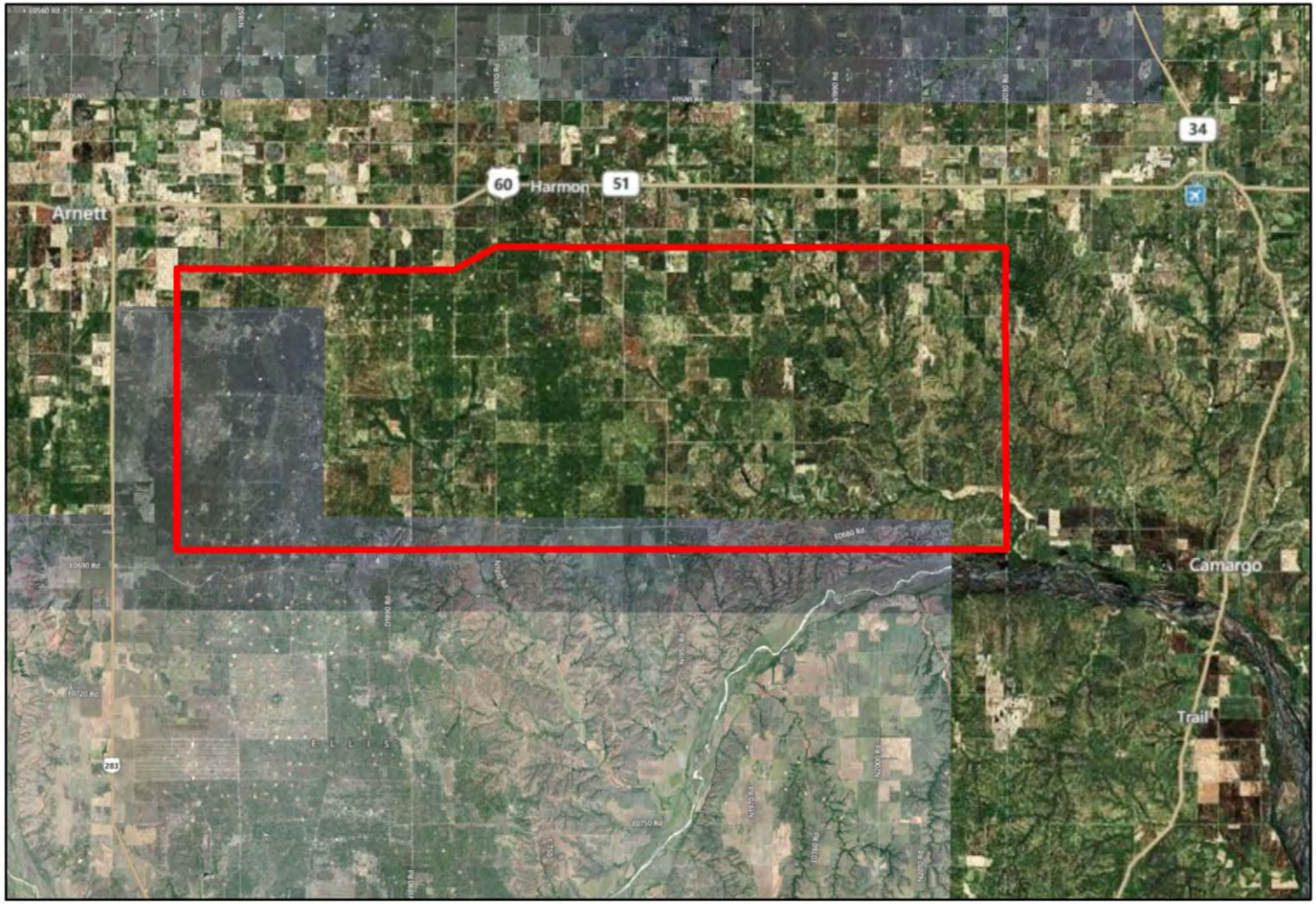


0 1.25 2.5 5 Miles

26,463 acres

Figure B-15. Boundary of core conservation area number 13.

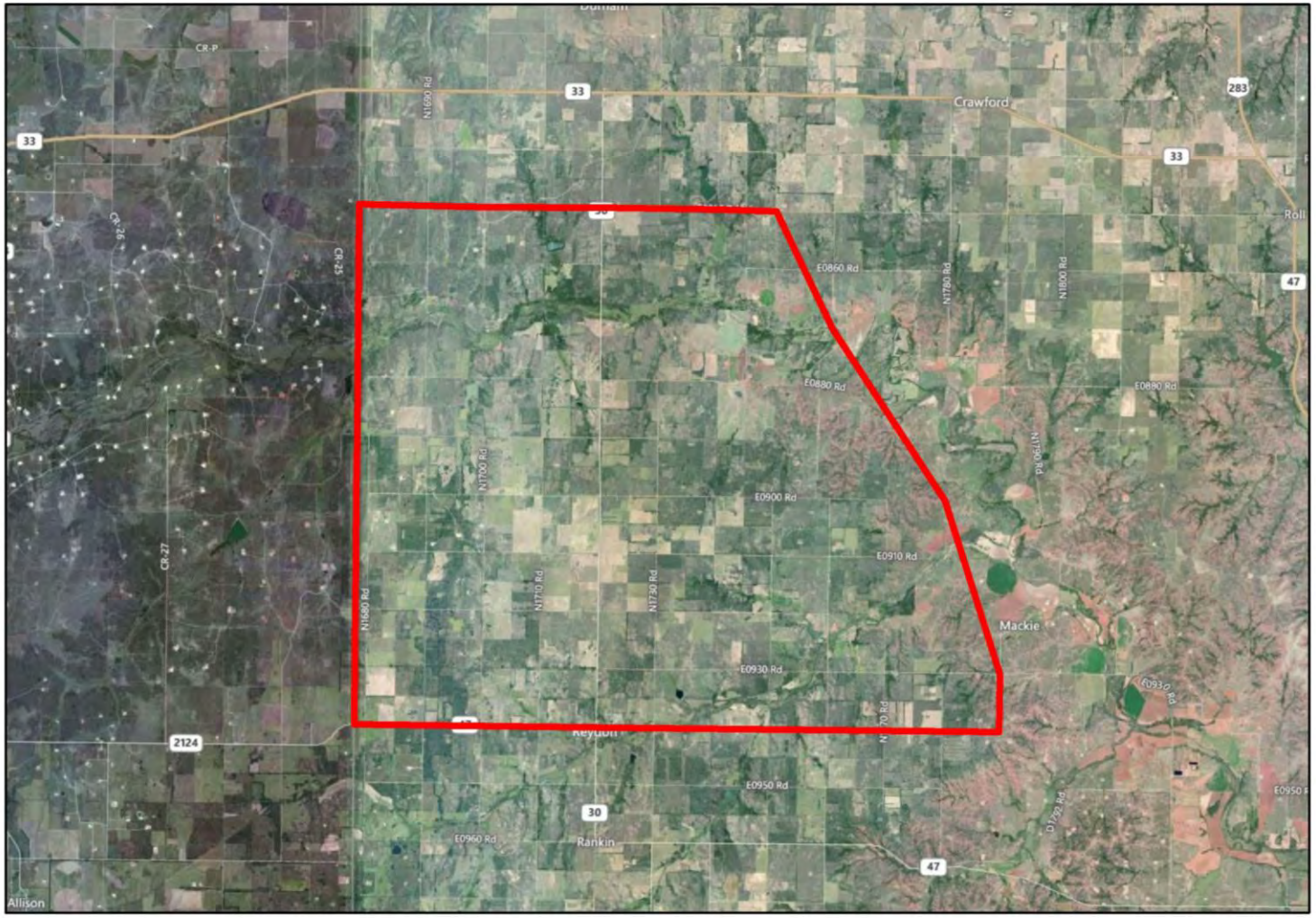
Draft LEPC Core Conservation Area #14



86,159 acres

Figure B-16. Boundary of core conservation area number 14.

Draft LEPC Core Conservation Area #15



0 1.25 2.5 5 Miles

55,010 acres

Figure B-17. Boundary of core conservation area number 15.