

Billing Code 4310–55–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2012–0071]

[4500030113]

RIN 1018–AV21

**Endangered and Threatened Wildlife and Plants; Listing the Lesser Prairie-
Chicken as a Threatened Species**

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service, propose to list the lesser prairie-chicken (*Tympanuchus pallidicinctus*), a grassland bird known from southeastern Colorado, western Kansas, eastern New Mexico, western Oklahoma, and the Texas Panhandle, as a threatened species under the Endangered Species Act of 1973, as amended (Act). If we finalize the rule as proposed, it would extend the Act's protection to this species. We have determined that designation of critical habitat for the lesser prairie-chicken under the Act is prudent but not determinable at this time. We are seeking information and comments from the public regarding the lesser prairie-chicken and this proposed rule.

DATES: We will accept comments received or postmarked on or before [INSERT DATE 90 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES** section, below) must be received by 11:59 p.m. Eastern Time on the closing date.

Public Hearings: We will hold four public hearings on this proposed rule. The public hearings will be held in Woodward, Oklahoma, on Tuesday, February 5; Garden City, Kansas, on Thursday, February 7; Lubbock, Texas, on Monday, February 11; and Roswell, New Mexico, on Tuesday, February 12. The public hearings will be held from 6:30 p.m. to 8:30 p.m.

ADDRESSES: *Document availability:* You may obtain copies of the proposed rule on the Internet at <http://www.regulations.gov> at Docket No. FWS–R2–ES–2012–0071 or by mail from the Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Written Comments: You may submit written comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal:

<http://www.regulations.gov>. Search for Docket No. FWS–R2–ES–2012–0071. You may submit a comment by clicking on

“Comment Now!”

(2) *By hard copy:* Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R2–ES–2012–0071; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042–PDM; Arlington, VA 22203.

We request that you send comments only by the methods described above. We will post all comments on <http://www.regulations.gov>. This generally means that we will post any personal information you provide us (see the Information Requested section below for more information).

Public hearings: The public hearings will be held at the following locations:

(1) Woodward, Oklahoma: High Plains Technology Center Seminar Center, 3921 34th Street, Woodward, OK 73801.

(2) Garden City, Kansas: Garden City Community College, 801 N. Campus Drive, Garden City, KS 67846.

(3) Lubbock, Texas: Lubbock Civic Center, 1501 Mac Davis Lane, Lubbock, TX 79401.

(4) Roswell, New Mexico: Eastern New Mexico University Fine Arts Auditorium, 64 University Boulevard, Roswell, NM 88203.

People needing reasonable accommodations in order to attend and participate in the public hearing should contact Dixie Porter, Field Supervisor, Oklahoma Ecological Services Field Office, as soon as possible (see **FOR FURTHER INFORMATION CONTACT** below).

FOR FURTHER INFORMATION CONTACT: Dixie Porter, Field Supervisor, Oklahoma Ecological Services Field Office, 9014 East 21st Street, Tulsa, OK 74129; by telephone 918-581-7458 or by facsimile 918-581-7467. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800-877-8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

This document consists of: (1) A proposed rule to list the lesser prairie-chicken as a threatened species; and (2) a finding that critical habitat is prudent but not determinable at this time.

Why we need to publish a rule. Under the Endangered Species Act, a species may warrant protection through listing if it is an endangered or threatened species throughout all or a significant portion of its range. In this proposal, we are explaining why the lesser prairie-chicken warrants protection under the Endangered Species Act. This rule proposes to list the lesser prairie-chicken as a threatened species throughout its range.

The Endangered Species Act provides the basis for our action. Under the Endangered Species Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. The primary factors supporting the proposed threatened status for lesser prairie-chicken are the historical, ongoing, and probable future impacts of cumulative habitat loss and fragmentation. These impacts are the result of: conversion of grasslands to agricultural uses; encroachment by invasive woody plants; wind energy

development; petroleum production; and presence of roads and manmade vertical structures including towers, utility lines, fences, turbines, wells, and buildings.

We will request peer review of the methods used in our proposal. We will specifically request that several knowledgeable individuals with scientific expertise in this species or related fields review the scientific information and methods that we used in developing this proposal.

We are seeking public comment on this proposed rule. Anyone is welcome to comment on our proposal or provide additional information on the proposal that we can use in making a final determination on the status of this species. Please submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section. Within 1 year following the publication of this proposal, we will publish in the **Federal Register** a final determination concerning the listing of the species or withdraw the proposal if new information is provided that supports that decision.

Public Comments

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned governmental agencies, Native American tribes, the scientific community, industry,

general public, or any other interested parties concerning this proposed rule. We particularly seek comments regarding:

(1) The historical and current status and distribution of the lesser prairie-chicken, its biology and ecology, specific threats (or lack thereof) and regulations that may be addressing those threats and ongoing conservation measures for the species and its habitat.

(2) Information relevant to the factors that are the basis for making a listing determination for a species under section 4(a) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*), which are:

- (a) The present or threatened destruction, modification, or curtailment of the species' habitat or range;
- (b) Overutilization for commercial, recreational, scientific, or educational purposes;
- (c) Disease or predation;
- (d) The inadequacy of existing regulatory mechanisms; or
- (e) Other natural or manmade factors affecting its continued existence and threats to the species or its habitat.

(3) Which areas would be appropriate as critical habitat for the species and why areas should or should not be proposed for designation as critical habitat, including

whether there are threats to the species from human activity that would be expected to increase due to the designation and whether that increase in threat would outweigh the benefit of designation such that the designation of critical habitat may not be prudent.

(4) Specific information on:

- The amount and distribution of habitat for the lesser prairie-chicken,
- What may constitute “physical or biological features essential to the conservation of the species,” within the geographical range currently occupied by the species,
 - Where these features are currently found,
 - Whether any of these features may require special management considerations or protection,
 - What areas, that were occupied at the time of listing (or are currently occupied) and that contain features essential to the conservation of the species, should be included in the designation and why,
 - What areas not occupied at the time of listing are essential for the conservation of the species and why.

(5) Information on the projected and reasonably likely impacts of climate change on the lesser prairie-chicken and its habitat.

(6) Information as to which prohibitions, and exceptions to those prohibitions, are necessary and advisable to provide for the conservation of the lesser prairie-chicken pursuant to section 4(d) of the Act.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or threatened species must be made “solely on the basis of the best scientific and commercial data available.”

You may submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section.

If you submit a comment via <http://www.regulations.gov>, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy comments on <http://www.regulations.gov>. Please include sufficient information with your comments to allow us to verify any scientific or commercial information you include.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on <http://www.regulations.gov> at Docket No. FWS–R2–ES–2012–0071, or by appointment during normal business hours at the Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Previous Federal Actions

On October 6, 1995, we received a petition, dated October 5, 1995, from the Biodiversity Legal Foundation, Boulder, Colorado, and Marie E. Morrissey (petitioners). The petitioners requested that we list the lesser prairie-chicken as threatened throughout its known historical range in the United States. The petitioners defined the historical range to encompass west-central Texas north through eastern New Mexico and western Oklahoma to southeastern Colorado and western Kansas and stated that there may have been small populations in northeastern Colorado and northwestern Nebraska. The petitioners also requested that critical habitat be designated as soon as the needs of the species are sufficiently well known. However, from October 1995 through April 1996, we were under a moratorium on listing actions as a result of Public Law 104–6, which, along with a series of continuing budget resolutions, eliminated or severely reduced our listing budget through April 1996. We were unable to act on the petition during that period. On July 8, 1997 (62 FR 36482), we announced our 90-day finding that the petition presented substantial information indicating that the petitioned action may be

warranted. In that notice, we requested additional information on the status, trend, distribution, and habitat requirements of the species for use in conducting a status review. We requested that information be submitted to us by September 8, 1997. In response to a September 3, 1997, request by the Lesser Prairie-Chicken Interstate Working Group, we reopened the comment period for an additional 30 days beginning on November 3, 1997 (62 FR 59334). We subsequently published our 12-month finding for the lesser prairie-chicken on June 9, 1998 (63 FR 31400), concluding that the petitioned action was warranted but precluded by other higher priority listing actions.

On October 25, 1999, we published our combined plant and animal candidate notice of review, which initially identified the lesser prairie-chicken as a candidate for listing with a listing priority number (LPN) of 8 (64 FR 57534). Our policy (48 FR 43098; September 21, 1983) requires the assignment of an LPN to all candidate species. This listing priority system was developed to ensure that we have a rational system for allocating limited resources in a way that ensures those species in greatest need of protection are the first to receive such protection. The listing priority system considers magnitude of threat, immediacy of threat, and taxonomic distinctiveness in assigning species numerical listing priorities on a scale from 1 to 12. In general, a smaller LPN reflects a greater need for protection than a larger LPN. The lesser prairie-chicken was assigned an LPN of 8 indicating that the magnitude of threats was moderate and the immediacy of the threats to the species was high.

On January 8, 2001 (66 FR 1295), we published our resubmitted petition findings for 25 animal species, including the lesser prairie-chicken, having outstanding “warranted-but-precluded” petition findings as well as notice of one candidate removal. The lesser prairie-chicken remained a candidate with an LPN of 8 in our October 30, 2001 (66 FR 54808); June 13, 2002 (67 FR 40657); May 4, 2004 (69 FR 24876); May 11, 2005 (70 FR 24870); September 12, 2006 (71 FR 53755); and December 6, 2007 (72 FR 69033) Candidate Notices of Review. In our December 10, 2008 (73 FR 75176), candidate notice of review, we changed the LPN for the lesser prairie-chicken from an 8 to a 2. This change in LPN reflected a change in the magnitude of the threats from moderate to high primarily due to an anticipated increase in the development of wind energy and associated placement of transmission lines throughout the estimated occupied range of the lesser prairie-chicken. Our June 9, 1998, 12-month finding (63 FR 31400) did not recognize wind energy and transmission line development as a threat because such development within the known range was almost nonexistent at that time. Changes in the magnitude of other threats, such as conversion of certain Conservation Reserve Program (CRP) lands from native grass cover to cropland or other less ecologically valuable habitat and observed increases in oil and gas development, also were important considerations in our decision to change the LPN. The immediacy of the threats to the species did not change and continued to be high. Our November 9, 2009 (74 FR 57804), November 10, 2010 (75 FR 69222), and October 26, 2011 (76 FR 66370) Candidate Notices of Review retained an LPN of 2 for the lesser prairie-chicken.

Since making our 12-month finding, we have received several 60-day notices of intent to sue from WildEarth Guardians (then Forest Guardians) and several other parties for failure to make expeditious progress toward listing of the lesser prairie-chicken. These notices were dated August 13, 2001; July 23, 2003; November 23, 2004; and May 11, 2010. WildEarth Guardians subsequently filed suit on September 1, 2010, in the U.S. District Court for the District of Colorado. A revised notice of intent to sue dated January 24, 2011, in response to motions from New Mexico Oil and Gas Association, New Mexico Cattle Growers Association, and Independent Petroleum Association of New Mexico to intervene on behalf of the Secretary of Interior, also was received from WildEarth Guardians.

This complaint was subsequently consolidated in the U.S. District Court for the District of Columbia along with several other cases filed by the Center for Biological Diversity or WildEarth Guardians relating to petition finding deadlines and expeditious progress toward listing. A settlement agreement in *In re Endangered Species Act Section 4 Deadline Litigation*, No. 10-377 (EGS), MDL Docket No. 2165 (D.D.C. May 10, 2011) was reached with WildEarth Guardians in which we agreed to submit a proposed listing rule for the lesser prairie-chicken to the **Federal Register** for publication by September 30, 2012.

Summary of Recent and Ongoing Conservation Actions

Numerous conservation actions have been implemented within the historical range of the lesser prairie-chicken, many focused primarily on the currently occupied portion of the range, during the last 10 to 15 years. The State conservation agencies have taken a lead role in implementation of these actions, but several Federal agencies and private conservation organizations have played an important supporting role in many of these efforts. Recently, several multi-State efforts have been initiated, and the following section briefly discusses many of the known conservation efforts for the lesser prairie-chicken.

Multi-State Conservation Efforts

The CRP administered by the U.S. Department of Agriculture's (USDA) Farm Services Agency and targeted at agricultural landowners has provided short-term protection and enhancement of millions of acres within the range of the lesser prairie-chicken. The CRP is a voluntary program that allows eligible landowners to receive annual rental payments and cost-share assistance to remove land from agricultural production and establish vegetative cover for the term of the contract. Contract terms are for 10 to 15 years, and the amount and dispersion of land enrolled in CRP fluctuates as contracts expire and new lands are enrolled. All five States within the range of the lesser prairie-chicken have lands enrolled in CRP. Many of the States, with the exception of Kansas, initially used nonnative grasses as the predominant cover type established on enrolled lands. Kansas chose to use native species of grasses as the cover type for many

of their enrolled lands, resulting in a considerable benefit to lesser prairie-chicken conservation. As the program has evolved since its inception in 1985, use of native grasses as the predominant cover type has been encouraged, resulting in even greater benefit for lesser prairie-chickens. Use of native grasses in the CRP helps create suitable nesting and brood rearing habitat for the lesser prairie-chicken

The State Acres For Wildlife Enhancement program (SAFE) is a conservation practice utilized under CRP to benefit high-priority species including the lesser prairie-chicken. Beginning in 2008, the SAFE program was implemented in Colorado, Kansas, New Mexico, Oklahoma, and Texas to target grassland habitat improvement measures within the range of the lesser prairie-chicken. These measures help improve suitability of existing grasslands for nesting and brood rearing by lesser prairie-chickens. In accordance with CRP guidelines, crop producers can voluntarily enroll eligible lands in 10- to 15-year contracts in exchange for payments, incentives, and cost-share assistance to establish natural vegetation on enrolled lands. Areas allocated for the SAFE program vary by State and are as follows: Colorado 8,700 hectares (ha) (21,500 acres (ac)); Kansas 12,141 (30,000 ac); New Mexico 1,052 ha (2,600 ac); Oklahoma 6,111 ha (15,100 ac); and Texas 31,727 (78,400 ac). Total potential enrollment in SAFE program is 59,731 ha (147,600 ac) or about 1 percent of the current estimated occupied range. The current status of the SAFE program, organized by State, is provided in the sections that follow.

In 2011, the USDA Natural Resources Conservation Service (NRCS) began implementation of the Lesser Prairie Chicken Initiative. The Lesser Prairie Chicken Initiative provides conservation assistance, both technical and financial, to landowners throughout the Lesser Prairie Chicken Initiative's administrative boundary. The NRCS has partnered with other stakeholders to fund, through the Strategic Watershed Action Teams program, additional staff positions dedicated to providing accelerated and targeted technical assistance to landowners within the current range of the lesser prairie-chicken. Technical assistance is voluntary help provided by NRCS that is intended to assist non-federal land users in addressing opportunities, concerns, and problems related to the use of natural resources and to help land users make sound natural resource management decisions on private, tribal, and other non-federal land. This assistance may be in the form of resource assessment, practice design, resource monitoring, or follow-up of installed practices. The Lesser Prairie Chicken Initiative focuses on maintenance and enhancement of suitable habitat while benefiting agricultural producers by maintaining the farming and ranching operations throughout the region. Numerous partners are involved in this multi-state initiative including the State conservation agencies, the Playa Lakes Joint Venture, and the Wood Foundation. The Environmental Quality Incentives Program (EQIP) and the Wildlife Habitat Incentives Program (WHIP) are the primary programs used to provide for conservation through the Lesser Prairie Chicken Initiative. The EQIP is a voluntary program that provides financial and technical assistance to agricultural producers through contracts up to a maximum term of 10 years in length. These contracts provide financial assistance to help plan and implement conservation

practices that address natural resource concerns and opportunities to improve soil, water, plant, animal, air, and related resources on agricultural land. Similarly, the WHIP is a voluntary program designed for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, including tribal lands. Through WHIP, NRCS may provide both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. Cost-share agreements between NRCS and the landowner may extend up to 10 years from the date the agreement is signed. Through these two programs, NRCS has committed some \$17.5 million to the Lesser Prairie Chicken Initiative in Texas alone. In 2010, the identified funds were allocated throughout the historical range, with some 33,956 ha (83,907 ac) placed under contract within those counties that intersected the estimated occupied range. By entering into a contract with NRCS, the landowner agrees to implement specified conservation actions through provisions of the applicable Farm Bill conservation program, such as WHIP or EQIP. Another 32,139 ha (79,417 ac) were allocated to contracts on lands outside of the estimated occupied range but within unoccupied portions of the historical range. In 2011, efforts were undertaken to more precisely apply the funds to areas within the estimated occupied range.

The North American Grouse Partnership, in cooperation with the National Fish and Wildlife Foundation and multiple State conservation agencies and private foundations, have embarked on the preparation of the prairie grouse portions of an overarching North American Grouse Management Strategy. The Prairie Grouse

Conservation Plan, which was completed in 2008 (Vodehnal and Haufler 2008, entire), provides recovery actions and defines the levels of funding necessary to achieve management goals for all species of prairie grouse in North America. The prairie grouse portions of this strategy encompass some 26 million ha (65 million ac) of grassland habitat in the United States and Canada.

The Lesser Prairie-Chicken Interstate Working Group was formed in 1996. This group, composed largely of State agency biologists under the oversight of the Western Association of Fish and Wildlife Agencies' Grassland Coordinator, meets annually to share information on the status of the lesser prairie-chicken, results of new research, and ongoing threats to the species. The Working Group has played an important role in defining and implementing conservation efforts for the lesser prairie-chicken. In 1999, they published a conservation strategy for the lesser prairie-chicken (Mote *et al.* 1999, entire). Then, in 2008, the Working Group published a lesser prairie-chicken conservation initiative (Davis *et al.* 2008, entire).

Since 2004, the Sutton Center has been working to reduce or eliminate the mortality of lesser prairie-chickens due to fence collisions on their study areas in Oklahoma and Texas. Forceful collisions with fences during flight can cause direct mortality of lesser prairie-chickens (Wolfe *et al.* 2007, pp. 96–97, 101). However, mortality risk appears to be dependent on factors such as fencing design (height, type, number of strands), length, and density, as well as landscape topography and proximity of

fences to habitats used by lesser prairie-chickens. The Sutton Center has used competitive grants and other funding sources to either physically remove unnecessary fencing or to apply markers of their own design (Wolfe *et al.* 2009, entire) to the top two strands to increase visibility of existing fences. To date, approximately 335 kilometers (km) (208 miles (mi)) of barbed-wire fence in Oklahoma and Texas have been treated. Treatments are typically concentrated within 1.6 km (1 mi) of active lesser prairie-chicken leks. Approximately 208 km (129 mi) of unneeded fences have been removed. Collectively, these conservation activities have the potential to significantly reduce the threat of collision mortality on 44,110 ha (109,000 ac) of occupied habitat. Our Partners for Fish and Wildlife Program (PFW) initiated a similar fence marking effort in New Mexico during 2008. Although the amount of marked fences has not been quantified, the effort is an important contribution to ongoing conservation efforts. However, continued fence construction throughout the range of the lesser prairie-chicken and the localized influence of these conservation efforts likely limits the effectiveness of such measures at the population level.

The Service and the five State conservation agencies are currently working with 19 wind energy development companies to develop a programmatic Habitat Conservation Plan (HCP) for several species, including the lesser prairie-chicken. An HCP is a planning document required as part of an application for a permit for incidental take of a Federally listed species. The HCP describes the anticipated effects of the proposed taking; how those impacts will be minimized or mitigated; and how the HCP is to be

funded. The Oklahoma Department of Wildlife Conservation (ODWC) received a nontraditional section 6 HCP planning grant that is supporting this effort. The HCP is scheduled to be finalized in the spring of 2014. We anticipate the conservation program of the HCP could involve acquisition and setting aside of conservation or mitigation lands.

Recently the five State conservation agencies developed an Internet-based mapping tool as a pilot project under the Western Governors' Association Wildlife Council. This tool, known as the Southern Great Plains Crucial Habitat Assessment Tool (CHAT), was made accessible to the public in September 2011. The CHAT is available for use by conservation managers, industry, and the public to aid in conservation planning for the lesser prairie-chicken. The tool identifies priority habitat for the lesser prairie-chicken including possible habitat corridors linking important conservation areas. The CHAT classifies areas on a scale of 1 to 5 by their relative value as lesser prairie-chicken habitat. The most important category is identified as "irreplaceable" and is indicative of areas that are rare or fragile and considered essential to achieving and maintaining population viability. The lowest category is considered "common" and represents areas that are relatively common and generally less limiting to lesser prairie-chicken populations or metapopulations. These areas are generally better suited for development uses. The CHAT includes other data layers that may facilitate conservation planning, including current and historical lesser prairie-chicken range, land cover types, oil and gas well density, presence of vertical structures, and hexagonal summary polygon

to provide users contextual information about the surrounding landscape. A revision of the CHAT is planned in the coming months, and the tool will be updated annually. Use of the tool is currently voluntary but ultimately may play an important role in guiding future development and conserving important habitats.

Candidate Conservation Agreements (CCAs) and Candidate Conservation Agreements with Assurances (CCAAs) are formal, voluntary agreements between the Service and one or more parties to address the conservation needs of one more candidate species or species likely to become candidates in the near future. These agreements are intended to reduce or remove identified threats to a species. Implementing conservation efforts before species are listed increases the likelihood that simpler, more cost-effective conservation options are available and that conservation efforts will succeed. Development of CCAa and CCAAs is guided by regulations at 50 CFR 17.22(d) and 50 CFR 17.32(d).

Under a CCA, Federal managers and other cooperators (non-governmental organizations and lease holders) implement conservation measures that reduce threats on Federal lands and leases. Under a CCAA, non-Federal landowners and lease holders voluntarily provide habitat protection or enhancement measures on their lands, thereby reducing threats to the species. A section 10(a)(1)(A) Enhancement of Survival Permit is issued in association with a CCAA. If the species is later listed under the Act, the permit authorizes take that is incidental to otherwise lawful activities specified in the agreement,

when performed in accordance with the terms of the agreement. Further, the CCAA provides assurances that if the subject species is later listed under the Act, participants who are appropriately implementing certain conservation actions under the CCAA will not be required to implement additional conservation measures.

The lesser prairie-chicken is covered by a CCA with the Bureau of Land Management (BLM) and two “umbrella” CCAAs, one each in Texas and New Mexico. A draft umbrella CCAA for Oklahoma was made available for public review and comment on June 25, 2012 (77 FR 37917). An additional CCAA has been established with a single landowner in southwestern Kansas; however, this CCAA has since expired. Under these agreements, the participants agree to implement certain conservation measures that are anticipated to reduce threats to lesser prairie-chicken and improve their population stability, through increases in adult and juvenile survivorship, nest success, and recruitment rates and reduced mortality. Dependent upon the level of participation, expansion of the occupied range may occur. Conservation measures typically focus on maintenance, enhancement, or restoration of nesting and brood rearing habitat. Some possible conservation measures include removal of invasive woody plants such as mesquite and eastern red cedar, implementation of prescribed fire, marking of fences, removal of unneeded fences, improved grazing management, and similar measures that help reduce the impact of the existing threats.

All of the State conservation agencies and many Federal agencies within the range of the lesser prairie-chicken conduct outreach efforts intended to inform and educate the public about the conservation status of the species. Many of these efforts specifically target landowners and other interested stakeholders involved in lesser prairie-chicken conservation. Annual festivals focused on the lesser prairie-chicken are held in several States (Milnesand, New Mexico; Woodward, Oklahoma; and Canadian, Texas) that help inform and raise awareness for the public. Often festival participants are able to visit an active lesser prairie-chicken breeding area to observe courtship displays.

Colorado

The Colorado Parks and Wildlife (CPW) hosted a workshop on the conservation of the lesser prairie-chicken in late 2009. This workshop provided information to local landowners and other interested parties on conservation of the lesser prairie-chicken. Specific management actions, such as grassland restoration and enhancement, intended to benefit conservation of the lesser prairie-chicken were highlighted.

The NRCS is using EQIP and WHIP to implement habitat improvement projects for the lesser prairie-chicken in Colorado. Colorado also has implemented a Habitat Improvement Program (HIP) for the lesser prairie-chicken that provides cost-sharing to private landowners, subject to prior consultation and approval from a CPW biologist, for enrolling fields or conducting habitat enhancements beneficial to the species.

Approximately 2,250 ha (5,560 ac) have been enrolled in this program (Verquer and Smith 2011, p. 7). Additionally, Colorado has a Wildlife Habitat Protection Program designed to facilitate acquisition of conservation easements and purchase of lands for the lesser prairie-chicken. The lesser prairie-chicken is one of five priorities for 2012, and up to \$14 million is available in the program.

Currently about 4,433 ha (10,954 ac) have been enrolled under the lesser prairie-chicken CRP SAFE continuous sign-up in Colorado. These enrolled areas are typically recently expired CRP lands and contain older grass stands in less than optimal habitat condition. In late winter 2010 or early spring 2011, one-third of these enrolled lands received a forb and legume inter-seeding consisting of dryland alfalfa and other species to improve habitat quality. This effort is anticipated to result in the establishment of alfalfa and additional forbs, resulting in improved nesting and brood-rearing habitat. Some 4,249 ha (10,500 ac) of the initial 8,701 ha (21,500 ac) allocated for SAFE remain to be enrolled. High interest by landowners indicates that these additional acres will be enrolled in the near future (Verquer and Smith 2011, p. 7).

Our Partners for Fish and Wildlife Program (PFW) program has contributed financial and technical assistance for restoration and enhancement activities benefitting the lesser prairie-chicken in Colorado. The PFW program has executed 14 private lands agreements facilitating habitat restoration and enhancement for the lesser prairie-chicken on about 9,307 ha (23,000 ac) of private lands in southeastern Colorado.

A cooperative project between the CPW and the U.S. Forest Service (USFS) has established several temporary grazing exclosures adjacent to active leks on the Comanche National Grassland in an attempt to improve nesting habitat. The efficacy of these treatments is unknown, and further monitoring is planned to determine the outcome of these efforts (Verquer and Smith 2011, p. 7).

In addition, more than 4,450 ha (11,000 ac) have been protected by perpetual conservation easements held by CPW, The Nature Conservancy, and the Greenlands Reserve Land Trust.

Kansas

The Kansas Department of Wildlife, Parks, and Tourism (KDWPT) has targeted lesser prairie-chicken habitat improvements through various means including the Landowner Incentive Program, voluntary mitigation projects for energy development, and a state-level WHIP. The Landowner Incentive Program improved some 9,118 ha (22,531 ac) for lesser prairie-chickens during the period from 2007 to 2011. Since 2008, the KDWPT has provided \$64,836 in landowner cost-share through the WHIP for practices benefitting the lesser prairie-chicken on about 2,364 ha (5,844 ac). Currently more than 11,662 ha (28,819 ac) of the original allocation have been enrolled under the lesser prairie-chicken CRP SAFE continuous signup in Kansas. Primary practices

include tree removal, prescribed fire, grazing management (including perimeter fencing), and native grass establishment that will improve lesser prairie-chicken nesting and brood rearing habitat.

Funds available through the state wildlife grants program also have been used to benefit the lesser prairie-chicken in Kansas. The KDWPT was awarded a 5-year state wildlife grant in 2009 focusing on lesser prairie-chicken habitat improvements. During the first funding cycle, a total of \$181,127.34 was allocated to six projects encompassing some 1,484 ha (3,667 ac). During two subsequent application periods, nine more projects were funded at a cost of \$180,584, targeting some 1,319 ha (3,260 ac).

Like several of the other States within the range of the lesser prairie-chicken, the KDWPT partnered with Pheasants Forever and NRCS to fund three employee positions that will provide technical assistance to private landowners participating in conservation programs with an emphasis on practices favorable to the lesser prairie-chicken. These employees will primarily assist in the implementation and delivery of the NRCS's Lesser Prairie Chicken Initiative in Kansas.

Additionally, KDWPT has a walk-in hunting program that was initiated in 1995 in an effort to enhance the hunting tradition in Kansas. The program provides hunters access to private property and has become one of the most successful access programs in the country. By 2004, more than 404,000 ha (1 million ac) have been enrolled in the

program. Landowners receive a small payment in exchange for allowing public hunting access to enrolled lands. Payments vary by the amount of acres enrolled and length of contract period. Conservation officers monitor the areas, and violators are ticketed or arrested for offenses such as vandalism, littering, or failing to comply with hunting or fishing regulations.

The Service's PFW program has contributed financial and technical assistance for restoration and enhancement activities that benefit the lesser prairie-chicken in Kansas. Primary activities include control of invasive woody plant species like eastern red cedar and enhanced use of prescribed fire to improve habitat conditions in native grasslands. The PFW program has executed 54 private lands agreements on about 51,246 ha (126,878 ac) of private lands benefitting conservation of the lesser prairie-chicken in Kansas. An approved CCAA was developed on 1,133 ha (2,800 ac) in south-central Kansas; however, this CCAA has since expired.

New Mexico

In January 2003, a working group composed of local, state, and Federal officials, along with private and commercial stakeholders, was formed to address conservation and management activities for the lesser prairie-chicken and dunes sagebrush lizard (*Sceloporus arenicolus*) in New Mexico. This working group, formally named the New Mexico Lesser Prairie-Chicken/Sand Dune Lizard Working Group, published the

Collaborative Conservation Strategies for the Lesser Prairie-Chicken and Sand Dune Lizard in New Mexico (Strategy) in August 2005. This Strategy provided guidance in the development of BLM's Special Status Species Resource Management Plan Amendment (RMPA), approved in April 2008, which also addressed the concerns and future management of lesser prairie-chicken and dunes sagebrush lizard habitats on BLM lands, and established the Lesser Prairie-Chicken Habitat Preservation Area of Critical Environmental Concern. Both the Strategy and the RMPA prescribe active cooperation among all stakeholders to reduce or eliminate threats to these species in New Mexico. As an outcome, the land-use prescriptions contained in the RMPA now serve as baseline mitigation (for both species) to those operating on Federal lands or non-Federal lands with Federal minerals.

Following approval of the RMPA, a CCA was drafted by a team including the Service, BLM, Center of Excellence for Hazardous Materials Management, and participating cooperators. The CCA addresses the conservation needs of the lesser prairie-chicken and dunes sagebrush lizard on BLM lands in New Mexico by undertaking habitat restoration and enhancement activities and minimizing habitat degradation. These efforts would protect and enhance existing populations and habitats, restore degraded habitat, create new habitat, augment existing populations of lesser prairie-chickens, restore populations, fund research studies, or undertake other activities on their Federal leases or allotments that improve the status of the lesser prairie-chicken. Through this CCA, Center of Excellence for Hazardous Materials Management will work with

participating cooperators who voluntarily commit to implementing or funding specific conservation actions, such as burying powerlines, controlling mesquite, minimizing surface disturbances, marking fences, and improving grazing management, in an effort to reduce or eliminate threats to both species. The CCA builds upon the BLM's RMPA for southeast New Mexico. The RMPA established the foundational requirements that will be applied to all future Federal activities, regardless of whether a permittee or lessee participates in this CCA. The strength of the CCA comes from the implementation of additional conservation measures that are additive, or above and beyond those foundational requirements established in the RMPA. In addition to the CCA, a CCAA has been developed in association with the CCA to facilitate conservation actions for the lesser prairie-chicken and dunes sagebrush lizard on private and State lands in southeastern New Mexico.

Since the CCA and CCAA were finalized in December 2008, 29 oil and gas companies have enrolled a total of 330,180 ha (815,890 ac) of mineral holdings under the CCA. In addition, 39 private landowners in New Mexico have enrolled about 616,571 ha (1,523,573 ac). There currently are additional pending mineral and ranching enrollment applications being reviewed and processed for inclusion. Recently, BLM also has closed 149,910 ha (370,435 ac) to future oil and gas leasing and closed some 342,770 ha (847,000 ac) to wind and solar development. They have reclaimed 536 ha (1,325 ac) of abandoned well pads and associated roads and now require burial of powerlines within 3.2 km (2 mi) of leks. Some 52 km (32.5 mi) of aboveground powerlines have been

removed to date. Additionally, BLM has implemented control efforts for mesquite (*Prosopis glandulosa*) on some 148,257 ha (366,350 ac) and has plans to do so on an additional 128,375 ha (317,220 ac). More discussion of mequite control is addressed in the “Shrub Control and Eradication” section below.

Acquisition of land for the protection of lesser prairie-chicken habitat also has occurred in New Mexico. The New Mexico Department of Game and Fish (NMDGF) currently has designated 29 areas specifically for management of the lesser prairie-chickens totaling more than 11,850 ha (29,282 ac). These areas are closed to the public during the breeding and nesting season (March 1 to July 30), each year and restrictions are in place to minimize noise and other activities associated with oil and gas drilling. In 2007, the State Game Commission used New Mexico State Land Conservation Appropriation funding to acquire 2,137 ha (5,285 ac) of private ranchland in Roosevelt County. This property, the Sandhills Prairie Conservation Area (formerly the Lewis Ranch), is located east of Milnesand, New Mexico, and adjoins two existing Commission-owned Prairie-Chicken Areas. The BLM, on March 3, 2010, also acquired 3,010 ha (7,440 ac) of land east of Roswell, New Mexico, to protect key habitat for the lesser prairie-chicken. The Nature Conservancy owns and manages the 11,331-ha (28,000-ac) Milnesand Prairie Preserve near Milnesand, New Mexico.

The Service’s PFW program also has been active in lesser prairie-chicken conservation efforts in the State of New Mexico. Private lands agreements have been

executed on 65 properties encompassing some 28,492 ha (70,404 ac) of lesser prairie-chicken habitat in New Mexico. Additionally the entire 3,683 ha (2,600 ac) allotted to the lesser prairie-chicken CRP SAFE continuous signup in New Mexico has been enrolled in the program.

Oklahoma

The ODWC partnered with the Service, the Oklahoma Secretary of Environment, The Nature Conservancy, the Sutton Center, and the Playa Lakes Joint Venture to develop the Oklahoma Lesser Prairie-Chicken Spatial Planning Tool in 2009. The goal of the Oklahoma Lesser Prairie-Chicken Spatial Planning Tool is to reduce the impacts of ongoing and planned development actions within the range of the lesser prairie-chicken by guiding development away from sensitive habitats used by the species. The Oklahoma Lesser Prairie-Chicken Spatial Planning Tool assigns a relative value rank to geographic areas to indicate the value of the area to the conservation of the lesser prairie-chicken. The higher the rank (on a scale of 1 to 8), the more important the area is to the lesser prairie-chicken. The Oklahoma Lesser Prairie-Chicken Spatial Planning Tool, therefore, can be used to identify areas that provide high-quality habitat and determine where development, such as wind power, would have the least impact to the species. The Oklahoma Lesser Prairie-Chicken Spatial Planning Tool also can be used to determine a voluntary offset payment based on the cost of mitigating the impact of the anticipated development through habitat replacement. The voluntary offset payment is intended to

be used to offset the impacts associated with habitat loss. Use of the Oklahoma Lesser Prairie-Chicken Spatial Planning Tool and the voluntary offset payment is voluntary.

To date, in excess of \$11.1 million has been committed to the ODWC through the voluntary offset payment program. Most recently, the ODWC entered into a Memorandum of Agreement with Chermac Energy Corporation to partially offset potential habitat loss from a planned 88.5-km (55-mi) high-voltage transmission line. The line would run from near the Kansas State line to the Oklahoma Gas and Electric Woodward Extra High Voltage substation and will be used to carry up to 900 megawatts of wind energy from an existing wind farm in Harper County. The Memorandum of Agreement facilitates voluntary offset payments for impacts to the lesser prairie-chicken and their habitat. The agreement calls for the payment of a total of \$2.5 million, with the money being used to help leverage additional matching funds from private and Federal entities for preservation, enhancement, and acquisition of lesser prairie-chicken habitat. A large percentage of the voluntary offset payment funds have been used to acquire lands for the conservation of the lesser prairie-chicken and other fish and wildlife resources.

In 2008, the ODWC acquired two properties known to be used by the lesser prairie-chicken. The Cimarron Bluff Wildlife Management Area encompasses 1,388 ha (3,430 ac) in northeastern Harper County, Oklahoma. The Cimarron Hills Wildlife Management Area in northwestern Woods County, Oklahoma, encompasses 1,526 ha (3,770 ac). The ODWC also recently purchased 5,580 ha (13,789 ac) within the range of

the lesser prairie-chicken to expand both the Beaver River and Packsaddle Wildlife Management Areas in Beaver and Ellis Counties, respectively.

Oklahoma State University hosts prescribed fire field days to help inform landowners about the benefits of prescribed fire for controlling invasion of woody vegetation in prairies and improving habitat conditions for wildlife in grassland ecosystems. Prescribed burning is an important tool landowners can use to improve the value of CRP fields and native prairie for wildlife, including the lesser prairie-chicken, by maintaining and improving vegetative structure, productivity, and diversity and by controlling exotic plant species. In 2009, the Environmental Defense Fund partnered with Oklahoma State University to prepare a report on the management of CRP fields for lesser prairie-chicken management. The document (Hickman and Elmore 2009, entire) was designed to provide a decision tree that would assist agencies and landowners with mid-contract management of CRP fields.

Like the other States, ODWC has partnered in the implementation of a State WHIP designed to enhance, create, and manage habitat for all wildlife species, including the lesser prairie-chicken. The State WHIP recently has targeted money for lesser prairie-chicken habitat improvements.

Several different “Ranch Conversations” have been held in northwestern Oklahoma over the past 10 years, most recently hosted by the Oklahoma High Plains

Resource Development and Conservation Office. These meetings invited private landowners and the general public to discuss lesser prairie-chicken conservation and management, receive information, and provide input on programs and incentives that are available for managing the lesser prairie-chicken on privately owned habitats.

In an effort to address ongoing development of oil and gas resources, the Oklahoma Wildlife Conservation Commission voted to approve a Memorandum of Understanding with the Oklahoma Independent Petroleum Association in February 2012 to establish a collaborative working relationship for lesser prairie-chicken conservation. Through this Memorandum of Understanding, the ODWC and Oklahoma Independent Petroleum Association will identify and develop voluntary steps (Best Management Practices) that can be taken by the Oklahoma Independent Petroleum Association's members to avoid and minimize the impacts of their operations on the lesser prairie-chicken. These Best Management Practices are currently under development.

Oklahoma received a USDA Conservation Innovation Grant to develop a wildlife credits trading program. When completed, the credit trading program will provide incentives to landowners who manage their lands for conservation of the lesser prairie-chicken. Currently, about 2,819 ha (6,965 ac) have been enrolled under the lesser prairie-chicken CRP SAFE continuous signup in Beaver, Beckham, Ellis, and Harper Counties.

The ODWC, in early 2012, entered into a contract with Ecosystem Management Research Institute to develop a conservation plan for the lesser prairie-chicken in Oklahoma. The primary goal of the Oklahoma Lesser Prairie Chicken Conservation Plan is to develop an overall strategy for conservation of the lesser prairie-chicken in Oklahoma. Development of the Oklahoma Lesser Prairie Chicken Conservation Plan will involve synthesis of all pertinent information currently available and input from diverse stakeholders. The Oklahoma Lesser Prairie Chicken Conservation Plan will identify priority conservation areas, population goals, and conservation strategies and actions; it also will link conservation actions to appropriate entities and contain an implementation timeline. A draft document is currently available, public comments were solicited through August 30, 2012, and the final plan is anticipated in September of 2012.

As discussed above, the ODWC has applied for an enhancement of survival permit pursuant to section 10(a)(1)(A) of the Act that includes a draft umbrella CCAA between the Service and ODWC for the lesser prairie-chicken in 14 Oklahoma counties (77 FR 37917). The draft CCAA and associated draft environmental assessment was made available for public review and comment in June 2012. The Service and ODWC are currently reviewing and addressing public comments, and a permitting decision is anticipated in the near future

The Service's PFW program also has contributed financial and technical assistance for restoration and enhancement activities that benefit the lesser prairie-

chicken in Oklahoma. Important measures include control of eastern red cedar and fence marking and removal to minimize collision mortality. The Oklahoma PFW program has implemented 154 private lands agreements on about 38,954 ha (96,258 ac) of private lands for the benefit of the lesser prairie-chicken in the State.

Texas

The Texas Parks and Wildlife Department (TPWD) hosted a series of landowner meetings and listening sessions in 6 (Hemphill, Wheeler, Gray, Bailey, Cochran, and Gaines) of the 13 counties confirmed to be occupied by the lesser prairie-chicken in Texas. Private landowners and the general public were invited to discuss conservation and management, receive information, and provide input on programs and incentives that are available for managing the lesser prairie-chicken on privately owned lands. In response to these meetings, TPWD worked with the Service and landowners to finalize the first statewide umbrella CCAA for the lesser prairie-chicken in Texas. The conservation goal of the Texas CCAA is to encourage protection and improvement of suitable lesser prairie-chicken habitat on non-Federal lands by offering private landowners incentives to implement voluntary conservation measures through available funding mechanisms and by providing technical assistance and regulatory assurances concerning land use restrictions that might otherwise apply should the lesser prairie-chicken become listed. The conservation measures would generally consist of prescribed grazing; prescribed burning; brush management; cropland and residue management;

range seeding and enrollment in various Farm Bill programs such as the CRP, the Grassland Reserve Program, and SAFE program; and wildlife habitat treatments through the EQIP. The Texas CCAA covers 50 counties, largely encompassing the Texas panhandle region, and was finalized on May 14, 2009. Currently, 22 private landowners (totaling approximately 255,044 ac) are enrolled under this agreement.

More recently, the TPWD, along with other partners, held five meetings in the Texas panhandle region as part of an effort to promote lesser prairie-chicken conservation. These meetings were held in May of 2009 and were intended to inform landowners about financial incentives and other resources available to improve habitat for the lesser prairie-chicken, including the SAFE program. The objective of the Texas SAFE program, administered by the Farm Service Agency, is to restore 2,093 ha (20,000 ac) of native mixed-grassland habitat for the lesser prairie-chicken in Texas. Additional allocations were approved, and currently some 31,245 ha (77,209 ac) have been enrolled in the SAFE program. Then, in March 2010, TPWD staff conducted a 2-day upland bird workshop where lesser prairie-chicken research and management was discussed.

In 2010, the NRCS and TPWD partnered to create an EQIP focused on lesser prairie-chicken conservation. This program provides technical and financial assistance to landowners interested in implementing land management practices for the lesser prairie-chicken within its historical range.

The Service's PFW program and the TPWD have been actively collaborating on range management programs designed to provide cost-sharing for implementation of habitat improvements for lesser prairie-chickens. The Service provided funding to TPWD to support a Landscape Conservation Coordinator position for the Panhandle and Southern High Plains region, as well as funding to support Landowner Incentive Program projects targeting lesser prairie-chicken habitat improvements (brush control and grazing management) in this region. More than \$200,000 of Service funds were committed in 2010, and an additional \$100,000 was committed in 2011. Since 2008, Texas has addressed lesser prairie-chicken conservation on some 5,693 ha (14,068 ac) under the Landowner Incentive Program. Typical conservation measures include native plant restoration, control of exotic vegetation, prescribed burning, selective brush management, and prescribed grazing. Currently, the PFW program has executed 66 private lands agreements on about 53,091 ha (131,190 ac) of privately owned lands for the benefit of the lesser prairie-chicken in Texas.

The TPWD continues to establish working relationships with wind developers and provides review and comment on proposed developments whenever requested. Through this voluntary comment process, TPWD provides guidance on how to prevent, minimize, and mitigate impacts from wind and transmission development on lesser prairie-chicken habitat and populations.

A Lesser Prairie-Chicken Advisory Committee also has been established in Texas and functions to provide input and information to the State's Interagency Task Force on Economic Growth and Endangered Species. The purpose of the task force is to provide policy and technical assistance regarding compliance with endangered species laws and regulations to local and regional governmental entities and their communities engaged in economic development activities so that compliance with endangered species laws and regulations is as effective and cost efficient as possible. Input provided by the Lesser Prairie-Chicken Advisory Committee serves to help the Task Force prevent listing and minimize harm to economic sectors if listing does occur. The advisory committee also assists in outreach and education efforts on potential listing decisions and methods to minimize the impact of listing.

The TPWD has worked in conjunction with several Texas universities to fund several lesser prairie-chicken research projects. In one of those projects, TPWD evaluated the use of aerial line transects and forward-looking infrared technology to survey for lesser prairie-chickens. Other ongoing research includes evaluation of lesser prairie-chicken population response to management of shinnery oak and evaluation of relationships among the lesser prairie-chicken, avian predators, and oil and gas infrastructure.

In 2009, the U.S. Department of Energy awarded Texas Tech University and the TPWD a collaborative grant to conduct aerial surveys on approximately 75 percent of the

estimated currently occupied range. This project aided in the initial development of a standardized protocol for conducting aerial surveys for the lesser prairie-chicken across the entire range. All five States are currently participating in these surveys; and a complete analysis of the results is expected sometime in the summer of 2012 and will be incorporated in the final determination.

Recently, The Nature Conservancy of Texas acquired approximately 2,428 ha (6,000 ac) of private ranchland in Yoakum and Terry Counties for the purpose of protecting and restoring lesser prairie-chicken habitat. This acquisition helped secure a geographically important lesser prairie-chicken population.

In addition to participation in annual lesser prairie-chicken festivals, the TPWD published an article on the lesser prairie-chicken and wind development in Texas in their agency magazine in October of 2009. The TPWD and the Dorothy Marcille Wood Foundation also produced a 12-page color brochure in 2009 about the lesser prairie-chicken entitled "A Shared Future."

In summary, we recognize the importance of the conservation efforts undertaken by all entities across the range of the lesser prairie-chicken. These actions outlined above have, at least in some instances, slowed, but not halted, alteration of lesser prairie-chicken habitat. However, continued implementation of these and similar future actions is crucial to lesser prairie-chicken conservation. In many instances, these efforts have

helped reduce the severity of the threats to the species, particularly in localized areas. However, our review of conservation efforts indicates that the measures identified are not adequate to fully address the known threats, including the primary threat of habitat fragmentation, in a manner that effectively reduces or eliminates the threats (see discussion below). All of the efforts are limited in size or duration, and the measures typically are not implemented at a scale that would be necessary to effectively reduce the threats to this species across its known range. Often the measures are voluntary, with little certainty that the measures will be implemented. In some instances, mitigation for existing development within the range of the lesser prairie-chicken has been secured, but the effectiveness of the mitigation is unknown. Conservation of this species will require persistent, targeted implementation of appropriate actions over the range of the species to sufficiently reduce or eliminate the primary threats to the lesser prairie-chicken.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition often results in public awareness and facilitates conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required

by Federal agencies and the prohibitions against certain activities involving listed species are discussed, in part, below.

Recovery Planning

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline soon after a species is listed, preparation of a draft and final recovery plan, and periodic revisions to the plan as significant new information becomes available. The recovery outline guides the immediate implementation of urgently needed recovery actions and describes the process to be used to develop a recovery plan. The recovery plan identifies site-specific management actions that will achieve recovery of the species, measurable criteria that determine when a species may be downlisted or delisted, and methods for monitoring

recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (comprised of species experts, Federal and State agencies, nongovernment organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (<http://www.fws.gov/Endangered>), or from our Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

In general, the Service believes conservation and eventual recovery of the lesser prairie-chicken should consist of the establishment of secure strongholds or core areas of high quality habitat that are at least 10,117 ha (25,000 ac) in size and support 6–10 active leks, each being used by at least 6 males (Applegate and Riley 1998, p. 14). Ideally these areas would contain minimal amounts of habitat fragmentation and be managed such that the areas are secure from pressures of ongoing development. As fragmentation within these areas increases, the total amount of area would need to expand accordingly such that the total amount of high quality habitat is at least 10,117 ha. It is expected that a minimum of four strongholds will be needed, distributed across the ecological diversity of the species, in order to secure the status of the species. The Service views the species' occupied range as a matrix comprising four primary quadrants, each one exemplifying a unique combination of precipitation, temperature, and vegetation type variables. The quadrants are separated from east to west by the boundary between the shortgrass prairie

and central-mixed-grass-prairie Bird Conservation Regions and from north to south by the Canadian River. To ensure redundancy, resiliency, and representation across the species' range, the Service recommends at least one lesser prairie-chicken stronghold be established and maintained in each quadrant. Resiliency refers to the capacity of an ecosystem or an organism to recover quickly from a disturbance by tolerating or adapting to the anticipated alterations caused by the disturbance. Redundancy, in this context, refers to the ability of a species to compensate for fluctuations in or loss of populations across the species' range such that the loss of a single population has little or no lasting effect on the structure and functioning of the species as a whole. Representation refers to the conservation of the diversity of a species.

While a minimum of four strongholds is recommended in order to secure the status of the species, additional strongholds and connections between them will be needed in order to conserve the species. A more complete explanation of this preliminary conservation strategy can be found in the Service's (2012) technical white paper titled "Conservation Needs of the Lesser Prairie-chicken" (available at <http://www.regulations.gov>).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribal and nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research and monitoring,

captive propagation and reintroduction, and outreach and education. Although land acquisition is an example of a type of recovery action, the recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. Consequently, recovery of these species will require cooperative conservation efforts involving private, State, and possibly Tribal lands.

If this species is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the States of Colorado, Kansas, New Mexico, Oklahoma, and Texas would be eligible for Federal funds to implement management actions that promote the protection and recovery of the lesser prairie-chicken. Information on our grant programs that are available to aid species recovery can be found at: <http://www.fws.gov/grants>.

Although the lesser prairie-chicken is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Federal Agency Consultation

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402.

Section 7(a)(4) requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may adversely affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Some examples of Federal agency actions within the species' habitat that may require conference or consultation, or both, as described in the preceding paragraph include landscape-altering activities on Federal lands; provision of Federal funds to State and private entities through Service programs, such as the PFW Program, State Wildlife Grant Program, and Federal Aid in Wildlife Restoration program; construction and operation of communication, radio, and similar towers by the Federal Communications Commission or Federal Aviation Administration; issuance of section 404 Clean Water Act permits by the U.S. Army Corps of Engineers; construction and management of

petroleum pipeline and power line rights-of-way by the Federal Energy Regulatory Commission; construction and maintenance of roads or highways by the Federal Highway Administration; implementation of certain USDA agricultural assistance programs; Federal grant, loan, and insurance programs; or Federal habitat restoration programs such as EQIP; and development of Federal minerals, such as oil and gas.

Prohibitions and Exceptions

The purposes of the Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in the Act. The Act is implemented through regulations found in the CFR. When a species is listed as endangered, certain actions are prohibited under section 9 of the Act, as specified in 50 CFR 17.21. These prohibitions, which will be discussed further below, include, among others, take within the United States, within the territorial seas of the United States, or upon the high seas; import; export; and shipment in interstate or foreign commerce in the course of a commercial activity.

The Act does not specify particular prohibitions, or exceptions to those prohibitions, for threatened species. Instead, under section 4(d) of the Act, the Secretary of the Interior was given the discretion to issue such regulations as he deems necessary

and advisable to provide for the conservation of such species. The Secretary also has the discretion to prohibit by regulation with respect to any threatened species, any act prohibited under section 9(a)(1) of the Act. Exercising this discretion, the Service has developed general prohibitions (50 CFR 17.31) and exceptions to those prohibitions (50 CFR 17.32) under the Act that apply to most threatened species. Under 50 CFR 17.43, permits may be issued to allow persons to engage in otherwise prohibited acts.

Alternately, for other threatened species, the Service develops specific prohibitions and exceptions that are tailored to the specific conservation needs of the species. In such cases, some of the prohibitions and authorizations under 50 CFR 17.31 and 17.32 may be appropriate for the species and incorporated into a special rule under section 4(d) of the Act, but the 4(d) special rule will also include provisions that are tailored to the specific conservation needs of the threatened species and which may be more or less restrictive than the general provisions at 50 CFR 17.31.

For example, for several fish species that are listed as threatened species, the Service has prepared a 4(d) special rule. In these situations, threatened fish co-occur with other species that are not listed as threatened or endangered species. Recreational fishing of the non-listed species may occur in these areas, usually under a permit or license program managed by the State Conservation Agency. In some of these cases, the Service has prepared a 4(d) special rule which generally prohibits the activities that are defined in the Act for endangered species, but does not prohibit take if it is incidental to recreational fishing activities that are conducted pursuant to an appropriate State program.

Similarly, we are considering whether it is appropriate to fashion a 4(d) rule that would not prohibit take that is incidental to implementing a sector-specific or comprehensive lesser prairie-chicken conservation program. We anticipate that conservation programs given credit under such a 4(d) rule would need to be developed and administered by an entity having jurisdiction or authority over the activities in the program; would need to be approved by the Service as adequately protective to provide a net conservation benefit to the lesser prairie-chicken; and would need to include robust adaptive management, monitoring, and reporting components sufficient to demonstrate that the conservation objectives of the plan are being met.

Several ongoing conservation efforts may satisfy or be moving toward this end, such as the Lesser Prairie-Chicken Initiative, implementation of a multi-State rangewide conservation strategy, or individual candidate conservation agreements with assurances that currently have permits issued pursuant to section 10 of the Act.

Accordingly, we are soliciting public comment as to which prohibitions, and exceptions to those prohibitions, are necessary and advisable to provide for the conservation of the lesser prairie-chicken (see **Public Comments** above). After reviewing the initial public comments on this topic, we will evaluate whether a 4(d) special rule is appropriate for the lesser prairie-chicken, and, if so, publish a proposed 4(d) special rule for public comment.

Currently, we have not proposed a 4(d) special rule for the lesser prairie-chicken. If the lesser prairie-chicken is ultimately listed as a threatened species without a 4(d) special rule, the general prohibitions (50 CFR 17.31) and exceptions to these prohibitions (50 CFR 17.32) for threatened species would be applied to the lesser prairie-chicken, as explained above. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.31 for threatened wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C. 42–43; 16 U.S.C. 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32 for threatened species. A permit must be issued for the following purposes: for scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. We anticipate that we would receive requests for all three types of permits, particularly as they relate to development of wind power facilities or implementation of

Safe Harbor Agreements. Requests for copies of the regulations regarding listed species and inquiries about prohibitions and permits may be addressed to the Field Supervisor at the address in the **FOR FURTHER INFORMATION CONTACT** section.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of species proposed for listing. The following activities could potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting of the species, including import or export across State lines and international boundaries, except for properly documented antique specimens of these taxa at least 100 years old, as defined by section 10(h)(1) of the Act.

(2) Actions that would result in the unauthorized destruction or alteration of the species' habitat, as previously described in this rule. Such activities could include, but are not limited to, the removal of native shrub or herbaceous vegetation by any means for any infrastructure construction project or direct conversion of native shrub or herbaceous vegetation to another land use.

(3) Actions that would result in the long-term (e.g., greater than 3 years) alteration of preferred vegetative characteristics of lesser prairie-chicken habitat, as previously described in this proposed rule, particularly those actions that would cause a reduction or loss in the native invertebrate community within those habitats. Such activities could include, but are not limited to, inappropriate livestock grazing, the application of herbicides or insecticides, and seeding of nonnative plant species that would compete with native vegetation for water, nutrients, and space.

(4) Actions that would result in lesser prairie-chicken avoidance of an area during one or more seasonal periods. Such activities could include, but are not limited to, the construction of vertical structures such as power lines, fences, communication towers, and buildings; motorized and nonmotorized recreational use; and activities such as well drilling, operation, and maintenance, which would entail significant human presence, noise, and infrastructure.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Background

Species Information

The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is a species of prairie grouse endemic to the southern high plains of the United States, commonly recognized for its feathered feet, stout build, ground-dwelling habit, and lek mating behavior. The lesser prairie-chicken is closely related and generally similar, although not identical in every aspect of behavior and life history, to other species of North American prairie grouse (e.g., greater prairie-chicken (*T. cupido pinnatus*), Attwater's prairie-chicken (*T. cupido attwateri*), sharp-tailed grouse (*T. phasianellus*), greater sage-grouse (*Centrocercus urophasianus*), and Gunnison's sage-grouse (*C. minimus*)). Plumage of the lesser prairie-chicken is characterized by a cryptic pattern of alternating brown and buff-colored barring, and is similar in mating behavior and appearance, although somewhat lighter in color, to the greater prairie-chicken. Males have long tufts of feathers on the sides of the neck, termed pinnae, that are erected during courtship displays. Pinnae are smaller and less prominent in females. Males also display brilliant yellow supraorbital eyecombs and dull reddish esophageal air sacs during courtship displays (Copelin 1963, p. 12; Sutton 1977, entire; Johnsgard 1983, p. 318). A more detailed summary of the appearance of the lesser prairie-chicken is provided in Hagen and Giesen (2005, unpaginated).

Lesser prairie-chickens are dimorphic in size, with the females being smaller than the males (See Table 1 in Hagen and Giesen 2005, unpaginated). Adult lesser prairie-

chicken body length varies from 38 to 41 centimeters (cm) (15 to 16 inches (in)) (Johnsgard 1973, p. 275; Johnsgard 1983, p. 318), and body mass varies from 734 to 813 grams (g) (1.6 to 1.8 pounds (lbs)) for males and 628 to 772 g (1.4 to 1.7 lbs) for females (Giesen 1998, p. 14). Adults weigh more than yearling birds.

Taxonomy

The lesser prairie-chicken is in the Order Galliformes, Family Phasianidae, subfamily Tetraoninae, and is recognized as a species separate from the greater prairie-chicken (Jones 1964, pp. 65–73; American Ornithologist's Union 1998, p. 122). The lesser prairie-chicken was first described as a subspecies of the greater prairie-chicken (Ridgway 1873, p. 199) but was later named a full species in 1885 (Ridgway 1885, p. 355). Additional information on lesser prairie-chicken systematics and taxonomy can be found in Hagen and Giesen (2005, unpaginated).

Life-History Characteristics

Lesser prairie-chickens are polygynous (a mating pattern in which a male mates with more than one female in a single breeding season) and exhibit a lek mating system. The lek is a place where males traditionally gather to conduct a communal, competitive courtship display. The males use their specialized plumage and vocalizations to attract females for mating. The sequence of vocalizations and posturing of males, often

described as “booming, gobbling, yodeling, bubbling, or duetting,” has been described by Johnsgard (1983, p. 336) and Haukos (1988, pp. 44–45) and is well summarized by Hagen and Giesen (2005, unpaginated). Male lesser prairie-chickens gather to display on leks at dawn and dusk beginning as early as late January and continuing through mid-May (Copelin 1963, p. 26; Hoffman 1963, p. 730; Crawford and Bolen 1976a, p. 97; Sell 1979, p. 10; Merchant 1982, p. 40), although fewer numbers of birds generally attend leks during the evening (Taylor and Guthery 1980a, p. 8). Male birds may remain on the lek for up to 4 hours (Copelin 1963, pp. 27–28; Sharpe 1968, p. 76; Crawford and Bolen 1975, pp. 808–810; Giesen 1998, p. 7), with females typically departing the lek following successful copulation (Sharpe 1968, pp. 154, 156). Dominant, usually older, males occupy and defend territories near the center of the lek where most of the copulations occur, while younger males occupy the periphery and compete for central access (Sharpe 1968, pp. 73–89; Wiley 1974, p. 203; Ehrlich *et al.* 1988, p. 259). A relatively small number of dominant males account for the majority of copulations at each lek (Sharpe 1968, p. 87; Wiley 1974, p. 203; Locke 1992, p. 1). Young males are rarely successful in breeding due to the dominance by older males. The spring display period may extend into June (Hoffman 1963, p. 730; Jones 1964, p. 66); however, Jones (1964, p. 66) observed some courtship activity even during July in Oklahoma.

Male lesser prairie-chickens exhibit strong site fidelity (loyalty to a particular area; philopatry) to their display grounds (Copelin 1963, pp. 29–30; Hoffman 1963, p. 731; Campbell 1972, pp. 698–699). Such behavior is typical for most species of prairie

grouse (e.g., greater prairie-chicken, lesser prairie-chicken, sharp-tailed grouse, greater sage-grouse, and Gunnison's sage-grouse) in North America (Schroeder and Robb 2003, pp. 231–232). Once a lek site is selected, males persistently return to that lek year after year (Wiley 1974, pp. 203–204) and may remain faithful to that site for life. They often will continue to use these traditional areas even when the surrounding habitat has declined in value (for example, concerning greater sage-grouse; see Harju *et al.* 2010, entire). Female lesser prairie-chickens, due to their tendency to nest within 2.5 km (1.5 mi) of a lek (Giesen 1994a, p. 97), also may display fidelity to nesting areas but the degree of fidelity is not clearly established (Schroeder and Robb 2003, p. 292). However, Haukos and Smith (1999, p. 418) observed that female lesser prairie-chickens are more likely to visit older, traditionally used lek sites than temporary, nontraditional lek sites (those used for no more than 2 years). Temporary or satellite leks occasionally may be established during the breeding season and appear indicative of population fluctuations (e.g., an expanding population has more satellite leks than a declining population) (Hamerstrom and Hamerstrom 1973, pp. 7, 13; Schroeder and Braun 1992, p. 280; Haukos and Smith 1999, pp. 415, 417) or habitat quality (Cannon and Knopf 1979, p. 44; Merrill *et al.* 1999, pp. 193–194). Lesser prairie-chicken satellite leks have been observed to form later in the breeding season and coincide with decreased attendance at the permanent leks (Haukos and Smith 1999, p. 418). These satellite leks consisted primarily of birds that were unable to establish territories on the permanent leks (Haukos and Smith 1999, p. 418). Locations of traditional, permanent lek sites also may change in

response to disturbances (Crawford and Bolen 1976b, pp. 238–240; Cannon and Knopf 1979, p. 44).

Because of this fidelity to breeding areas, prairie grouse may not immediately demonstrate a population response when faced with environmental change. Considering that landscapes and habitat suitability can change rapidly, strong site fidelity can result in a lag period between when a landscape degradation occurs and when a population response is observed (Gregory *et al.* 2011, pp. 29–30). In some birds exhibiting strong philopatry, Wiens *et al.* (1986, p. 374) thought that the overall response to a particular habitat alteration might not become evident until after the most site-tenacious individuals had died. Delayed population responses have been observed in birds impacted by wind energy development (Stewart *et al.* 2007, pp. 5–6) and in greater sage-grouse impacted by oil and gas development (Doherty *et al.* 2010, p. 5). Consequently routine lek count surveys typically used to monitor prairie grouse may be slow in revealing impacts of environmental change (Gregory *et al.* 2011, pp. 29–30).

Leks are normally located on the tops of wind-swept ridges, exposed knolls, sparsely vegetated dunes, and similar features in areas having low vegetation height or bare soil and enhanced visibility of the surrounding area (Copelin 1963, p. 26; Jones 1963a, p. 771; Taylor and Guthery 1980a, p. 8). The features associated with lek sites also may contribute to the transmission of sounds produced during lekking (Butler *et al.* 2010, entire) and these sounds may aid females in locating lek sites (Hagen and Giesen

2005, unpaginated). Background noises are known to increase in landscapes altered by human development and may interfere with normal behavioral activities (Francis *et al.* 2009, p. 1415). Birds may be particularly vulnerable to elevated levels of background noise, due to their reliance on acoustic communication, and elevated noise levels may negatively impact breeding in some birds particularly where acoustic cues are used during the reproductive process (Francis *et al.* 2009, pp. 1415, 1418).

Areas that have been previously disturbed by humans, such as infrequently used roads, abandoned drilling pads, abandoned farmland, recently cultivated fields, and livestock watering sites also can be used as lek sites (Crawford and Bolen 1976b, pp. 238–239; Davis *et al.* 1979, pp. 81, 83; Sell 1979, p. 14; Taylor 1979, p. 707). However, ongoing human activity, such as presence of humans or noise, may discourage lekking by causing birds to flush, and, in some instances, may cause lek sites to be abandoned (Hunt and Best 2004, pp. 2, 124). Leks often are surrounded by taller, denser cover that is used for escape, thermal cover, and feeding cover. New leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat. Evidence of expanding lesser prairie-chicken populations tends to be demonstrated by increases in the number of active leks rather than by increases in the number of males displaying per lek (Hoffman 1963, p. 731; Snyder 1967, p. 124; Cannon and Knopf 1981, p. 777; Merchant 1982, p. 54; Locke 1992, p. 43).

Females arrive at the lek in early spring after the males begin displaying, with peak hen attendance at leks typically occurring in early to mid-April (Copelin 1963, p. 26; Hoffman 1963, p. 730; Crawford and Bolen 1975, p. 810; Davis *et al.* 1979, p. 84; Merchant 1982, p. 41; Haukos 1988, p. 49). Sounds produced by courting males serve to advertise the presence of the lek to females in proximity to the display ground (Robb and Schroeder 2005, p. 29). Within 1 to 2 weeks of successful mating, the hen will select a nest site, normally within 1 to 3 km (0.6 to 2 mi) of a lek (Copelin 1963, p. 44; Giesen 1994a, p. 97), construct a nest, and lay a clutch of 8 to 14 eggs (Bent 1932, p. 282; Copelin 1963, p. 34; Merchant 1982, p. 44; Fields 2004, pp. 88, 115–116; Hagen and Giesen 2005, unpaginated; Pitman *et al.* 2006a, p. 26). Nesting is generally initiated in mid-April and concludes in late May (Copelin 1963, p. 35; Snyder 1967, p. 124; Merchant 1982, p. 42; Haukos 1988, pp. 7–8). Hens most commonly lay one egg per day and initiate incubation once the clutch is complete (Hagen and Giesen 2005, unpaginated). Incubation lasts 24 to 27 days (Coats 1955, p. 18; Sutton 1968, p. 679; Pitman *et al.* 2006a, p. 26) with hatching generally peaking in late May through mid-June (Copelin 1963, p. 34; Merchant 1982, p. 42; Pitman *et al.* 2006a, p. 26). Hens typically leave the nest within 24 hours after the first egg hatches (Hagen and Giesen 2005, unpaginated). Renesting may occur when the first attempt is unsuccessful (a successful nest is one in which at least one egg hatches) (Johnsgard 1973, pp. 63–64; Merchant 1982, p. 43; Pitman *et al.* 2006a, p. 25). Renesting is more likely when nest failure occurs early in the nesting season and becomes less common as the nesting season

progresses (Pitman *et al.* 2006a, p. 27). Clutches associated with renesting attempts tend to be smaller than clutches at first nesting (Fields 2004, p. 88; Pitman *et al.* 2006a, p. 27).

Nests generally consist of bowl-shaped depressions in the soil (Giesen 1998, p. 9). Nests are lined with dried grasses, leaves, and feathers, and there is no evidence that nests are reused in subsequent years (Giesen 1998, p. 9). Adequate herbaceous cover, including residual cover from the previous growing season, is an important factor influencing nest success, primarily by providing concealment of the nest (Suminski 1977, p. 32; Riley 1978, p. 36; Riley *et al.* 1992, p. 386; Giesen 1998, p. 9). Young are precocial (mobile upon hatching) and nidifugous (typically leaving the nest within hours of hatching) (Coats 1955, p. 5). Chicks are usually capable of short flights by 14 days of age (Hagen and Giesen 2005, unpaginated). Broods may remain with females for up to 18 weeks (Giesen 1998, p. 9; Pitman *et al.* 2006c, p. 93), but brood breakup generally occurs by September when the chicks are approximately 70 days of age (Taylor and Guthery 1980a, p. 10). Males do not incubate the eggs, assist in chick rearing, or provide other forms of parental care (Wiley 1974, p. 203). Nest success (proportion of nests that hatch at least one egg) varies, but averages about 30 percent (range 0–67 percent) (Hagen and Giesen 2005, unpaginated).

Availability of food and cover are key factors that affect chick and juvenile survival. Chick survival averaged only about 25 percent during the first 35 days following hatching (Hagen 2003, p. 135). Survival for chicks between 35 days of age

and the following spring was estimated to be 53.9 percent in southwestern Kansas (Hagen *et al.* 2009, p. 1326). Jamison (2000, p. 57) estimated survival of chicks from hatching to early autumn (60 days post-hatching), using late summer brood sizes provided in several early studies, to be 27 percent in Kansas and 43–65 percent in Oklahoma. These values were considerably higher than the 19 percent he observed in his study and may reflect an inability in the earlier studies to account for the complete loss of broods and inclusion of mixed broods (combined broods from several females) when estimating brood size (Jamison 2000, p. 57). Pitman *et al.* (2006b, p. 677) estimated survival of chicks from hatching to 60-days post-hatching to be 17.7 percent. Recruitment was characterized as low with survival of juvenile birds from hatching to the start of the first breeding season the following year estimated to be only 12 percent (Pitman *et al.* 2006b, pp. 678–680), which may be a significant limiting factor in southwestern Kansas. However, the authors cautioned that these estimates might not be indicative of survival estimates in other areas due to low habitat quality, specifically poor distribution of nesting and brood-rearing habitats within the study area (Pitman *et al.* 2006b, p. 680).

Lesser prairie-chicken home ranges vary both by sex and by season and may be influenced by a variety of factors. Males tend to have smaller home ranges than do females, with the males generally remaining closer to the leks than do the females (Giesen 1998, p. 11). In Colorado, Giesen (1998, p. 11) observed that spring and summer home ranges for males were 211 ha (512 ac) and for females were 596 ha (1,473 ac). In the spring, home ranges are fairly small when daily activity focuses on lekking and

mating. Home ranges of nesting females in New Mexico varied, on average, from 8.5 to 92 ha (21 to 227 ac) (Merchant 1982, p. 37; Riley *et al.* 1994, p. 185). Jamison (2000, p. 109) observed that range size peaked in October as birds began feeding in recently harvested grain fields. Median range size in October was 229 to 409 ha (566 to 1,400 ac). In Texas, Taylor and Guthery (1980b, p. 522) found that winter monthly home ranges for males could be as large as 1,945 ha (4,806 ac) and that subadults tended to have larger home ranges than did adults. More typically, winter ranges are more than 300 ha (740 ac) in size, and the size declines considerably by spring. Based on observations from New Mexico and Oklahoma, lesser prairie-chicken home ranges increase during periods of drought (Giesen 1998, p. 11; Merchant 1982, p. 55), possibly because of reduced food availability and cover. Davis (2005, p. 3) states that the combined home range of all lesser prairie-chickens at a single lek is about 49 square kilometers (sq km) (19 square miles (sq mi) or 12,100 ac).

Many grouse species are known to be relatively poor dispersers and normally move less than 40 km (25 mi) (Braun *et al.* 1994, pp. 432–433). Dispersal helps maintain healthy, robust populations by contributing to population expansion, recolonization, and gene flow (Sutherland *et al.* 2000, unpaginated). In lesser prairie-chickens, most movements within a given season are less than 10 km (6.2 mi), but Jamison (2000, p. 107) thought that movements as large as 44 km (27.3 mi) might occur in fragmented landscapes. Recent studies of lesser prairie-chicken in Kansas demonstrated some birds may move as much as 50 km (31 mi) from their point of capture (Hagen *et al.* 2004, p.

71). Although recorded dispersal movements indicate that lesser prairie-chickens are obviously physically capable of longer distance dispersal movements, these longer movements appear to be infrequent. Jamison (2000, p. 107) recorded only 2 of 76 tagged male lesser prairie-chickens left the 5,760 ha (14,233 ac) primary study area over a 3-year period. He thought site fidelity rather than habitat was more important in influencing movements of male lesser prairie-chickens (Jamison 2000, p. 111). Environmental factors also may influence dispersal patterns, particularly in fragmented landscapes where predation rates may be higher and habitat suitability may be reduced in smaller sized parcels. Lesser prairie-chickens appear to be sensitive to the size of habitat fragments and may avoid using parcels below a preferred size regardless of habitat type or quality (see separate discussion under “Effects of Habitat Fragmentation” below). As the landscape becomes more fragmented, longer dispersal distances over areas of unsuitable habitats may be required.

Daily movements of males tend to increase in fall and winter and decrease with onset of spring, with median daily movements typically being less than 786 meters per day (Jamison 2000, pp. 106, 112). In Texas, Haukos (1988, p. 46) recorded daily movements of 0.1 km (0.06 mi) to greater than 6 km (3.7 mi) by female lesser prairie-chickens prior to onset of incubation. Taylor and Guthery (1980b, p. 522) documented a single male moving 12.8 km (8 mi) in 4 days, which they considered to be a dispersal movement. Because lesser prairie-chickens exhibit limited dispersal ability and do not typically disperse over long distances, they do not readily recolonize areas following

localized extinctions, particularly where the distance between habitat patches exceeds their typical dispersal capabilities.

In general, there is little documentation of historical dispersal patterns, and the existence of large-scale migration movements is not known. However, both Bent (1932, pp. 284–285) and Sharpe (1968, pp. 41–42) thought that the species, at least historically, might have been migratory with separate breeding and wintering ranges. Taylor and Guthery (1980a, p. 10) also thought the species was migratory prior to widespread settlement of the High Plains, but migratory movements have not recently been documented. The lesser prairie-chicken is now thought to be nonmigratory.

Lesser prairie-chickens forage during the day, usually during the early morning and late afternoon, and roost at night (Jones 1964, p. 69). Diet of the lesser prairie-chicken is very diverse, primarily consisting of insects, seeds, leaves, and buds and varies by age, location, and season (Giesen 1998, p. 4). They forage on the ground and within the vegetation layer (Jones 1963b, p. 22) and are known to consume a variety of invertebrate and plant materials. For example, in New Mexico, Smith (1979, p. 26) documented 30 different kinds of food items consumed by lesser prairie-chickens. In Texas, Crawford and Bolen (1976c, p. 143) identified 23 different plants in the lesser prairie-chicken diet. Jones (1963a, pp. 765–766), in the *Artemisia filifolia* (sand sagebrush) dominated grasslands of Oklahoma, recorded 16 different plant species eaten by lesser prairie-chickens.

Lesser prairie-chicken energy demands are almost entirely derived from daily foraging activities rather than stored fat reserves (Giesen 1998, p. 4). Olawsky (1987, p. 59) found that, on average, lesser prairie-chicken body fat reserves were less than 4.5 percent of body weight. Consequently, quality and quantity of food consumed can have a profound effect on the condition of individual birds. Inadequate food supplies and reduced nutritional condition can affect survival, particularly during harsh winters, and reproductive potential. Poor condition can lead to poor performance on display grounds, impact nesting success, and reduce overwinter survival. Sufficient nutrients and energy levels are important for reproduction and overwintering. Males expend energy defending territories and mating while females have demands of nesting, incubation, and any renesting. Reduced condition can lead to smaller clutch sizes. Because lesser prairie-chicken diets vary considerably by age, season, and habitat type and quality, habitat alteration can influence availability of certain foods. While not as critical for adults, presence of forbs and associated insect populations can be very important for proper growth and development of chicks and poults.

Generally, chicks and young juveniles tend to forage almost exclusively on insects, such as grasshoppers and beetles, and other animal matter while adults tend to consume a higher percentage of vegetative material (Giesen 1998, p. 4). The majority of the published diet studies have been conducted in the southwestern portions of the historical range where the *Quercus havardii* (shinnery oak) dominated grasslands are

prevalent. Throughout their range, when available, lesser prairie-chickens will use cultivated grains, such as *Sorghum vulgare* (grain sorghum) and *Zea mays* (corn), during the fall and winter months (Snyder 1967, p. 123; Campbell 1972, p. 698; Crawford and Bolen 1976c, pp. 143–144; Ahlborn 1980, p. 53; Salter *et al.* 2005, pp. 4–6). However, lesser prairie-chickens tend to predominantly rely on cultivated grains when production of natural foods, such as acorns and grass and forb seeds are deficient (Copelin 1963, p. 47; Ahlborn 1980, p. 57).

Food availability for gamebird young is most critical during the first 20 days (3 weeks) post-hatching when rapid growth is occurring (Dobson *et al.* 1988, p. 59). Diet of lesser prairie-chicken chicks less than 5 weeks of age is entirely composed of insects and similar animal matter. Specifically, diet of chicks in New Mexico that were less than 2 weeks of age was 80 percent treehoppers (Mebracidae) (Davis *et al.* 1979, p. 71; Davis *et al.* 1980 p. 78). Overall, chicks less than 5 weeks of age consumed predominantly (87.7 percent) short-horned grasshoppers (Acrididae), treehoppers, and long-horned grasshoppers (Tettigonidae) (Davis *et al.* 1980, p. 78). Ants (Formicidae), mantids (Mantidae), snout beetles (Curculionidae), darkling beetles (Tenebrionidae), robber flies (Asilidae), and cockroaches (Blattidea) collectively provided the remaining 12.3 percent of the chicks' diet (Davis *et al.* 1980, p. 78). Similarly Suminski (1977, pp. 59–60) examined diet of chicks 2 to 4 weeks of age in New Mexico and found that diet was entirely composed of insects. Treehoppers, short-horned grasshoppers, and ants were the most significant (95 percent) items consumed, by volume. Insects and similar animal

matter are a particularly prevalent component in the diet of young prairie-chickens (Drake 1994, pp. 31, 34, 36). Insects are high in protein (Riley *et al.* 1998, p. 42), and a high-protein diet was essential in pheasants for normal growth and feather development (Woodward *et al.* 1977, p. 1500). Insects and other arthropods also have been shown to be extremely important in the diet of young sage grouse and Attwater's prairie-chicken (Service 2010, pp. 30–31).

Older chicks between 5 and 10 weeks of age ate almost entirely short-horned grasshoppers (80.4 percent) (Davis *et al.* 1980, p. 78). They also began to consume plant material during this period. Shinnery oak acorns, seeds of *Lithospermum incisum* (narrowleaf stoneseed), and foliage and flowers of *Commelina erecta* (erect dayflower) comprised less than 1 percent of the diet (Davis *et al.* 1980, p. 78). Correspondingly, Suminski (1977, pp. 59, 61) observed that chicks between 6 and 10 weeks of age had begun to consume very small quantities (1.3 percent by volume) of plant material. The remainder of the diet was still almost entirely composed of insects. By far the most prevalent insect was short-horned grasshoppers (Acrididae), accounting for 73.9 percent of the diet (Davis *et al.* 1980, p. 78). As the birds grew, the sizes of insects eaten increased. Analysis of food habits of juvenile birds from 20 weeks of age and older, based on samples collected between August and December, revealed that 82.6 percent of diet was plant material by volume and 17.4 percent was invertebrates (Suminski 1977, p. 62). Shinnery oak acorns contributed 67 percent of the overall diet, by volume. Key

insects included crickets (Gryllidae), short-horned grasshoppers, mantids, and butterfly (Lepidoptera) larvae.

Plant materials are a principal component of the diet for adult lesser prairie-chickens; however, the composition of the diet tends to vary by season and habitat type. The majority of the diet studies examined foods contained in the crop (an expanded, muscular pouch within the digestive tract of most birds that aids in breakdown and digestion of foods) and were conducted in habitats supporting shinnery oak. However, Jones (1963b, p. 20) reported on lesser prairie-chicken diets from sand sagebrush habitats.

In the spring (March, April, and May), lesser prairie-chickens fed heavily on green vegetation (60 to 79 percent) and mast and seeds (15 to 28 percent) (Davis *et al.* (1980, p. 76; Suminski 1977, p. 57). Insects comprised less than 13 percent of the diet primarily due to their relative scarcity in the spring months. Treehoppers and beetles were the most common types of insects found in the spring diet. The proportion of vegetative material provided by shinnery oak leaves, catkins, and acorns was high. Similarly, Doerr (1980, p. 8) also examined the spring diet of lesser prairie-chickens. However, he compared diets between areas treated with the herbicide tebuthiuron and untreated areas, and it is unclear whether the birds he examined came from treated or untreated areas. Birds collected from treated areas likely would have limited access to shinnery oak, possibly altering the observed occurrence of shinnery oak in the diet. He

reported that animal matter was the dominant component of the spring diet and largely consisted of short-horned grasshoppers and darkling beetles (Doerr 1980, pp. 30–31). Ants, ground beetles (Carabidae), and stinkbugs (Pentatomidae) were slightly less prevalent in the diet. Shinnery oak acorns and plant seeds were the least common component, by volume, in the diet in the Doerr (1980) studies.

In the summer, insects become a more important component of the diet. In New Mexico, insects comprised over half (55.3 percent) of the overall summer (June, July, and August) diet with almost half (49 percent) of the insects being short- and long-horned grasshoppers and treehoppers (Davis *et al.* 1980, p. 77). Plant material consumed was almost equally divided between foliage (leaves and flowers; 23.3 percent) and mast and seeds (21.4 percent). Shinnery oak parts comprised 22.5 percent of the overall diet. Olawsky (1987, pp. 24, 30) also examined lesser prairie-chicken diets during the summer season (May, June, and July); however, he also compared diets between areas treated with tebuthiuron and untreated pastures in Texas and New Mexico. While the diets in treated and untreated areas were different, the diet from the untreated area should be representative of a typical summer diet. Total plant matter from birds collected from the untreated areas comprised 68 to 81 percent, by volume (Olawsky 1987, pp. 30–32). Foliage comprised 21 to 25 percent, and seeds and mast, 36 to 60 percent, of the diet from birds collected in the untreated area. Shinnery oak acorns were the primary form of seeds and mast consumed. Animal matter comprised 19 to 32 percent of the overall diet,

and almost all of the animal matter consisted of treehoppers and short-horned grasshoppers (Olawsky 1987, pp. 30–32).

Several studies have reported on the fall and winter diets of lesser prairie-chickens. Davis *et al.* (1979, pp. 70–80), Smith (1979, pp. 24–32), and Riley *et al.* (1993, pp. 186–189) all reported on lesser prairie-chicken food habits from southeastern New Mexico (Chaves County), where the birds had no access to grain fields (Smith 1979, p. 31). They generally found that fall (October to early December) and winter (January and February) diets generally consist of a mixture of seeds, vegetative material, and insects.

The fall diet differed between years primarily due to reduced availability of shinnery oak acorns (Smith 1979, p. 25). Reduced precipitation in the fall of 1976 was thought to have influenced acorn production in 1977 (Riley *et al.* 1993, pp. 188). When acorns were available, shinnery oak acorns comprised almost 62 percent, by volume, of the diet but less than 17 percent during a year when the acorn crop failed (Smith 1979, p. 26). On average, total mast and seeds consumed was 43 percent, vegetative material was 39 percent, and animal matter was 18 percent by volume of the fall diet (Davis *et al.* 1979, p. 76). Over 81 percent of the animal matter consumed was short-horned grasshoppers (Davis *et al.* 1979, p. 76).

Crawford (1974, pp. 19–20, 35–36) and Crawford and Bolen (1976c, pp. 142–144) reported on the fall (mid-October) diet of lesser prairie-chickens in west Texas over

a 3-year period. Twenty-three species of plants were identified from the crops over the course of the study. Plant matter accounted for 90 percent of the food present by weight and 81 percent by volume. Grain sorghum also was prevalent, comprising 63 percent by weight and 43 percent by volume of total diet. Alhborn (1980, pp. 53–58) also documented use of grain sorghum during the fall and winter in eastern New Mexico. The remainder of the diet (10 percent by weight and 19 percent by volume) was animal matter (insects only). Over 62 percent, by volume, of the animal matter was composed of short-horned grasshoppers. Other insects that were important in the diet included darkling beetles, walking sticks (Phasmidae), and wingless long-horned grasshoppers (Gryllacrididae). During the fall and winter in eastern New Mexico, Alhborn (1980, pp. 53–58) reported that vegetative material from shinnery oak constituted 21 percent of the total diet.

Similarly, Doerr (1980, p. 32) reported on the lesser prairie-chickens from west Texas in the fall (October). The diet largely comprised animal matter (86 percent by volume) with short-horned grasshoppers contributing 81 percent by volume of the total diet. Stinkbugs also were prevalent in the diet. Foliage was the least important component, consisting of only 2.5 percent by volume. Seeds and acorns comprised 11 percent of the diet and consisted entirely of shinnery oak acorns and seeds of *Linum rigidum* (stiffstem flax).

Shinnery oak acorns (69 percent) and annual buckwheat (14 percent) were the primary components of the winter (January and February) diet of lesser prairie-chickens in southeastern New Mexico (Riley *et al.* 1993, p. 188). Heavy selection for acorns in winter was attributed to need for a high energy source to help sustain body temperature in cold weather (Smith 1979, p. 28). Vegetative matter was about 26 percent of overall diet, by volume, with 5 percent of the diet consisting of animal matter, almost entirely comprising ground beetles (Carabidae) (Davis *et al.* 1979, p. 78).

In contrast to the above studies, Jones (1963b, p. 20) and Doerr (1980, p. 8) examined food items present in the droppings rather than from the crops. Although this approach is valid, differential digestion of the food items likely overemphasizes the importance of indigestible items and underrepresents occurrence of foods that are highly digestible (Jones 1963b, p. 21; Doerr 1980, pp. 27, 33). Jones' study site was located in the sand sagebrush dominated grasslands in the more northern portion of the historical range where shinnery oak was unavailable. However, Doerr's study site was located in the shinnery oak dominated grasslands of the southwest Texas panhandle.

In the winter (December through February), where *Rhus trilobata* (skunkbush sumac) was present, Jones (1963b, pp. 30, 34) found lesser prairie-chickens primarily used sumac buds and foliage of sumac, sand sagebrush, and *Gutierrezia sarothrae* (broom snakeweed), particularly when snow was on the ground. Small annual plants present in the diet were *Vulpia (Festuca) octoflora* (sixweeks fescue), annual buckwheat,

and *Evax prolifera* (big-headed evax; bigheaded pygmycudweed) (Jones 1963b, p. 30). Grain sorghum wasn't used to any appreciable extent, particularly when skunkbush sumac was present, but was eaten when available. Relatively few insects were available during the winter period. However, beetles were consumed throughout the winter season and grasshoppers were important in December. Doerr (1980, p. 28) found grasshoppers, crickets, ants, and wasps were the most commonly observed insects in the winter diet. Foliage from sand sagebrush and *Cryptantha cinerea* (James' cryptantha) was prevalent, but shinnery oak acorns were by far the most significant plant component detected in the winter diet.

In the spring (March through May), lesser prairie-chickens used seeds and foliage of early spring annuals such as *Viola bicolor* (johnny jumpup) and *Silene antirrhina* (sleepy catchfly) (Jones 1963b, p. 49). Skunkbush sumac continued to be an important component of the diet. Insect use increased as the spring season progressed. Doerr (1980, p. 29) also observed that grasshoppers and crickets were prevalent in the spring diet. However, foliage and acorns of shinnery oak were more abundant in the diet than any other food item.

In the summer (June through August), lesser prairie-chickens continued to use sumac and other plant material, but insects dominated the diet (Jones 1963b, pp. 64–65). Grasshoppers were the principal item found in the diet, but beetles were particularly favored in shrubby habitats. Similarly, Doerr (1980, p. 25) found grasshoppers and

crickets were the most important component of the summer diet followed in importance by beetles. Jones (1963b, pp. 64–65) reported fruits from skunkbush sumac to be the most favored plant material in the diet. Doerr (1980, p. 25) found *James cryptantha* and erect dayflower were the two most important plants in the diet in his study. Insects remained a principal food item in the fall (September through November), at least until November when plant foods, such as *Cyperus schweinitzii* (flatsedge) and *Ambrosia psilostachya* (western ragweed) became more prevalent in the diet (Jones 1963b, pp. 80–81).

Little is known regarding the specific water requirements of the lesser prairie-chicken, but their distribution does not appear to be influenced by the presence of surface water. Total annual precipitation across the range of the lesser prairie-chicken varies, on average, from roughly 63 cm (25 in) in the eastern portions of the historical range to as little as 25 cm (10 in) in the western portions of the range. Consequently, few sources of free-standing surface water existed in lesser prairie-chicken historical range prior to settlement. Lesser prairie-chickens likely rely on food sources and consumption of dew to satisfy their metabolic moisture requirement (Snyder 1967, p. 123; Hagen and Giesen 2005, unpaginated; Bidwell *et al.* 2002, p. 6) but will use surface water when it is available. Because much of the historically occupied range is now used for domestic livestock production, numerous artificial sources of surface water, such as stock ponds and stock tanks, have been developed throughout the region. Several studies have documented use of these water sources by lesser prairie-chickens during the spring, late

summer, and fall seasons (Copelin 1963, p. 20; Jones 1964, p. 70; Crawford and Bolen 1973, pp. 471–472; Crawford 1974, p. 41; Sell 1979, p. 31), and they may be particularly important during periods of drought (Crawford and Bolen 1973, p. 472; Crawford 1974, p. 41). Hoffman (1963, p. 732) supported development of supplemental water sources (i.e., guzzlers) as a potential habitat improvement tool. Others, such as Davis *et al.* (1979, pp. 127–128) and Applegate and Riley (1998, p. 15) cautioned that creating additional surface water sources will influence grazing pressure and possibly contribute to degradation of habitat conditions for lesser prairie-chickens. Some livestock watering facilities may create hazardous conditions (e.g., drowning; Sell 1979, p. 30), but the frequency of these incidents is unknown.

Lesser prairie-chickens have a relatively short lifespan and high annual mortality. Campbell (1972, p. 694) estimated a 5-year maximum lifespan, although an individual nearly 7 years old has been documented in the wild by the Sutton Avian Research Center (Sutton Center) (Wolfe 2010). Differences in survival may be associated with sex, weather, harvest (where allowed), age, and habitat quality. Campbell (1972, p. 689), using 9 years of band recovery data from New Mexico, estimated annual mortality for males to be 65 percent. Hagen *et al.* (2005, p. 82) specifically examined survival in male lesser prairie-chickens in Kansas and found apparent survival varied by year and declined with age. Annual mortality was estimated to be 55 percent (Hagen *et al.* 2005, p. 83). Male survival may be lower during the breeding season due to increased predation or costs associated with territorial defense while lekking (Hagen *et al.* 2005, p. 83). In

female lesser prairie-chickens, Hagen *et al.* (2007, p. 522) estimated that annual mortality in two remnant patches of native sand sagebrush prairie near Garden City, Finney County, Kansas was about 50 percent at a study site southwest of Garden City and about 65 percent at a study site southeast of Garden City).

Adult annual survival in Texas apparently varied by habitat type. In sand sagebrush habitat, survival was estimated to be 0.52, whereas survival was only 0.31 in shinnery oak habitat (Lyons *et al.* 2009, p. 93). For both areas, survival was about 4 percent lower during the breeding season than during the nonbreeding period (Lyons *et al.* 2009, p. 93). Hagen *et al.* (2007, p. 522) also reported lower survival during the reproductive season (31 percent mortality) compared to the nonbreeding season (23 percent mortality) in Kansas. However, survival times did not differ between sand sagebrush habitats in Oklahoma and shinnery oak habitats in New Mexico (Patten *et al.* 2005a, p. 1274). Birds occupying sites with greater than 20 percent shrub cover survived longer than those in areas with less dense shrub cover (Patten *et al.* 2005a, p. 1275).

Habitat

The preferred habitat of the lesser prairie-chicken is native short- and mixed-grass prairies having a shrub component dominated by *Artemisia filifolia* (sand sagebrush) or *Quercus havardii* (shinnery oak) (hereafter described as native rangeland) (Donaldson 1969, pp. 56, 62; Taylor and Guthery 1980a, p. 6; Giesen 1998, pp. 3–4). Small shrubs

are important for summer shade (Copelin 1963, p. 37; Donaldson 1969, pp. 44–45, 62), winter protection, and as supplemental foods (Johnsgard 1979, p. 112). Historically, trees and other tall woody vegetation were largely absent from these grassland ecosystems, except in canyons and along water courses. Landscapes supporting less than 63 percent native rangeland appear incapable of supporting self-sustaining lesser prairie-chicken populations (Crawford and Bolen 1976a, p. 102).

Outside of the grasslands in Kansas, lesser prairie-chickens are primarily found in the sand sagebrush dominated rangelands of Colorado, Kansas, Oklahoma, and Texas, and in the shinnery oak-bluestem grasslands of New Mexico, Oklahoma, and Texas. Sand sagebrush is a 0.6- to 1.8-m (2- to 6-ft) tall shrub that occurs in 11 States of the central and western United States (Shultz 2006, p. 508). Within the central and southern Great Plains, sand sagebrush is often a dominant species on sandy soils and may exhibit a foliar cover of 20 to 50 percent (Collins *et al.* 1987, p. 94; Vermeire 2002, p. 1). Sand-sage shrublands have been estimated to occupy some 4.8 million ha (11.8 million ac) in the central and southern Great Plains (Berg 1994, p. 99).

The shinnery oak vegetation type is endemic to the southern great plains and is estimated to have historically covered an area of 2.3 million ha (over 5.6 million ac), although its current range has been considerably reduced through eradication (Mayes *et al.* 1998, p. 1609). The distribution of shinnery oak overlaps much of the historical lesser prairie-chicken range in New Mexico, Oklahoma, and Texas (Peterson and Boyd 1998, p.

2). Shinnery oak is a rhizomatous (a horizontal, usually underground stem that often sends out roots and shoots from its nodes) shrub that reproduces slowly and does not invade previously unoccupied areas (Dhillion *et al.* 1994, p. 52). Mayes *et al.* (1998, p. 1611) documented that a single rhizomatous shinnery oak can occupy an area exceeding 7,000 square meters (sq m) (75,300 square feet (sq ft)). While not confirmed through extensive research throughout the plant's range, it has been observed that shinnery oak in some areas multiplies by slow rhizomatous spread and eventual fracturing of underground stems from the original plant. In this way, single clones have been documented to occupy up to 81 ha (200 ac) over an estimated timeframe of 13,000 years (Cook 1985, p. 264; Anonymous 1997, p. 483), making shinnery oak possibly the largest and longest-lived plant species in the world.

Within the historical range of the species, the USDA's CRP, administered by the Farm Services Administration, has promoted the establishment and conservation of certain grassland habitats. Originally funded as a mechanism to reduce erosion from highly erodible soils, the program has since become a means to at least temporarily retire any environmentally sensitive cropland from production and establish vegetative cover on that land. Initially, many types of grasses were approved for use as permanent vegetative cover, including several that are introduced or nonnative. As the program changed and efforts to establish more environmentally beneficial grasses gained momentum, the use of native grasses became more prevalent. In Kansas in particular, much of the vegetative cover established through the CRP within the historical range of

the lesser prairie-chicken was a mix of native warm-season grasses such as *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), and *Panicum virgatum* (switchgrass) (Rodgers and Hoffman 2005, p. 120). These grasses are important components of lesser prairie-chicken habitat and have led to reoccupation of large areas of the historical range in western Kansas by lesser prairie-chickens, particularly north of the Arkansas River.

In other areas, nonnative grasses were used that provided limited to no habitat value for the lesser prairie-chicken. Exotic old world bluestems and *Eragrostis curvula* (weeping lovegrass) were extensively seeded in CRP tracts in Texas, New Mexico, and Oklahoma (Haufler *et al.* 2012, p. 17). For example, about 70 to 80 percent of the original CRP seedings in eastern New Mexico consisted of dense, single-species stands of weeping lovegrass, *Bothriochloa bladhii* (Caucasian bluestem), or *B. ischaemum* (yellow bluestem) (Rodgers and Hoffman 2005, p. 122). Consequently these areas contributed very little to lesser prairie-chicken conservation as they provide poor-quality nesting habitat. As these nonnative grasslands have matured, some species of native grasses and shrubs are beginning to reestablish within these fields. Although these areas still have limited habitat value for lesser prairie-chickens, the species is occasionally using these older stands of grass for roosting and nesting (Rodgers and Hoffman 2005, p. 122). Where CRP lands support the suitable vegetative structure and composition required by lesser prairie-chickens, these fields can provide suitable, but likely

temporary, habitat. More information on the CRP program is provided in the sections that follow.

Leks are characterized by areas of sparse vegetation and are generally located on elevated features, such as ridges or grassy knolls (Giesen 1998, p. 4). Vegetative cover characteristics, primarily height and density, may have a greater influence on lek establishment than elevation (Giesen 1998, p. 4). Copelin (1963, p. 26) observed display grounds within short grass meadows of valleys where sand sagebrush was tall and dense on the adjacent ridges. Early spring fires also encouraged lek establishment when vegetation likely was too high (0.6 to 1.0 m (2.0 to 3.3 ft)) to facilitate displays (Cannon and Knopf 1979, pp. 44–45). Several authors, as discussed in Giesen (1998, p. 4), observed that roads, oil and gas pads, and similar forms of human disturbance create habitat conditions that may encourage lek establishment. However, Taylor (1979, p. 707) emphasized that human disturbance, which is often associated with these artificial lek sites, is detrimental during the breeding season and did not encourage construction of potential lek sites in areas subject to human disturbance. Giesen (1998, p. 9) reported that hens usually nest and rear broods within 3.4 km (1.7 mi) of leks and may return to nest in areas of previously successful nests (Riley 1978, p. 36). Giesen (1994a, pp. 97–98) and Hagen and Giesen (2005, unpaginated) also reported that hens often nest closer to a lek other than the one on which they mated.

Typical nesting habitat can be described as native rangeland, although there is some evidence that the height and density of forbs (broad-leaved herb other than a grass) and residual grasses is greater at nesting locations than on adjacent rangeland (Giesen 1998, p. 9). Nests are often located on north and northeast facing slopes as protection from direct sunlight and the prevailing southwest winds (Giesen 1998, p. 9). Giesen (1998, p. 9) reports that habitat used by young is similar to that of adults, and the daily movement of the broods is usually 300 m (984 ft) or less. After the broods break up, the juveniles form mixed flocks with adult birds (Giesen 1998, p. 9), and juvenile habitat use is similar to that of adult birds. Giesen (1998, p. 4) reports that wintering habitat is similar to that used for breeding with the exception that small grain fields are used more heavily during this period than during the breeding season. Habitats used by broods had greater total biomass of invertebrates and forb cover than areas not frequented by broods in Kansas, emphasizing the importance of forbs in providing the invertebrate populations used by young lesser prairie-chickens (Jamison *et al.* 2002, pp. 520, 524).

Home range and dispersal distances of lesser prairie-chickens are indicative of their requirement for large blocks of interconnected, ecologically diverse native grassland. As reported by Giesen (1998, p. 11) and Taylor and Guthery (1980b, p. 522), a single lesser prairie-chicken may have a home range (geographic area to which an organism typically confines its activity) of 211 ha (512 ac) to 1,945 ha (4,806 ac). More recently, studies in Kansas demonstrated some birds may move as much as 50 km (31 mi) from their point of capture (Hagen *et al.* 2004, p. 71). While some overlap in home

ranges is expected, rarely would those home ranges overlap completely due to competition for space, food, and other resources. Taylor and Guthery (1980a, p. 11) used lesser prairie-chicken movements in west Texas to estimate the area needed to meet the minimum requirements of a lek population. A contiguous area of suitable habitat encompassing at least 32 sq km (12 sq mi or 7,900 ac) would support about 90 percent of the annual activity associated with a given lek and an area of 72 sq km (28 sq mi or 17,791 ac) would include all of the annual activity associated with a lek except for some movements of juveniles (Taylor and Guthery (1980a, p. 11). Bidwell *et al.* (2002, p. 3) conclude that at least 101.2 sq km (39 sq mi or 25,000 ac) of contiguous high-quality habitat is needed to maintain a sustainable population of lesser prairie-chickens. Because lesser prairie-chickens typically nest and rear their broods in proximity to a lek other than the one used for mating (Giesen 1998, p. 9), a complex of two or more leks is likely the very minimum required to sustain a viable lesser prairie-chicken population. Hagen *et al.* (2004, p. 76) recommended that lesser prairie-chicken management areas be at least 4,096 sq km (1,581 sq mi or 1,012,140 ac) in size. Management areas of this size would incorporate the longest-known movements of individual birds and be large enough to maintain healthy lesser prairie-chicken populations despite the presence of potentially large areas of unsuitable habitat.

Historical Range and Distribution

Prior to description by Ridgeway in 1885, most observers did not differentiate between the lesser and greater prairie-chicken. Consequently, estimating historical abundance and occupied range is difficult. Historically, the lesser prairie-chicken is known to have occupied native rangeland in portions of southeastern Colorado (Giesen 1994b, pp. 175–182), southwestern Kansas (Baker 1953, p. 9; Schwilling 1955, p. 10), western Oklahoma (Duck and Fletcher 1944, p. 68), the Texas panhandle (Henika 1940, p. 15; Oberholser 1974, p. 268), and eastern New Mexico (Ligon 1927, pp. 123–127).

Lesser prairie-chickens also have been documented from Nebraska, based on at least four specimens known to have been collected near Danbury in Red Willow County during the 1920s (Sharpe 1968, p. 50). Sharpe (1968, pp. 51, 174) considered the occurrence of lesser prairie-chickens in Nebraska to be the result of a short-lived range expansion facilitated by settlement and cultivation of grain crops. Lesser prairie-chickens are not currently believed to occur in Nebraska. Sharpe did not report any confirmed observations since the 1920s (Sharpe 1968, entire), and no sightings have been documented despite searches over the last 5 years in southwestern Nebraska (Walker 2011). Therefore, Nebraska is generally considered outside the historical range of the species.

Based on a single source, Crawford (1974, p. 4) reported that the lesser prairie-chicken was successfully introduced to the island of Niihau in the State of Hawaii. Prairie-chickens were known to have been released on Niihau, a privately owned island,

in 1934 (Fisher 1951, p. 37), but the taxonomic identity of those birds has not ever been confirmed. Schwartz and Schwartz (1949, p. 120) believed that these birds were indeed lesser prairie-chickens. Fisher and members of his expedition did observe at least eight individual prairie-chickens during a visit to Niihau in 1947, but no specimens were collected due to their scarcity and the landowner's requests (Fisher 1951, pp. 33–34, 37). Consequently, the specific identity of these birds could not be confirmed, and their current status on the island remains unknown (Pratt *et al.* 1987, p. 324; Pyle and Pyle 2009, p. 5). Similarly, Jeschke and Strayer (2008, p. 127) indicate that both lesser and greater prairie-chickens were introduced to parts of Europe, but both species failed to become established there. Although we do not believe that either greater or lesser prairie-chickens still persist in Hawaii or Europe, we request that any recent information on the status of lesser prairie-chickens in either Hawaii or Europe be provided to us during the comment period.

Johnsgard (2002, p. 32) estimated the maximum historical range of the lesser prairie-chicken to have encompassed some 260,000 to 388,500 sq km (100,000 to 150,000 sq mi), with about two-thirds of the historical range occurring in Texas. Taylor and Guthery (1980a, p. 1, based on Aldrich 1963, p. 537) estimated that, by the 1880s, the area occupied by lesser prairie-chicken was about 358,000 sq km (138,225 sq mi), and, by 1969, they estimated the occupied range had declined to roughly 125,000 sq km (48,263 sq mi) due to widespread conversion of native prairie to cultivated cropland. Taylor and Guthery (1980a, p. 4) estimated that, by 1980, the occupied range

encompassed only 27,300 sq km (10,541 sq mi), representing a 90 to 93 percent reduction in occupied range since pre-European settlement and a 92 percent reduction in the occupied range since the 1880s.

In 2007, cooperative mapping efforts by species experts from the Colorado Parks and Wildlife (CPW) (formerly Colorado Division of Wildlife), Kansas Department of Wildlife, Parks and Tourism (KDWPT) (formerly Kansas Department of Wildlife and Parks), New Mexico Department of Game and Fish (NMDGF), Oklahoma Department of Wildlife Conservation (ODWC), and Texas Parks and Wildlife Department (TPWD), in cooperation with the Playa Lakes Joint Venture, reestimated the maximum historical and occupied ranges. They determined the maximum occupied range, prior to European settlement, to have been approximately 456,087 sq km (176,096 sq mi) (Playa Lakes Joint Venture 2007, p. 1). The approximate historical range, by State, based on this cooperative mapping effort is the following: 21,911 sq km (8,460 sq mi) in Colorado; 76,757 sq km (29,636 sq mi) in Kansas; 52,571 sq km (20,298 sq mi) in New Mexico; 68,452 sq km (26,430 sq mi) in Oklahoma; and 236,396 sq km (91,273 sq mi) in Texas. Since 2007, the CPW slightly expanded the historical range in Colorado, based on new information. The total maximum historically occupied range, based on this adjustment, is now estimated to be about 466,998 sq km (180,309 sq mi).

Current Range and Distribution

The lesser prairie-chicken still occurs within the States of Colorado, Kansas, New Mexico, Oklahoma, and Texas (Giesen 1998, p. 3). During the 2007 mapping effort (Playa Lakes Joint Venture 2007, p. 1; Davis *et al.* 2008, p 19), the State conservation agencies estimated the current occupied range encompassed 65,012 sq km (25,101 sq mi). The approximate occupied range, by State, based on this cooperative mapping effort is 4,216 sq km (1,628 sq mi) in Colorado; 29,130 sq km (11,247 sq mi) in Kansas; 8,570 sq km (3,309 sq mi) in New Mexico; 10,969 sq km (4,235 sq mi) in Oklahoma; and 12,126 sq km (4,682 sq mi) in Texas.

Since 2007, the occupied and historical range in Colorado and the occupied range in Kansas have been adjusted to reflect new information. The currently occupied range in Colorado is now estimated to be 4,456 sq km (1,720 sq mi), and, in Kansas, the lesser prairie-chicken is now thought to occupy about 34,479 sq km (13,312 sq mi). In Kansas, the adjustment was due to expansion of lesser prairie-chicken populations in Ellis, Graham, Sheridan, and Trego Counties. The total estimated occupied range is now believed to encompass some 70,601 sq km (27,259 sq mi). The currently occupied range now represents roughly 16 percent of the revised historical range. This value is a close approximation because a small portion of the expanded range in Kansas lies outside the estimated maximum historical range and was not included in this analysis. Considering there are historical records from Nebraska, the maximum historical range currently in use is likely smaller than the maximum that would exist if the temporarily occupied range in Nebraska was included in the analysis.

The overall distribution of lesser prairie-chicken within all States except Kansas has declined sharply, and the species is generally restricted to variously sized, often highly fragmented parcels of untilled native rangeland (Taylor and Guthery 1980a, pp. 2–5) or areas with significant CRP enrollments that were initially seeded with native grasses (Rodgers and Hoffman 2005, pp. 122–123). The estimated current occupied range, based on cooperative mapping efforts described above, and as derived from calculations of the area of each mapped polygon using geographical information software, represents about an 84 percent reduction in overall occupied range since pre-European settlement.

Table 1.—Estimated historical and current occupied lesser prairie-chicken range by State.

| State | Historical Range | Current Range | Extent | |
|------------|------------------|---------------|------------------------------------|------------------------------------|
| | | | Historical | Current |
| Colorado | 6 counties | 4 counties | 21,910.9 sq km (8,459.8 sq mi) | 4,216.5 sq km (1,628.0 sq mi) |
| Kansas | 38 counties | 35 counties | 76,757.4 sq km (29,636.2 sq mi) | 29,130.2 sq km (11,247.2 sq mi) |
| New Mexico | 12 counties | 7 counties | 52,571.2 sq km (20,297.9 sq mi) | 8,570.1 sq km (3,308.9 sq mi) |
| Oklahoma | 22 counties | 8 counties | 68,452.1 sq km (26,429.5 sq mi) | 10,969.1 sq km (4,235.2 sq mi) |

| | | | | |
|--------------|----------------------------|--------------|--------------------------------------|------------------------------------|
| Texas | 34 counties (1940s-50s) | 13 counties* | 236,396.2 sq km (91,273.1 sq mi) | 12,126.5 sq km (4,682.1 sq mi) |
| TOTAL | 107 counties | 67 counties | 456,087.8 sq km (176,096.5 sq mi) | 65,012.4 sq km (25,101.4 sq mi) |

*Timmer (2012, p. 36) only observed lesser prairie-chickens in 12 counties

Population Estimates

Very little information is available regarding the size of lesser prairie-chicken populations prior to 1900. Once the five States supporting lesser prairie-chickens were officially opened for settlement beginning in the late 1800s, settlement occurred quickly and the landscape began to change rapidly. Numbers of lesser prairie-chickens likely changed rapidly as well. Despite the lack of conclusive information on population size, the lesser prairie-chicken was reportedly quite common throughout its range in Colorado, Kansas, New Mexico, Oklahoma, and Texas in the early twentieth century (Bent 1932, pp. 280–281,283; Baker 1953, p. 8; Bailey and Niedrach 1965, p. 51; Sands 1968, p. 454; Fleharty 1995, pp. 38–44; Robb and Schroeder 2005, p. 13). Litton (1978, p. 1) suggested that as many as two million birds may have occurred in Texas alone prior to 1900. By the 1930s, the species had begun to disappear from areas where it had been considered abundant, and the decline was attributed to extensive cultivation, overgrazing by livestock, and drought (Bent 1932, p. 280). Populations were nearly extirpated from

Colorado, Kansas, and New Mexico, and were markedly reduced in Oklahoma and Texas (Baker 1953, p. 8; Crawford 1980, p. 2).

Rangewide estimates of population size were almost nonexistent until the 1960s and likely corresponded with more frequent and consistent efforts by the States to monitor lesser prairie-chicken populations. Although lesser prairie-chicken populations can fluctuate considerably from year to year in response to variable weather and habitat conditions, generally the overall population size has continued to decline from the estimates of population size available in the early 1900s (Robb and Schroeder 2005, p. 13). By the mid-1960s, Johnsgard (1973, p. 281) estimated the total rangewide population to be between 36,000 and 43,000 individuals. In 1980, the estimated rangewide fall population size was thought to be between 44,400 and 52,900 birds (Crawford 1980, p. 3). Population size in the fall is likely to be larger than population estimates derived from spring counts due to recruitment that occurs following the nesting season. By 2003, the estimated total rangewide population was 32,000 birds, based on information provided by the Lesser Prairie-Chicken Working Group (Rich *et al.* 2004, unpaginated). Prior to the implementation of a rangewide survey effort in 2012, the best available population estimates indicate that the lesser prairie-chicken population likely would be approximately 45,000 birds or less (see Table 2). This estimate is a rough approximation of the maximum population size and should not be considered as the actual current population size. Although the estimate uses the most current information available, population estimates for some States have not been determined in several years

and reported values may not represent actual population sizes. For example, the values reported for Colorado and Oklahoma were published in 2000 and recent estimates of total population size for these States have not been determined. The aerial surveys conducted in 2012, as explained below, provide the best estimate of current population size.

Table 2. —Recent population estimates prior to 2012 by State.

| State | Recent Population Estimates Prior to 2012 |
|---------------|--|
| Colorado | < 1,500 (in 2000) |
| Kansas | 19,700 – 31,100 (in 2006) |
| New Mexico | 6,130 (in 2011) |
| Oklahoma | < 3,000 (in 2000) |
| Texas | 1,254 – 2,649 (in 2010-11) |
| TOTAL | < 45,000 |

In the spring (March 30 to May 3) of 2012, the States, in conjunction with the Western Association of Fish and Wildlife Agencies, implemented a rangewide sampling

framework and survey methodology using small aircraft. This aerial survey protocol was developed to provide a more consistent approach for detecting rangewide trends in lesser prairie-chicken population abundance across the occupied range. The goal of this survey was to estimate the abundance of active leks and provide information that could be used to detect trends in lek abundance over time. The sampling framework used 15-by-15-km (9-by-9-mi) grid cells overlapping the estimated occupied range, as existed in 2011, plus a 7.5-km (4.6-mi) buffer. Additional information on the survey approach is provided in McDonald *et al.* 2011, entire. Another survey is planned for the spring of 2013, provided funding is available. We intend to incorporate those results, subject to availability, into our final determination.

The aerial survey study area was divided into four regions that encompassed the estimated occupied range of the lesser prairie-chicken. These regions were delineated based on habitat type and results grouped by individual State were not provided. The four regional groupings were the Shinnery Oak Prairie Region of eastern New Mexico and southwest Texas; the Sand Sagebrush Prairie Region located in southeastern Colorado, southwestern Kansas, and western Oklahoma Panhandle; the Mixed Grass Prairie Region located in the northeastern Texas panhandle, northwestern Oklahoma, and south-central Kansas; and the Short Grass/CRP Mosaic in northwestern Kansas and eastern Colorado. During surveys of the 264 blocks selected, 40 lesser prairie-chicken leks, 6 mixed leks comprised of both lesser and greater prairie-chickens, and 100 non-lek aggregations of lesser prairie-chickens were observed (McDonald *et al.* 2012, p. 15). For

this study, an active lek was defined as having five or more birds per lek. If fewer than five individual birds were observed, ground surveys were conducted of those bird groups to determine if lekking birds were present. If not, those areas were classified as “non-leks”. After the survey observations were adjusted to account for probability of detection, some 3,174 lesser prairie-chicken leks were estimated to occur over the entire occupied range (McDonald *et al.* 2012, p. 18). Another 441 mixed leks, consisting of both lesser and greater prairie-chickens, were estimated to occur within the occupied range. These mixed leks were limited to the Short Grass/CRP Mosaic region where the range of the two species overlaps. Using the respective average group size, by each identified region, an estimate of the total number of lesser prairie-chickens and lesser/greater prairie-chicken hybrids could be derived (McDonald *et al.* 2012, p. 20). The total estimated abundance of lesser prairie-chickens was 37,170 individuals, with the number of hybrids estimated to be 309 birds (McDonald *et al.* 2012, p. 21). The estimated total number of lesser prairie-chicken leks and population size, by habitat region, are as follows: Shinnery Oak Prairie Region—428 leks and 3,699 birds; Sand Sagebrush Prairie Region—105 leks and 1,299 birds; Mixed Grass Prairie Region—877 leks and 8,444 birds; and the Short Grass/CRP Mosaic Region—1,764 leks and 23,728 birds (McDonald *et al.* 2012, pp. 20, 23).

State-by-State Information on Population Status

Each of the State conservation agencies within the occupied range of the lesser prairie-chicken provided us with information regarding the current status of the lesser prairie-chicken within their respective States, and most of the following information was taken directly from agency reports, memos, and other status documents. Population survey data are collected from spring lek surveys in the form of one or both of the following indices: average lek size (i.e., number of males or total birds per lek); or density of birds or leks within a given area. Most typically, the data are collected along fixed survey routes where the number of displaying males counted is assumed to be proportional to the population size, or the number of leks documented is assumed to be an index of population size or occupied range. These techniques are useful in evaluating long-term trends and determining occupancy and distribution but are very limited in their usefulness for reliably estimating population size (Johnson and Rowland 2007, pp. 17–20). However, given existing constraints, such as available staff and funding, they provide the best opportunity to assess lesser prairie-chicken populations.

Although each State annually conducts lesser prairie-chicken surveys according to standardized protocols, those protocols vary by State. Thus, each State can provide information relative to lesser prairie-chicken numbers and trends by State, but obtaining consistent information across the entire range is difficult given the current approach to population monitoring. However, in the absence of more reliable estimators of bird density, total counts of active leks over large areas were recommended as the most reliable trend index for prairie grouse populations such as lesser prairie-chickens (Cannon

and Knopf 1981, p. 777; Hagen *et al.* 2004, p. 79). About 95 percent of the currently estimated occupied range occurs on privately owned land, as determined using the Protected Areas Database of the United States hosted by the U.S. Geological Survey Gap Analysis Program. This database describes land areas that are under public ownership and the extent of private ownership can be determined by subtracting the amount of public lands from the total land base encompassed by the occupied range.

Colorado—Lesser prairie-chickens were likely resident in six counties (Baca, Bent, Cheyenne, Kiowa, Kit Carson, and Prowers Counties) in Colorado prior to European settlement (Giesen 2000, p. 140). At present, lesser prairie-chickens are known to occupy portions of Baca, Cheyenne, Prowers, and Kiowa Counties, but are not known to persist in Bent and Kit Carson Counties. Present delineated range includes portions of eastern Lincoln County although breeding birds have not been documented from this county. Populations in Kiowa and Cheyenne Counties number fewer than 100 individuals and appear to be isolated from other populations in Colorado and adjacent States (Giesen 2000, p. 144). The lesser prairie-chicken has been State-listed as threatened in Colorado since 1973. Colorado Department of Wildlife (now CPW) estimated 800 to 1,000 lesser prairie-chicken in the State in 1997. Giesen (2000, p. 137) estimated the population size, as of 2000, to be fewer than 1,500 breeding individuals.

CPW has been monitoring leks annually since 1959, primarily by using standard survey routes (Hoffman 1963, p. 729). A new survey method was initiated in 2004,

designed to cover a much broader range of habitat types and a larger geographic area, particularly to include lands enrolled in the CRP. The new methodology resulted in the discovery of more leks and the documented use of CRP fields by lesser prairie-chickens in Colorado. In 2011, CPW used aerial surveys in addition to the more traditional ground surveys in an attempt to identify new leks in Cheyenne County (Remington 2011).

A total count of 161 birds and 17 active leks were detected in 2011 (Verquer and Smith 2011, pp. 1–2). A lek is considered active when at least three males are observed displaying on the lek. There were six active leks in Baca County, nine active leks in Prowers County, and two active leks in Cheyenne County. No active leks were detected in Kiowa County although leks have been active in this county as recently as 2008 (Verquer 2008, p. 1). No new active leks were detected in Cheyenne County. Habitat provided by CRP continues to be very important to persistence of birds in Prowers County.

Since 1977, the total number of birds observed during routine survey efforts has varied from a high of 448 birds in 1990 to a low of 74 birds in 2007. The general population trajectory, based on number of birds observed on active leks during the breeding season is declining, excluding information from 1992 when limited survey data were collected. The number of active leks remained fairly stable between 1999 and 2006. During this period, the highest number of active leks recorded, 34, occurred in 2004 and again in 2006. The fewest number of active leks observed occurred in 2002 when 24 leks

were observed. The average number of active leks observed between 1999 and 2006 was 30.1.

Beginning in 2007 and continuing to present, the number of active leks observed has remained fairly stable. Since 2007, the highest recorded number of active leks was 18, which occurred in 2007. The fewest number of active leks observed was 13 recorded in 2009. The average number of active leks over this period was 16.4, roughly half of the average number of active leks (30) observed during the period between 1999 and 2006. Drought conditions observed in 2006, followed by severe winter weather, probably account for the decline in the number of lesser prairie-chickens observed in 2007 (Verquer 2007, pp. 2–3). In the winter of 2006–2007, heavy snowfall severely reduced food and cover in Prowers, southern Kiowa, and most of Baca Counties for over 60 days. Then, in the spring of 2008, nesting and brood rearing conditions were unfavorable due to drought conditions in southeastern Colorado (Verquer 2009, p. 5).

As a complement to CPW surveys, counts are completed on the USFS Comanche National Grassland in Baca County. On the Comanche National Grassland, the estimated area occupied by the lesser prairie-chicken over the past 20 years was approximately 27,373 ha (65,168 ac) (Augustine 2005, p. 2). Surveys conducted during 1984 to 2005 identified 53 different leks on or immediately adjacent to USFS lands. Leks were identified based on the presence of at least three birds on the lek. Lek censuses conducted from 1980 to 2005 showed the number of males counted per lek since 1989

has steadily declined (Augustine 2006, p. 4). The corresponding population estimate, based on number of males observed at leks, on the Comanche National Grassland was highest in 1988 with 348 birds and lowest in 2005 with approximately 64 birds and only 8 active leks (Augustine 2006, p. 4). The estimate of males per lek in 2005 declined more than 80 percent from that of 1988, from 174 males per lek to 32 males per lek, respectively. In 2009, each historical lek was surveyed 2 to 3 times, and 4 active leks were observed (Shively 2009b, p. 1). A high count of 25 males was observed using these four leks. In the spring of 2008, five active leks and 34 birds were observed (Shively 2009a, p. 3).

Kansas—In the early part of the last century, lesser prairie-chicken historical range included all or part of 38 counties, but by 1977, the species was known to exist in only 17 counties, all located south of the Arkansas River (Waddell and Hanzlick 1978, pp. 22–23). Since 1999, biologists have documented lesser prairie-chicken expansion and reoccupation of 17 counties north of the Arkansas River, primarily attributable to favorable habitat conditions (e.g., native grasslands) created by implementation of the CRP in those counties. Currently, lesser prairie-chickens occupy approximately 34,479 sq km (13,312 sq mi) within all or portions of 35 counties in western Kansas. Greater prairie-chickens in Kansas also have expanded their range, and, as a result, mixed leks of both lesser prairie-chickens and greater prairie-chickens occur within an overlap zone covering portions of 7 counties (2,500 sq km (965 sq mi)) in western Kansas (Bain and Farley 2002, p. 684). Within this zone, apparent hybridization between lesser prairie-

chickens and greater prairie-chickens is now evident (Bain and Farley 2002, p. 684). Two survey routes used by KDWPT are located within this overlap zone; however, hybrids have been observed on only one of those routes. Although hybrid individuals are included in the counts, the number of hybrids observed is typically less than 1 percent, or 2 to 7 birds, of the total number of birds observed on the surveyed areas.

Since inception of standard lesser prairie-chicken survey routes in 1967, the number of standard survey routes has gradually increased. The number of standard routes currently surveyed in Kansas for lesser prairie-chickens is 14 and encompasses an area of 627.5 sq km (242.3 sq mi). Flush counts are taken twice at each lek located during the standard survey routes. An estimated population density is calculated for each route by taking the higher of the two flush counts, doubling that count primarily to account for females, and then dividing the estimated number of birds by the total area surveyed per route. The current statewide trend in lesser prairie-chicken abundance between 2004 and 2009 indicates a declining population (Pitman 2011, p. 15).

In 2006, KDWPT estimated the breeding population of lesser prairie-chickens in the State to be between 19,700 and 31,100 individuals (Rodgers 2007a, p. 1). The total breeding population estimates were derived using the National Gap Analysis Program, where the population indices from each habitat type along 15 survey routes were extrapolated for similar habitat types throughout total occupied lesser prairie-chicken range statewide.

New Mexico—In the 1920s and 1930s, the former range of the lesser prairie-chicken in New Mexico was described as all of the sand hill rangeland of eastern New Mexico, from Texas to Colorado, and as far west as Buchanan in DeBaca County. Ligon (1927, pp. 123–127) mapped the breeding range at that time as encompassing portions of seven counties, a small subset of what he described as former range. Ligon (1927, pp. 123–127) depicted the historical range in New Mexico as encompassing all or portions of 12 counties. In the 1950s and 1960s, occupied range was more extensive than the known occupied range in 1927 (Davis 2005, p. 6), indicating reoccupation of some areas since the late 1920s. Presently, the NMDGF reports that lesser prairie-chickens are known from six counties (Chaves, Curry, DeBaca, Lea, Roosevelt and Quay Counties) and suspected from one additional county (Eddy County). The occupied range of the lesser prairie-chicken in New Mexico is conservatively estimated to encompass approximately 5,698 sq km (2,200 sq mi) (Davis 2006, p. 7) compared with its historical range of 22,390 sq km (8,645 sq mi). Based on the cooperative mapping efforts conducted by the Playa Lakes Joint Venture and the Lesser Prairie-Chicken Interstate Working Group, occupied range in New Mexico was estimated to be 8,570 sq km (3,309 sq mi), considerably larger than the conservative estimate used by Davis (2006, p. 7). One possible reason for the difference in occupied range is that Davis (2006, p. 7) did not consider the known distribution to encompass any portion of Eddy County or southern Lea County. Approximately 59 percent of the historical lesser prairie-chicken range in New Mexico is

privately held, with the remaining historical and occupied range occurring on lands managed by the BLM, USFS, and New Mexico State Land Office (Davis 2005, p. 12).

In the 1950s, the lesser prairie-chicken population was estimated at 40,000 to 50,000 individuals, but, by 1968, the population had declined to an estimated 8,000 to 10,000 individuals (Sands 1968, p. 456). Johnsgard (2002, p. 51) estimated the number of lesser prairie-chickens in New Mexico at fewer than 1,000 individuals by 2001. Similarly, the Sutton Center estimated the New Mexico lesser prairie-chicken population to number between 1,500 and 3,000 individuals, based on observations made over a 7-year period (Wolfe 2008). Using lek survey data, NMDGF currently estimates the statewide lesser prairie-chicken population to be about 6,130 birds (Beauprez 2011, p. 22). Based on the estimated population sizes in New Mexico since 2001, the population appears to be increasing slightly (Beauprez 2011, p. 22). Longer term trends are not available as roadside listening routes did not become established until 1998. Prior to that date, counts were conducted on some of the NMDGF Prairie-Chicken Areas or on lands under the jurisdiction of the BLM. The current roadside survey uses 29 standard routes established since 1999, 10 additional routes established in 2003 within the northeastern part of lesser prairie-chicken historical range, and 41 routes randomly selected from within the 382 townships located within the survey boundary.

Since initiating the 10 additional northeastern routes in 2003, NMDGF reports that no leks have been detected in northeastern New Mexico. Results provide strong

evidence that lesser prairie-chickens no longer occupy their historical range within Union, Harding, and portions of northern Quay Counties (Beauprez 2009, p. 8). However, a solitary male lesser prairie-chicken was observed and photographed in northeastern New Mexico by a local wildlife law enforcement agent in December 2007. Habitat in northeastern New Mexico appears capable of supporting lesser prairie-chicken, but the lack of any known leks in this region since 2003 suggests that lesser prairie-chicken populations in northeastern New Mexico, if still present, are very small.

The core of occupied lesser prairie-chicken range in this State lies in east-central New Mexico (Chaves, Curry, DeBaca, Lea, and Roosevelt Counties). Populations in southeastern New Mexico, defined as the area south of U.S. Highway 380, remain low and continue to decline. The majority of historically occupied lesser prairie-chicken habitat in southeastern New Mexico occurs primarily on BLM land. Snyder (1967, p. 121) suggested that this region is only marginally populated except during favorable climatic periods. Best *et al.* (2003, p. 232) concluded anthropogenic factors have, in part, rendered lesser prairie-chicken habitat south of U.S. Highway 380 inhospitable for long-term survival of lesser prairie-chickens in southeastern New Mexico. Similarly, NMDGF suggests that habitat quality likely limits recovery of populations in southeastern New Mexico (Beauprez 2009, p. 13).

The New Mexico State Game Commission owns and manages 29 Prairie-chicken Areas ranging in size from 10 to 3,171 ha (29 to 7,800 ac) within the core of occupied

range in east central New Mexico. These Prairie-chicken Areas total 109 sq km (42 sq mi), or roughly 1.6 percent of the total occupied lesser prairie-chicken range in New Mexico. Instead of the typical roadside counts, the NMDGF conducts “saturation” surveys on each individual Prairie-chicken Area to determine the presence of lesser prairie-chicken leks and individual birds over the entire Prairie-chicken Area (Beauprez 2009, p. 7). Adjacent lands are included within these surveys, including other State Trust Lands, some adjacent BLM lands, and adjacent private lands. The Prairie-chicken Areas are important to persistence of the lesser prairie-chicken in New Mexico. However, considering the overall areal extent of the Prairie-chicken Areas and that many Prairie-chicken Areas are small and isolated, continued management of the surrounding private and Federal lands is integral to viability of the lesser prairie-chicken in New Mexico.

Oklahoma—Lesser prairie-chickens historically occurred in 22 Oklahoma counties. By 1961, Copelin (1963, p. 53) reported lesser prairie-chickens from only 12 counties. By 1979, lesser prairie-chickens were verified in eight counties, and the remaining population fragments encompassed an estimated area totaling 2,792 sq km (1,078 sq mi), a decrease of approximately 72 percent since 1944. At present, the ODWC reports lesser prairie-chickens continue to persist in eight counties with an estimated occupied range of approximately 950 sq km (367 sq mi). Horton (2000, p. 189) estimated the entire Oklahoma lesser prairie-chicken population numbered fewer than 3,000 birds in 2000. A more recent estimate has not been conducted.

The ODWC is aware of 96 known historical and currently active leks in Oklahoma. During the mid-1990s, all of these leks were active. Survey efforts to document the number of active leks over the occupied range have recently been completed, but the results are currently unavailable.

The number of roadside listening routes currently surveyed annually in Oklahoma has varied from five to seven over the last 20 years, and counts of the number of males per lek have been conducted since 1968. Beginning with the 2002 survey, male counts at leks were replaced with flush counts, which did not differentiate between the sexes of birds flushed from the surveyed lek (ODWC 2007, pp. 2, 6). Comparing the total number of males observed during survey efforts between the years 1977 through 2001 reveals a declining trend. However, examination of the overall density of leks (number per sq mi), another means of evaluating population status of lesser prairie-chickens, over five of the standard routes since 1985 is stable to slightly declining. Information on lek density prior to 1985 was unavailable. The standard route in Roger Mills County was not included in this analysis because the lek was rarely active and has not been surveyed since 1994. A survey route in Woods County was included in the analysis even though surveys on this route did not begin until 2001. However, excluding the Woods County route did not alter the apparent trend. The average lek density since 2001 is 0.068 leks per sq mi (Schoeling 2010, p. 3). Between 1985 and 2000, the average lek density was 0.185 leks per sq mi, when the route in Roger Mills County is excluded from the analysis. Over the last 10 years, the density of active leks has varied from a low of 0.02 leks per sq km (0.05 leks

per sq mi) in 2004, 2006, and 2009, to a high of 0.03 leks per sq km (0.09 leks per sq mi) in 2005 and 2007 (Schoeling 2010, p. 3).

Texas—Systematic surveys to identify Texas counties inhabited by lesser prairie-chickens began in 1940 (Henika 1940, p. 4). From the early 1940s (Henika 1940, p. 15; Sullivan *et al.* 2000) to mid-1940s (Litton 1978, pp. 11–12), to the early 1950s (Seyffert 2001, pp. 108–112), the range of the lesser prairie-chicken in Texas was estimated to encompass all or portions of 34 counties. Species experts considered the occupied range at that time to be a reduction from the presettlement range. By 1989, TPWD estimated occupied range encompassed all or portions of only 12 counties (Sullivan *et al.* 2000, p. 179). In 2005, TPWD reported that the number of occupied counties likely has not changed since the 1989 estimate. In March 2007, TPWD reported that lesser prairie-chickens were confirmed from portions of 13 counties (Ochiltree, Lipscomb, Roberts, Hemphill, Gray, Wheeler, Donley, Bailey, Lamb, Cochran, Hockley, Yoakum, and Terry Counties) and suspected in portions of another eight counties (Moore, Carson, Oldham, Deaf Smith, Randall, Swisher, Gaines, and Andrews Counties).

Based on recent aerial and road surveys conducted in 2010 and 2011, new leks were detected in Bailey, Cochran, Ochiltree, Roberts, and Yoakum Counties, expanding the estimated occupied ranges in those counties (TPWD 2011). However, no lesser prairie-chickens were detected in Andrews, Carson, Deaf Smith, Oldham, or Randall Counties. Active leks were reported from the same 13 counties identified in 2007.

However, in 2012, Timmer (2012, pp. 36, 125–131) only observed lesser prairie-chickens from 12 counties: Bailey, Cochran, Deaf Smith, Donley, Gray, Hemphill, Lipscomb, Ochiltree, Roberts, Terry, Wheeler, and Yoakum. Lesser prairie-chicken populations in Texas primarily persist in two disjunctive regions—the Permian Basin/Western Panhandle region and the Northeastern Panhandle region.

Maximum occupied range in Texas, as of September 2007, was estimated to be 12,787 sq km (4,937.1 sq mi), based on habitat conditions in 20 panhandle counties (Davis *et al.* 2008, p. 23). Conservatively, based on those portions of the 13 counties where lesser prairie-chickens are known to persist, the area occupied by lesser prairie-chickens in Texas is 7,234.2 sq km (2,793.1 sq mi). Using an estimated mean density of 0.0088 lesser prairie-chickens per ac (range 0.0034–0.0135 lesser prairie-chickens per ac), the Texas population is estimated at a mean of 15,730 individuals in the 13 counties where lesser prairie-chickens are known to occur (Davis *et al.* 2008, p. 24).

Since 2007, Texas has been evaluating the usefulness of aerial surveys as a means of detecting leks and counting the number of birds attending the identified lek (McRoberts 2009, pp. 9–10). Initial efforts focused on measuring lek detectability and assessing the response of lekking birds to disturbance from survey aircraft. More recently, scientists at Texas Tech University used aerial surveys to estimate the density of lesser prairie-chicken leks and statewide abundance of lesser prairie-chickens in Texas. This study conducted an inventory of 208 survey blocks measuring 7.2 by 7.2 km (4.5 by

4.5 mi), encompassing some 87 percent of the occupied range in Texas during the spring of 2010 and 2011 (Timmer 2012, pp. 26–27, 33). Timmer (2012, p. 34) estimated 2.0 leks per 100 sq km (0.02 leks per sq km). Previously reported estimates of rangewide average lek density varied from 0.10 to 0.43 leks per sq km (Davison 1940, Sell 1979, Giesen 1991, Locke 1992 as cited in Hagen and Giesen 2005, unpaginated). The total estimate of the number of leks was 293.6 and, based on the estimated number of birds observed using leks, the statewide population was determined to be 1,822.4 lesser prairie-chickens (Timmer 2012, p. 34).

Recent Trends

In June 2012, we were provided with an interim assessment of lesser prairie-chicken population trends since 1997 (Hagen 2012, entire). The objective of this analysis was to provide an evaluation of recent lesser prairie-chicken population trends both rangewide and within the four primary habitat types (CRP-shortgrass prairie dominated landscape, mixed grass prairie landscape, sand sagebrush prairie landscape, and shinnery oak landscape) that encompass the occupied range of the species. The analysis employed modeling techniques intended to provide a more unified assessment of population trends, considering that each State uses slightly different methods to monitor lesser prairie-chickens and that sampling effort has varied over time, with sampling efforts typically increasing in recent years. The results of this analysis suggest that lesser prairie-chicken population trends have increased since 1997.

However, we are reluctant to place considerable weight on this interim assessment for several reasons. First, and perhaps most important, is that the analysis we were provided is a preliminary product. We anticipate that a more complete, and perhaps peer-reviewed, product would be submitted during the comment period on this proposed rule. Second, we have concerns with the differences in how lek counts are conducted and how those differences were addressed. For example, when the States conduct flush counts at the leks, all of the States, except Oklahoma, count the number of males flushed from the lek. However, since 1999, Oklahoma has counted all birds flushed from the lek and did not differentiate between males and females. Additionally, some of the States use numbers derived from lek counts conducted over large areas rather than road side listening routes. We are unsure how these differences in sampling methodology would influence the pooled trend information presented, particularly for large geographical areas where two different sampling methods are used in the analysis. Third, the trend information presents only information gathered since 1997 or more recently, without considering historical survey information. The trends evident from sampling efforts since 1997 likely reflect increased sampling effort following publication of the 12-month finding, and increased sampling effort could lead to biased results. In some instances, sampling methodology by agency likely varied between years during this time period as access to some study areas was restricted and new areas were established in their place. For example, in southwest Texas, two study areas were used until 1999, when an additional sampling area in Yoakum County was added. Then in 2007, the original

Gaines County study area was dropped and a new, smaller Gaines County study area was established to replace the original study area. Similar changes occurred in the northeastern panhandle of Texas where a new study area in Gray County was added in 1998. These changes in sampling location can confound efforts to make comparisons between years. An explanation regarding how these changes were addressed in the assessment would be helpful.

We also recognize the limitations of using lek counts to derive population trends over large areas (see Johnson and Rowland 2007, pp. 17-20). Consequently, we cautioned against using available data from lek counts to derive rangewide population trends for similar reasons. Such analyses can be misleading. However, information on historical and recent lesser prairie-chicken population trends over large geographical areas would improve our analysis of the status of the species and we support efforts to provide a reliable, accurate analysis of rangewide population trends, particularly if those analytical methods are repeatable over time.

Summary of Status Information

Lesser prairie-chicken populations are distributed over a relatively large area, and these populations can fluctuate considerably from year to year, a natural response to variable weather and habitat conditions. Changes in lesser prairie-chicken breeding populations may be indicated by a change in the number of birds attending a lek

(lek size), the number of active leks, or both. Although each State conducts standard surveys for lesser prairie-chickens, the application of survey methods and effort varies by State. Such factors complicate interpretation of population indices for the lesser prairie-chicken and may not reliably represent actual populations. Caution should be used in evaluating population trajectories, particularly short-term trends. In some instances, short-term analyses could reveal statistically significant changes from one year to the next but actually represent a stable population when evaluated over longer periods of time. For example, increased attendance of males at leks may be evident while the number of active leks actually declined. Some recent survey indices indicate that population trends might be stabilizing. However, the numbers of lesser prairie-chickens reported per lek are considerably less than the numbers of birds reported during the 1970s. Population indices appear to have exhibited a steeper decline during these earlier periods than is apparent in recent years. Observed lek attendance at many leks is low, likely due to reduced population sizes. Where lek attendance is low, it is unlikely that populations will recover to historical levels. Estimates of historical population size also can be unreliable and lead to inaccurate inferences about the populations of interest. However, the loss and alteration, including fragmentation, of lesser prairie-chicken habitat throughout its historical range over the past several decades is apparent and likely is more indicative of the status of the lesser prairie-chicken.

Summary of Factors Affecting the Species

The Act defines an endangered species as any species that is “in danger of extinction throughout all or a significant portion of its range” and a threatened species as any species “that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.” Thus, a species may be listed as a threatened species if it is likely to qualify for endangered status in the foreseeable future, or in other words, likely to become “in danger of extinction” within the foreseeable future. The Act does not define the term “foreseeable future.” However, in a January 16, 2009, memorandum addressed to the Acting Director of the Service, the Office of the Solicitor, Department of the Interior, concluded, “* * * as used in the [Act], Congress intended the term ‘foreseeable future’ to describe the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species (M-37021, January 16, 2009).”

In considering the foreseeable future as it relates to the status of the lesser prairie-chicken, we considered the factors acting on the species and looked to see if reliable predictions about the status of the species in response to those factors could be drawn. We considered the historical data to identify any relevant existing trends that might allow for reliable prediction of the future (in the form of extrapolating the trends). We also considered whether we could reliably predict any future events that might affect the status of the species, recognizing that our ability to make reliable predictions into the future is limited by the variable quantity and quality of available data.

Under section 4(a)(1) of the Act, we determine whether a species is an endangered or threatened species because of any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

After a review of the best available scientific information as it relates to the status of the species and the five listing factors described above, we have determined that the lesser prairie-chicken meets the definition of a threatened species (i.e., is likely to become in danger of extinction in the foreseeable future throughout all or a significant portion of its range). Following, we present a very brief explanation of the rationale leading to this conclusion followed by an in-depth discussion of the best available scientific information.

The range of the lesser prairie-chicken has been reduced by an estimated 84 percent (see discussion above in “Current Range and Distribution”). The primary factor responsible for the range contraction is habitat fragmentation due to a variety of mechanisms that contribute to habitat loss and alteration. This habitat loss is a significant threat to the lesser prairie-chicken because the species requires large parcels of intact native grassland and shrubland to maintain self-sustaining populations. Further, the life history of the species, primarily its lek breeding system and behavioral avoidance of

vertical structures that increase predation risk, make it especially vulnerable to ongoing impacts on the landscape, especially at its currently reduced numbers. Finally, due to its reduced population size and ongoing habitat loss and degradation, the species lacks sufficient redundancy and resiliency to recover from present and future impacts. While the current status of the lesser prairie-chicken has been substantially compromised by historical and current threats, there appear to be sufficient stable populations to ensure the persistence of the species over the near term. Therefore, as a result of continued population declines predicted into the foreseeable future, the species is likely to become in danger of extinction in the foreseeable future.

Following, we present our analysis of the best available information that has led us to this conclusion.

Habitat Fragmentation

Spatial habitat fragmentation occurs when some form of disturbance, usually habitat alteration or loss, results in the separation or splitting apart of larger, previously contiguous, functional components of habitat into smaller, often less valuable, noncontiguous parcels (Wilcove *et al.* 1986, p. 237; Johnson and Igl 2001, p. 25; Franklin *et al.* 2002, entire). Fragmentation influences habitat availability in three primary ways: total area of available habitat; size of habitat patches, including edge effects; and patch isolation (Johnson and Igl 2001, p. 25; Stephens *et al.* 2003, p. 101). Initially, reduction

in the total area of available habitat (i.e., habitat loss) may be more significant than fragmentation and can exert a much greater effect of extinction (Fahrig (1997, pp. 607, 609). However, as habitat loss continues, the effects of fragmentation often compound effects of habitat loss and produce even greater population declines than habitat loss alone (Bender *et al.* 1998, pp. 517–518, 525). At the point where some or all of the remaining habitat fragments or patches are below some minimum required size, the impact of additional habitat loss, when it consists of inadequately sized parcels, is minimal (Herkert 1994, p. 467). In essence, once a block of suitable habitat becomes so fragmented that the size of the remaining patches become biologically unsuitable, further habitat loss, when it consists of these unusable patches, is of little further consequence to the organism (Bender *et al.* 1998, p. 525).

Both habitat loss and fragmentation correlate with an ecological concept known as carrying capacity. Within any given block or patch of habitat, carrying capacity is the maximum number of organisms that can be supported indefinitely within that area, provided sufficient food, space, water, and other necessities are available, without causing degradation of the habitat within that patch. Theoretically, as habitat loss increases and the size of an area shrinks, the maximum number of individuals that could inhabit that particular habitat patch also would decline. Consequently, a reduction in the total area of available habitat can negatively influence biologically important characteristics such as the amount of space available for establishing territories and nest sites (Fahrig 1997, p. 603). Over time, the continued conversion and loss of habitats to

other land uses will reduce the ability of the land to support historical population levels, causing a decline in population sizes. Where the ability to effect restoration of these habitats is lost, the observed reduction in fish or wildlife populations is likely to be permanent. Within the United States, habitat loss and degradation were found to have contributed to the endangerment of 85 percent of the species listed either as imperiled by The Nature Conservancy or protected under the Act, at the time of their study (Wilcove *et al.* 1998, p. 609).

Fragmentation not only contributes to overall habitat loss but also causes a reduction in the size of individual habitat patches and influences the proximity of these patches to other patches of similar habitat (Stephens *et al.* 2003, p. 101; Fletcher 2005, p. 342). Habitat quality within a fragment may decline as the size of the fragment declines, particularly where habitat quality is a function of fragment size (Franklin *et al.* 2002, p. 23). Fahrig and Merriam (1994, p. 53) reported that both the size and shape of the fragment have been shown to influence population persistence. The size of the fragment can influence reproductive success, survival, and movements. As the distance between habitat fragments increases, dispersal between the habitat patches may cease, impacting population persistence and perhaps even leading to both localized and regional extinctions (Harrison and Bruna 1999, p. 226; With *et al.* 2008, p. 3153).

The proportion of habitat edge to interior habitat increases as the size of a fragment declines. The edge is the transition zone between the original habitat type and

the land use that caused fragmentation of the original parcel. In contrast, the core is the area within a fragment that remains intact and is largely or completely uninfluenced by the margin or edge of the fragment. Edge habitat proliferates with increasing fragmentation (Sisk and Battin 2002, p. 31). The response of individual species to the presence of edges varies markedly depending on their tolerance to the edge and the nature of its effects (Sisk and Battin 2002, p. 38). The effects often depend on the degree of contrast between the habitat edge and the adjacent land use matrix. The transition can be abrupt or something more gradual and less harsh. Most typically, edges have been documented to influence movements and survival, particularly for species that use interior or core habitats, serve as points of entry for predators and parasites (such as presence of fences adjacent to grasslands which provide hunting perches for avian predators), alter microclimates, subsidize feeding opportunities (such as providing access to waste grains in cropland areas), and influence species interactions, particularly with cosmopolitan species that tend to be habitat generalists (Sisk and Battin 2002, p. 38).

Fragmentation also can influence the heterogeneity or variation within the resulting fragment. Heterogeneity, in turn, influences the quality of the habitat within the fragment, with more homogeneous fragments generally being less valuable. Grasslands tend to be structurally simple and have little vertical layering. Instead, habitat heterogeneity tends to be largely expressed horizontally rather than vertically (Wiens 1974b, pp. 195–196). Prior to European settlement, the interaction of grazing by wild ungulates and fire created a shifting mosaic of vegetative patches having various

composition and structure (Pillsbury *et al.* 2011, p. 2). Under these conditions, many grassland birds distribute their behavioral activities unevenly throughout their territories by nesting in one area, displaying in another, and foraging in still others (Wiens 1974b, p. 208). Lesser prairie-chickens exhibit this pattern and cue in on specific vegetation structure and microenvironment features depending on the specific phase of their life cycle. Consequently, blocks of habitat that collectively or individually encompass multiple successional states that comprise tall grasses and shrubs needed for nesting, and are in proximity to more open grasslands supporting forbs for brood rearing, and are combined with smaller areas of short grass and bare ground used for breeding, support all of the habitat types used by lesser prairie-chickens throughout the year. Considering habitat diversity tends to be greater in larger patches, finding the appropriate mosaic of these features is more likely in larger fragments rather than smaller fragments (Helzer and Jelinski 1999, p. 1456). Such habitat heterogeneity is very different from habitat fragmentation. Habitat fragmentation occurs when the matrix separating the resulting fragments is converted to a use that is not considered habitat whereas habitat heterogeneity implies that patches each having different vegetative structure exist within the same contiguous block of habitat. Habitat heterogeneity may influence habitat quality, but it does not represent fragmentation (Franklin *et al.* 2002, p. 23).

Isolation is another factor that influences suitability of habitat fragments. As habitat loss continues to progress over time, the remnants not only become smaller and more fragmented, they become more isolated from each other. When habitat patches

become more isolated and the amount of unusable, unsuitable land use surrounding the islands of habitat increases, even patches of suitable quality and size may no longer be occupied. As fragmentation progresses, the ability of available dispersers to locate suitable fragments will decline. At some point, the amount of intervening unusable and unsuitable land comprising the matrix between the patches grows so wide that it exceeds the organism's dispersal capabilities, rendering the matrix impermeable to dispersal. In such instances, colonizers are unavailable to occupy the otherwise suitable habitat and reestablish connectivity. These patches may remain vacant indefinitely. While extinctions at the local level, and subsequent recolonization of the vacant patch, are common phenomena, recolonization depends on the availability of dispersing individuals and their ability to disperse within the broader landscape (Fahrig and Merriam 1994, p. 52). When the number of individuals at the landscape or regional level that are available to disperse declines, the overall population begins to decline and will, in turn, affect the number of individuals available to disperse. Connectivity between habitat patches is one means of facilitating dispersal, but the appropriate size or configuration of the dispersal corridors needed to facilitate connectivity for many species is unknown.

Causes of Habitat Fragmentation Within Lesser Prairie-Chicken Range

A number of factors can cause or contribute to habitat fragmentation. Generally, fragmentation can result from the direct loss or alteration of habitat due to conversion to other land uses or from habitat alteration which indirectly leaves the habitat in such a

condition that the remaining habitat no longer functionally provides the preferred life-history requisite. Functional habitat impacts can include disturbances that alter the existing successional state of a given area, create a physical barrier that precludes use of otherwise suitable areas, or triggers a behavioral response by the organism such that otherwise suitable habitats are abandoned or no longer used. Fragmentation tends to be most significant when human developments are dispersed across the landscape rather than being concentrated in fewer areas. Anthropogenic causes of fragmentation tend to be more significant than natural causes because the organism has likely evolved in concert with the natural causes.

Initially, settlement and associated land use changes had the greatest influence on fragmentation in the Great Plains. Knopf (1994, p. 249) identified four universal changes that occurred in Great Plains grasslands postsettlement, based on an evaluation of observations made by early explorers. These changes were identified as a change in the native grazing community, cultivation, wetland conversion, and encroachment of woody vegetation.

EuroAmerican settlement of much of the Great Plains began in earnest with passage of the Homestead Act of 1862. Continued settlement and agricultural development of the Great Plains during the late 1800s and early 1900s clearly contributed to conversion and fragmentation of once open native prairies into a mosaic of varied land uses such as cultivated cropland, expanding cedar woodlands, and remnants of grassland

(NRCS 1999, p. 1; Coppedge *et al.* 2001, p. 47; Brennan and Kuvlesky 2005, pp. 2–3).

Changes in agricultural practices and advancement of modern machinery combined with an increasing demand for agricultural products continued to spur conversion of native prairies well into the mid-1900s (NRCS 1999, p. 2). Increasing human population densities in rural areas of the Great Plains led to construction of housing developments as growing cities began to expand into the surrounding suburban landscapes. Development and intensification of unsuitable land uses in these urbanizing landscapes also contributed to conversion and fragmentation of grasslands, further reducing richness and abundance of avian populations (Perlut *et al.* 2008, p. 3149; Hansen *et al.* 2011, p. 826). See the section on settlement below for related discussion.

Oil and gas development also began during the mid to late 1800s. Eventually, invention of the automobile in the early twentieth century and its rise to prominence as the primary mode of personal transportation stimulated increased exploration and development of oil and gas (Hymel and Wolfsong 2006, p. 4). Habitat loss and fragmentation associated with access roads, drill pads, pipelines, waste pits, and other components typically connected with exploration and extraction of oil and gas are considered to be among the most significant ecological impacts from oil and gas development and the impacts often extend beyond the actual physical structures (Weller *et al.* 2002, p. 2). See the section on energy development below for related discussion.

As human populations continued to expand outside of existing suburban areas, particularly into rural regions, an increasing array of human features such as powerlines, highways, secondary roads, communication towers, and other types of infrastructure necessary to support these human populations appeared on the landscape (Leu *et al.* 2008, p. 1119). Often these developments can degrade ecosystem functions and lead to fragmentation even when the overall development footprint is relatively small.

Recent research demonstrates that natural vertical features like trees and artificial, above ground vertical structures such as power poles, fence posts, oil and gas wells, towers, and similar developments can cause general habitat avoidance and displacement in lesser prairie-chickens and other prairie grouse (Anderson 1969, entire; Robel 2002, entire; Robel *et al.* 2004, entire; Hagen *et al.* 2004, entire; Pitman *et al.* 2005, entire; Pruett *et al.* 2009a, entire; Hagen *et al.* 2011 entire). This avoidance behavior is presumably a behavioral response that serves to limit exposure to predation. The observed avoidance distances can be much larger than the actual footprint of the structure and appear to vary depending upon the type of structure. These structures can have significant negative impacts by contributing to further fragmentation of otherwise suitable habitats.

Prairie grouse, like the lesser prairie-chicken, did not evolve with tall, vertical structures present on the landscape and, in general, have low tolerance for tall structures. As discussed in “Altered Fire Regimes and Encroachment by Invasive Woody Plants”

below, encroachment of trees into native grasslands preferred by lesser prairie-chickens ultimately renders otherwise suitable habitat unsuitable unless steps are taken to remove these trees. Even artificially erected trees can cause an avoidance response. Anderson (1969, pp. 640–641) observed that greater prairie-chickens abandoned lek territories when a 4-m (13-ft) tall coniferous wind break was artificially erected 52 m (170 ft) from an active lek.

Increasingly, artificial vertical structures are appearing in landscapes used by lesser prairie-chickens. The placement of these vertical structures in open grasslands represents a significant change in the species' environment and is a relatively new phenomenon over the evolutionary history of this species. The effects of these structures on the life history of prairie grouse are only beginning to be evaluated, with similar avoidance behaviors also having been observed in sage grouse (75 FR 13910, March 23, 2010).

Robel (2002, p. 23) reported that a single commercial-scale wind turbine creates a habitat avoidance zone for the greater prairie-chicken that extends as far as 1.6 km (1 mi) from the structure. Lesser prairie-chickens likely exhibit a similar response to tall structures like wind turbines (Pitman *et al.* 2005, pp. 1267–1268). The Lesser Prairie-Chicken Interstate Working Group identified the need for a contiguous block of 52 sq km (20 sq mi) of high-quality rangeland habitat to successfully maintain a local population of lesser prairie-chicken; based on this need and the fact that the majority of remaining

populations are fragmented and isolated into islands of unfragmented, open prairie habitat, the Service recommended that an 8-km (5-mi) voluntary no-construction buffer be established around prairie grouse leks to account for behavioral avoidance and to protect lesser prairie-chicken populations and habitat corridors needed for future recovery (Manville 2004, pp. 3–4). No lesser prairie-chickens were observed nesting or lekking within 0.8 km (0.5 mi) of a gas line compressor station, and otherwise suitable habitat was avoided within a 1.6-km (1-mi) radius of a coal-fired power plant (Pitman *et al.* 2005, pp. 1267–1268). Pitman *et al.* (2005, pp. 1267–1268) also observed that female lesser prairie-chickens selected nest sites that were significantly further from powerlines, roads, buildings, and oil and gas wellheads than would be expected at random. Specifically, they observed that lesser prairie-chickens seldom nested or reared broods within approximately 177 m (580 ft) of oil or gas wellheads, 400 m (1,312 ft) of electrical transmission lines, 792 m (2,600 ft) of improved roads, and 1,219 m (4,000 ft) of buildings; and, the observed avoidance was likely influenced, at least in part, by disturbances such as noise and visual obstruction associated with these features. Similarly, Hagen *et al.* (2004, p. 75) indicated that areas used by lesser prairie-chickens were significantly further from these same types of features than areas that were not used by lesser prairie-chickens. They concluded that the observed avoidance was likely due to potential for increased predation by raptors or due to presence of visual obstructions on the landscape (Hagen *et al.* 2004, pp. 74–75).

Robel *et al.* (2004, pp. 256–262) determined that habitat displacement associated with avoidance of certain structures by lesser prairie-chickens can be substantial, collectively exceeding 21,000 ha (53,000 ac) in a three-county area of southwestern Kansas. Using information on existing oil and gas wells, major powerlines (115 kV and larger), and existing wind turbines and proposed wind energy development in northwestern Oklahoma, Dusang (2011, p. 61) modeled the effect of these anthropogenic structures on lesser prairie-chicken habitat in Oklahoma. He estimated that existing and proposed development of these structures potentially would eliminate some 960,917 ha (2,374,468 ac) of nesting habitat for lesser prairie-chickens, based on what is currently known about their avoidance of these structures.

Avoidance of vertical features such as trees and transmission lines likely is due to frequent use of these structures as hunting perches by birds of prey (Hagen *et al.* 2011, p. 72). Raptors actively seek out and use power poles and similar aboveground structures in expansive grassland areas where natural perches are limited. In typical lesser prairie-chicken habitat where vegetation is low and the terrain is relatively flat, power lines and power poles provide attractive hunting, loafing, and roosting perches for many species of raptors (Steenhof *et al.* 1993, p. 27). The elevated advantage of transmission lines and power poles serve to increase a raptor's range of vision, allow for greater speed during attacks on prey, and serve as territorial markers. While the effect of avian predation on lesser prairie-chickens undoubtedly depends on raptor densities, as the number of perches or nesting features increase, the impact of avian predation will increase (see separate

discussion under “*Predation*” below). The perception that these vertical structures are associated with predation may cause lesser prairie-chickens to avoid areas near these structures even when raptor densities are low. Sensitivity to electromagnetic fields generated by the transmission lines may be another reason lesser prairie-chickens might be avoiding these areas (Ferne and Reynolds 2005, p. 135) (see separate discussion under “*Wind Power and Energy Transmission Operation and Development*” below).

Where grassland patches remained, overgrazing, drought, lack of fire, woody plant and exotic grass invasions, and construction of various forms of infrastructure impacted the integrity of the remaining fragments (Brennan and Kuvlesky 2005, pp. 4–5). Domestic livestock management following settlement tended to promote more uniform grazing patterns, facilitated by construction of fences, which led to reduced heterogeneity in remaining grassland fragments (Fuhlendorf and Engle 2001, p. 626; Pillsbury *et al.* 2011, p. 2). See related discussions in the relevant sections below.

This ever-escalating fragmentation and homogenization of grasslands contributed to reductions in the overall diversity and abundance of grassland-endemic birds and caused populations of many species of grassland-obligate birds, such as the lesser prairie-chicken to decline (Coppedge *et al.* 2001, p. 48; Fuhlendorf and Engle, 2001, p. 626). Fragmentation and homogenization of grasslands is particularly detrimental for lesser prairie-chickens who typically prefer areas where individual habitat needs are in close

proximity to each other. For example, in suitable habitats, desired vegetation for nesting and brood rearing typically occurs within relatively short distances of the breeding area.

Human-caused habitat fragmentation with its associated habitat loss and degradation is considered by some to be the leading threat to biodiversity (Hunter and Gibbs 2007, p. 182), and grasslands as a whole are one of the most endangered ecosystems worldwide with agricultural development continuing to be a primary factor (With *et al.* 2008, p. 3152). Human disturbances are rapidly increasing the prevalence of edges in most terrestrial landscapes, and the process is not abating (Samson 1980a, p. 250; Sisk and Battin 2002, p. 41). The continued loss and conversion of grassland nesting and breeding habitat remains the largest threat to the future of many species of grassland birds (NRCS 1999, p. 3). As a group, grassland nesting birds have experienced greater declines in population size than any other group of birds, and some of the most significant causes include habitat loss and fragmentation, changes in land use, and habitat degradation (Knopf 1994, p. 251; Horn and Koford 2006, p. 109).

Effects of Habitat Fragmentation

While much of the conversion of native grasslands to agriculture in the Great Plains was largely completed by the 1940s and has slowed in more recent decades, grassland bird populations continue to decline (With *et al.* 2008, p. 3153). Bird populations may initially appear resistant to landscape change only to decline inexorably

over time because remaining grassland fragments may not be sufficient to prevent longer term decline in their populations (With *et al.* 2008, p. 3165). The decrease in patch size and increase in edges associated with fragmentation are known to have caused reduced abundance, reduced nest success, and reduced nest density in many species of grassland birds (Pillsbury *et al.* 2011, p. 2).

Habitat fragmentation has been shown to negatively impact population persistence and influence the species extinction process through several mechanisms (Wilcove *et al.* 1986, p. 246). Once fragmented, the remaining habitat fragments may be inadequate to support crucial life-history requirements (Samson 1980b, p. 297). The land-use matrix surrounding remaining suitable habitat fragments may support high densities of predators or brood parasites (organisms that rely on the nesting organism to raise their young), and the probability of recolonization of unoccupied fragments decreases as distance from the nearest suitable habitat patch increases (Wilcove *et al.* 1986, p. 248; Sisk and Battin 2002, p. 35). Invasion by undesirable plants and animals is often facilitated around the perimeter or edge of the patch, particularly where roads are present (Weller *et al.* 2002, p. 2). Additionally, as animal populations become smaller and more isolated, they are more susceptible to random (stochastic) events and reduced genetic diversity via drift and inbreeding (Keller and Waller 2002, p. 230). Population viability depends on the size and spacing of remaining fragments (Harrison and Bruna 1999, p. 226; With *et al.* 2008, p. 3153). O'Connor *et al.* (1999, p. 56) concluded that grassland birds, as a group, are particularly sensitive to habitat fragmentation, primarily

due to sensitivity to fragment size. Consequently, the effects of fragmentation are the most severe on area-sensitive species (Herkert 1994, p. 468).

Area-sensitive species are those species that respond negatively to decreasing habitat patch size (Robbins 1979, p. 198; Finch 1991, p. 1); the term was initially applied to songbirds inhabiting deciduous forests in eastern North America. However, an increasing number of studies are showing that many grassland birds also are area-sensitive and have different levels of tolerance to fragmentation of their habitat (e.g., see Herkert 1994, entire; Winter and Faaborg 1999, entire). For species that are area-sensitive, once a particular fragment or patch of suitable habitat falls below the optimum size, populations decline or disappear entirely even though suitable habitat may continue to exist within the larger landscape. When the overall amount of suitable habitat within the landscape increases, the patch size an individual area-sensitive bird may utilize generally tends to be smaller (Horn and Koford 2006, p. 115), but they appear to maintain some minimum threshold (Fahrig 1997, p. 608; NRCS 1999, p. 4). Winter and Faaborg (1999, pp. 1429, 1436) reported that the greater prairie-chicken was the most area-sensitive species observed during their study, and this species was not documented from any fragment of native prairie less than 130 ha (320 ac) in size.

Franklin *et al.* (2002, p. 23) described fragmentation in a biological context. According to Franklin, habitat fragmentation occurs when occupancy, reproduction, or survival of the organism has been affected. The effects of fragmentation can be

influenced by the extent, pattern, scale, and mechanism of fragmentation (Franklin *et al.* 2002, p. 27). Habitat fragmentation also can have positive, negative, or neutral effects, depending on the species (Franklin *et al.* 2002, p. 27). As a group, grouse are considered to be particularly intolerant of extensive habitat fragmentation due to their short dispersal distances, specialized food habits, generalized antipredator strategies, and other life-history characteristics (Braun *et al.* 1994, p. 432). Lesser prairie-chickens in particular have a low adaptability to habitat alteration, particularly activities that fragment suitable habitat into smaller, less valuable pieces. Lesser prairie-chickens utilize habitat patches with different vegetative structure dependent upon a particular phase in their life cycle, and the loss of even one of these structural components can significantly reduce the overall value of that habitat to lesser prairie-chickens. Fragmentation not only reduces the size of a given patch but also can reduce the interspersed or variation within a larger habitat patch, possibly eliminating important structural features crucial to lesser prairie-chickens.

Lesser prairie-chickens and other species of prairie grouse require large expanses (i.e., 1,024 to 10,000 ha (2,530 to 24,710 ac)) of interconnected, ecologically diverse native rangelands to complete their life cycles (Woodward *et al.* 2001, p. 261; Flock 2002, p. 130; Fuhlendorf *et al.* 2002, p. 618; Davis 2005, p. 3), more so than almost any other grassland bird (Johnsgard 2002, p. 124). Davis (2005, p. 3) states that the combined home range of all lesser prairie-chickens at a single lek is about 49 sq km (19 sq mi or 12,100 ac). According to Applegate and Riley (1998, p. 14), a viable lek will

have at least six males accompanied by an almost equal number of females. Because leks need to be clustered so that interchange among different leks can occur in order to reduce interbreeding problems on any individual lek, they considered a healthy population to consist of a complex of six to ten viable leks (Applegate and Riley 1998, p. 14).

Consequently, most grouse experts consider the lesser prairie-chicken to be an area-sensitive species, and large areas of intact, unfragmented landscapes of suitable mixed-grass, short-grass, and shrubland habitats are considered essential to sustain functional, self-sustaining populations (Giesen 1998, pp. 3–4; Bidwell *et al.* 2002, pp. 1–3; Hagen *et al.* 2004, pp. 71, 76–77). Therefore, areas of otherwise suitable habitat can readily become functionally unusable due to the effects of fragmentation.

The lesser prairie-chicken has several life-history traits common to most species of grouse that influence its vulnerability to the impacts of fragmentation, including short lifespan, low nest success, strong site fidelity, low mobility, and a relatively small home range. This vulnerability is heightened by the considerable extent of habitat loss that has already occurred over the range of the species. The resiliency and redundancy of these populations have been reduced as the number of populations that formerly occupied the known historical range were lost or became more isolated by fragmentation of that range. Isolation of remaining populations will continue to the extent these populations remain or grow more separated by areas of unsuitable habitat, particularly considering their limited dispersal capabilities (Robb and Schroeder 2005, p. 36).

Fragmentation is becoming a particularly significant ecological driver in lesser prairie-chicken habitats, and several factors are known to be contributing to the observed destruction, modification, or curtailment of the lesser prairie-chicken's habitat or range. Extensive grassland and untilled rangeland habitats historically used by lesser prairie-chickens have become increasingly scarce, and remaining areas of these habitat types continue to be degraded or fragmented by changing land uses. The loss and fragmentation of the mixed-grass, short-grass, and shrubland habitats preferred by lesser prairie-chickens has contributed to a significant reduction in the extent of currently occupied range. Based on the cooperative mapping efforts led by the Playa Lakes Joint Venture and Lesser Prairie-Chicken Interstate Working Group, lesser prairie-chickens are estimated to now occupy only about 16 percent of their estimated historically occupied range. What habitat remains is now highly fragmented (Hagen *et al.* 2011, p. 64).

Several pervasive factors, such as conversion of native grasslands to cultivated agriculture; change in the historical grazing and fire regime; tree invasion and brush encroachment; oil, gas, and wind energy development; road and highway expansion; and others, have been implicated in not only permanently altering the Great Plains landscape but in specifically causing much of the observed loss, alteration, and fragmentation of lesser prairie-chicken habitat (Hagen and Giesen 2005, np.; Elmore *et al.* 2009, pp. 2, 10–11; Hagen *et al.* 2011, p. 64). Additionally, lesser prairie-chickens actively avoid areas of human activity and noise or areas that contain certain vertical features (Robel *et al.* 2004, pp. 260–262; Pitman *et al.* 2005, pp. 1267–1268; Hagen *et al.* 2011, p. 70–71).

Avoidance of vertical features such as trees and transmission lines likely is due to frequent use of these structures as hunting perches by birds of prey (Hagen *et al.* 2011, p. 72). Pitman *et al.* (2005, pp. 1267–1268) observed that lesser prairie-chickens seldom nested or reared broods within approximately 177 m (580 ft) of oil or gas wellheads, 366 m (1,200 ft) of electrical transmission lines, 792 m (2,600 ft) of improved roads, and 1,219 m (4,000 ft) of buildings. The observed avoidance was likely influenced, at least in part, by disturbances such as noise and visual obstruction associated with these features. No lesser prairie-chicken nesting or lekking was observed within 0.8 km (0.5 mi) of a gas line compressor station, and otherwise suitable habitat was avoided within a 1.6-km (1-mi) radius of a coal-fired power plant (Pitman *et al.* 2005, pp. 1267–1268).

Oil and gas development activities, particularly drilling and road and highway construction, also contribute to surface fragmentation of lesser prairie-chicken habitat for many of the same reasons observed with other artificial structures (Hunt and Best 2004, p. 92). The incidence of oil and gas exploration has been rapidly expanding within the range of the lesser prairie-chicken. A more thorough discussion of oil and gas activities within the range of the lesser prairie-chicken is discussed below.

Many of the remaining habitat fragments and adjoining land use types subsequently fail to meet important habitat requirements for lesser prairie-chickens. Other human-induced developments, such as buildings, fences, and many types of vertical structures, which may have an overall smaller physical development footprint per

unit area, serve to functionally fragment otherwise seemingly suitable habitat; this causes lesser prairie-chickens to cease or considerably reduce their use of habitat patches impacted by these developments (Hagen *et al.* 2011 pp. 70–71). As the intervening matrix between the remaining fragments of suitable habitat becomes less suitable, dispersal patterns can be disrupted, effectively isolating remaining islands of habitat. These isolated fragments then become less resilient to the effects of change in the overall landscape and likely will be more prone to localized extinctions. The collective influence of habitat loss, fragmentation, and disturbance effectively reduces the size and suitability of the remaining habitat patches. Pitman *et al.* (2005, p. 1267) calculated that nesting avoidance at the distances they observed would effectively eliminate some 53 percent (7,114 ha; 17,579 ac) of otherwise suitable nesting habitat within their study area in southwestern Kansas. Once the remaining habitat patches fall below the minimum size required by lesser prairie-chickens, these patches become uninhabitable even though they may otherwise provide optimum habitat characteristics. Although a minimum size has not been established, studies and expert opinion, including those regarding greater prairie-chickens, suggest that the minimum parcel size is likely to exceed 100 ha (250 acres) (Samson 1980b, p. 295; Winter and Faaborg 1999, pp. 1429, 1436; Davis 2005, p. 3).

Fragmentation poses a threat to the persistence of local lesser prairie-chicken populations through many of the same mechanisms identified for other species of grassland birds. Factors such as habitat dispersion and the extent of habitat change,

including patch size, edge density, and total rate of landscape change influence juxtaposition and size of remaining patches of rangeland such that they may no longer be large enough to support populations (Samson 1980b, p. 297; Woodward *et al.* 2001, pp. 269–272; Fuhlendorf *et al.* 2002, pp. 623–626). Additionally, necessary habitat heterogeneity may be lost, and habitat patches may accommodate high densities of predators. Ultimately lesser prairie-chicken interchange among suitable patches of habitat may decrease, possibly affecting population and genetic viability (Wilcove *et al.* 1986, pp. 251–252; Knopf 1996, p. 144). Predation can have a major impact on lesser prairie-chicken demography, particularly during the nesting and brood-rearing seasons (Hagen *et al.* 2007, p. 524). Patten *et al.* (2005b, p. 247) concluded that habitat fragmentation, at least in Oklahoma, markedly decreases the probability of long-term population persistence in lesser prairie-chickens.

Many of the biological factors affecting the persistence of lesser prairie-chickens are exacerbated by the effects of habitat fragmentation. For example, human population growth and the resultant accumulation of infrastructure such as roads, buildings, communication towers, and powerlines contribute to fragmentation. We expect that construction of vertical infrastructure such as transmission lines will continue to increase into the foreseeable future, particularly given the increasing development of energy resources and urban areas (see “*Wind Power and Energy Transmission Operation and Development*” below). Where this infrastructure is placed in occupied lesser prairie-chicken habitats, the lesser prairie-chicken likely will be negatively affected. As the

density and distribution of human development continues in the future, direct and functional fragmentation of the landscape will continue. The resultant fragmentation is detrimental to lesser prairie-chickens because they rely on large, expansive areas of contiguous native grassland to complete their life cycle. Given the large areas of contiguous grassland needed by lesser prairie-chickens, we expect that many of these types of developments anticipated in the future will further fragment remaining blocks of suitable habitat and reduce the likelihood of persistence of lesser prairie-chickens over the long term. Long-term persistence is reduced when the suitability of the remaining habitat patches decline, further contributing to the scarcity of suitable contiguous blocks of habitat and resulting in increased human disturbance as parcel size declines. Human populations are increasing throughout the range of the lesser prairie-chicken, and we expect this trend to continue. Given the demographic and economic trends observed over the past several decades, residential development will continue.

The cumulative influence of habitat loss and fragmentation on lesser prairie-chicken distribution is readily apparent at the regional scale. Lesser prairie-chicken populations in eastern New Mexico and the western Texas Panhandle are isolated from the remaining populations in Colorado, Kansas, and Oklahoma. On a smaller, landscape scale, core populations of lesser prairie-chickens within the individual States are isolated from other nearby populations by areas of unsuitable land uses (Robb and Schroeder 2005, p. 16). Then, at the local level within a particular core area of occupied habitat, patches of suitable habitat have been isolated from other suitable habitats by varying

degrees of unsuitable land uses. Very few large, intact patches of suitable habitat remain within the historically occupied landscape.

We conducted a spatial analysis of the extent of fragmentation within the estimated occupied range of the lesser prairie-chicken. Infrastructure features such as roads, transmission lines, airports, cities and similar populated areas, oil and gas wells, and other vertical features such as communication towers and wind turbines were delineated. These features were buffered by known avoidance distances and compared with likely lesser prairie-chicken habitat such as that derived from the Southern Great Plains Crucial Habitat Tool and 2008 LandFire vegetation cover types. Based on this analysis, 99.8 percent of the suitable habitat patches were less than 2,023 ha (5,000 ac) in size. Our analysis revealed that only some 71 patches that were equal to, or larger than, 10,117 ha (25,000 ac) exist within the entire five-state estimated occupied range. Of the patches over 10,117 ha (25,000 ac), all were impacted by fragmenting features, just not to the extent that the patch was fragmented into a smaller sized patch.

This analysis is a very conservative estimate of the extent of fragmentation within the estimated occupied range. We only used reasonably available datasets. Some datasets were unavailable, such as the extent of fences, and other infrastructural features were not fully captured because our datasets were incomplete for those features. Unfortunately, a more precise quantification of the impact of habitat loss and alteration on persistence of the lesser prairie-chicken is complicated by a variety of factors

including time lags in response to habitat changes and a lack of detailed historical information on habitat conditions.

In summary, habitat fragmentation is an ongoing threat that is occurring throughout the occupied range of the lesser prairie-chicken. Similarly, much of the historical range is disjunct and separated by large expanses of unsuitable habitat. Once fragmented, most of the factors contributing to habitat fragmentation cannot be reversed. Many types of human developments likely will exist for extended time periods and will have a significant, lasting adverse influence on persistence of lesser prairie-chickens. Therefore, current and future habitat fragmentation is a threat to the lesser prairie-chicken. In the sections that follow, we will examine the various causes of lesser prairie-chicken habitat fragmentation in more detail.

Habitat Conversion for Agriculture

At the time the lesser prairie-chicken was determined to be taxonomically distinct from the greater prairie-chicken in 1885, much of the historical range was already being subjected to alteration as settlement of the Great Plains progressed. EuroAmerican settlement in New Mexico and Texas began prior to the 1700s, and at least one trading post already had been established in Colorado by 1825 (Coulson and Joyce 2003, pp. 34, 41, 44). Kansas had become a territory by 1854 and had already experienced an influx of settlers due to establishment of the Santa Fe Trail in 1821 (Coulson and Joyce 2003, p.

37). Western Oklahoma was the last area to experience extensive settlement with the start of the land run in 1889.

Settlement obviously brought about many changes within the historical range of the lesser prairie-chicken. Between 1915 and 1925, considerable areas of prairie sod had been plowed in the Great Plains and planted to wheat (Laycock 1987, p. 4). By the 1930s, the lesser prairie-chicken had begun to disappear from areas where it had been considered abundant with populations nearing extirpation in Colorado, Kansas, and New Mexico, and markedly reduced in Oklahoma and Texas. Several experts on the lesser prairie-chicken identified conversion of native sand sagebrush and shinnery oak rangeland to cultivated agriculture as an important factor in the decline of lesser prairie-chicken populations (Copelin 1963, p. 8; Jackson and DeArment 1963, p. 733; Crawford and Bolen 1976a, p. 102; Crawford 1980, p. 2; Taylor and Guthery 1980b, p. 2; Braun *et al.* 1994, pp. 429, 432–433; Mote *et al.* 1999, p. 3). By the 1930s, Bent (1932, pp. 283–284) hypothesized that extensive cultivation and overgrazing had already caused the species to disappear from portions of the historical range where lesser prairie-chickens had once been abundant. Additional areas of previously unbroken grassland were brought into cultivation in the 1940s, 1970s, and 1980s (Laycock 1987, pp. 4–5). Bragg and Steuter (1996, p. 61) estimated that by 1993, only 8 percent of the bluestem-grama association and 58 percent of the mesquite-buffalo grass association, as described by Kuchler (1964, entire), remained.

As the amount of native grasslands and untilled native rangeland declined in response to increasing settlement, the amount of suitable habitat capable of supporting lesser prairie-chicken populations declined accordingly. Correspondingly, as the amount of available suitable habitat diminished, carrying capacity was reduced and the number of lesser prairie-chickens declined. However, documenting the degree to which these settlement-induced impacts occurred is complicated by a lack of solid historical information on population size and extent of suitable habitat. Additionally, because cultivated grain crops may have provided increased or more dependable winter food supplies (Braun *et al.* 1994, p. 429), the initial conversion of smaller patches of native prairie to cultivation may have been temporarily beneficial to the species. Sharpe (1968, pp. 46–50) believed that the presence of cultivated grains may have facilitated the temporary occurrence of lesser prairie-chickens in Nebraska. However, landscapes having greater than 20 to 37 percent cultivated grains may not support stable lesser prairie-chicken populations (Crawford and Bolen 1976a, p. 102). While lesser prairie-chickens may forage in agricultural croplands, they avoid landscapes dominated by cultivated agriculture, particularly where small grains are not the dominant crop (Crawford and Bolen 1976a, p. 102). Areas of cropland do not provide adequate year-round food or cover for lesser prairie-chickens. Much of the historical lesser prairie-chicken habitat has already been converted to agricultural cropland.

In the Service's June 7, 1998, 12-month finding for the lesser prairie-chicken (63 FR 31400), we attempted to assess the loss of native rangeland using data available

through the National Resources Inventory of the USDA NRCS. However, very limited information on lesser prairie-chicken status was available to us prior to 1982. When we examined the 1992 National Resources Inventory Summary Report, we were able to estimate the change in rangeland acreage between 1982 and 1992 by each State within the range of the lesser prairie-chicken. As expected, when the trends were examined statewide, each of the five States within the range of the lesser prairie-chicken showed a decline in the amount of rangeland acreage over that time period, indicating that conversion of lesser prairie-chicken habitat likely continued to occur since the 1980s. In assessing the change specifically within areas occupied by lesser prairie-chickens, we then narrowed our analysis to just those counties where lesser prairie-chickens were known to occur. That analysis, which was based on the information available at that time, used a much smaller extent of estimated occupied range than likely occurred at that time. The analysis of the estimate change in rangeland acreage between 1982 and 1992, for counties specifically within lesser prairie-chicken range, did not demonstrate a statistically significant change, possibly due to small sample size and large variation about the mean. In this analysis, the data for the entire county was used without restricting to just those areas estimated to be within the historical and currently occupied ranges. A more recent, area-sensitive analysis was needed.

Although a more recent analysis of the Natural Resources Inventory information was desired, we were unable to obtain specific county-by-county information because the NRCS no longer releases county-level information. Release of Natural Resources

Inventory results is guided by NRCS policy and is in accordance with Office of Management and Budget and USDA Quality of Information Guidelines developed in 2001. NRCS releases Natural Resources Inventory estimates only when they meet statistical standards and are scientifically credible in accordance with these policies. In general, the Natural Resources Inventory survey system was not developed to provide acceptable estimates for areas as small as counties but rather for analyses conducted at the national, regional, and state levels, and for certain sub-state regions (Harper 2012).

We then attempted to use the 1992 National Land Cover Data (NLCD) information to estimate the extent and change in certain land cover types. The NLCD was the first land-cover mapping project that was national in scope and is based on images from the Landsat thematic mapper. No other national land-cover mapping program had previously been undertaken, despite the availability of Landsat thematic mapper information since 1984. The 1992 NLCD provides information on 21 different land cover classes at a 30-meter resolution. Based on the 1992 NLCD, and confining our analysis to just the known historical and currently occupied range, we estimated that there were 137,073.6 sq km (52,924.4 sq mi) of cultivated cropland in the entire historical range and 16,436.9 sq km (6,346.3 sq mi) in the currently occupied range. This includes areas planted to row crops, such as corn and cotton, small grains like wheat and *Hordeum vulgare* (barley), and fallow cultivated areas that had visible vegetation at the time of the imagery.

Estimating the extent of untilled rangeland is slightly more complicated. The extent of grassland areas dominated by native grasses and forbs could be determined in a manner similar to that for cultivated cropland. We estimated from the 1992 NLCD that there were 207,846 sq km (80,250 sq mi) of grassland within the entire historical range, with only some 49,000 sq km (18,919 sq mi) of grassland in the currently occupied range. However, the extent of shrubland also must be included in the analysis because areas classified as shrubland (i.e., areas having a canopy cover of greater than 25 percent) are used by lesser prairie-chicken, such as shinnery oak grasslands, and also may be grazed by livestock. We estimated that there were 92,799 sq km (35,830 sq mi) of shrubland within the entire historical range with some 4,439 sq km (1,714 sq mi) of shrubland in the currently occupied range, based on the 1992 NLCD.

These values can then be compared with those available through the 2006 NLCD information to provide a rough approximation of the change in land use since 1992. In contrast to the 1992 NLCD, the 2006 NLCD provides information on only 16 different land cover classes at a 30-meter resolution. Based on this dataset, and confining our analysis to just the known historical and currently occupied range, we estimated that there were 126,579 sq km (48,872 sq mi) of cultivated cropland in the entire historical range and 19,588 sq km (7,563 sq mi) in the currently occupied range. This cover type consists of any areas used annually to produce a crop and includes any land that is being actively tilled. Estimating the extent of untilled rangeland is conducted similarly to that for 1992. Using the 2006 NLCD, we estimated that there were 163,011 sq km (62,939 sq mi) of

grassland within the entire historical range with some 42,728 sq km (16,497 sq mi) of grassland in the currently occupied range. In 2006, the shrubland cover type was replaced by a shrub-scrub cover type. This new cover type was defined as the areas dominated by shrubs less than 5 m (16 ft) tall with a canopy cover of greater than 20 percent. We estimated that there were 146,818 sq km (56,686 sq mi) of shrub/scrub within the entire historical range, with some 10,291 sq km (3,973 sq mi) of shrub/scrub in the currently occupied range.

Despite the difference in the classification of land cover between 1992 and 2006, we were able to make rough comparisons between the two datasets. A comparison reveals that apparently the extent of cropland within the entire historical range declined between 1992 and 2006. In contrast, within the occupied range, the extent of cropland areas increased during that same period. A comparison of the grassland and untilled rangeland indicates that the amount of grassland declined in both the historical range and the occupied range between 1992 and 2006. However, the amount of shrub-dominated lands increased in both the historical and currently occupied range. Overall, the estimated amount of grassland and shrub-dominated land, as an indicator of untilled rangelands, increased somewhat over the historical range during that period but declined slightly within the occupied range during the same period. Based on the definition of shrub/scrub cover type in 2006, the observed increases in shrub-dominated cover only could have been due to increased abundance of eastern red cedar, an invasive woody

species that tends to decrease suitability of grasslands and untilled rangelands for lesser prairie-chickens (Woodward *et al.* 2001, pp. 270–271; Fuhlendorf *et al.* 2002, p. 625).

However, direct comparison between the 1992 and 2006 NLCD is problematic due to several factors. First, the 1992 NLCD was based on an unsupervised classification algorithm (an iterative process used to classify or “cluster” data obtained using remote sensing), whereas NLCD 2001 and later versions were based on a supervised classification and regression tree algorithm (data classification in which the data analyst uses available information to assist in the classification). Second, terrain corrections for the 1992 NLCD were based on digital elevation models with a 90-meter spatial resolution, whereas terrain correction for NLCD 2001 and later used 30-meter digital elevation models. Third, the impervious surface mapping that is part of NLCD 2001 and later versions resulted in the identification of many more roads than could be identified in the 1992 NLCD. However, most of these roads were present in 1992. Fourth, the imagery for the 2001 NLCD and later versions was corrected for atmospheric effects prior to classification, whereas NLCD 1992 imagery was not. Lastly, there are subtle differences between the NLCD 1992 and NLCD 2001 land-cover legends. Additionally, we did not have an estimated occupied range for 1992. Instead we used the occupied range as is currently estimated. The comparison in the amount of cropland, grassland, and shrubland could be influenced by a change in the amount of occupied range in 1992. Due to the influence of CRP grasslands (discussed below) on the distribution of lesser prairie-chickens in Kansas, the occupied range was much smaller in 1992. One would

anticipate that the influence of CRP establishment north of the Arkansas River in Kansas might have led to considerably more areas of grassland in 2006 as compared to 1992. However, the amount of grassland was observed to have declined within the occupied range of the lesser prairie-chicken between 1992 and 2006, possibly indicating that the extent of grasslands continued to decline despite the increase in CRP grasslands.

If we restrict our analysis to Kansas alone, the extent of grasslands in 1992 was about 39,381 sq km (15,205 sq mi) within the historical range and 22,923 sq km (8850 sq mi) in the occupied range. In 2006, the extent of grasslands in Kansas was some 27,351 sq km (10,560 sq mi) within the historical range and 18,222 sq km (7,035 sq mi) in the occupied range. While not definitive, the analysis indicates that the extent of grasslands continued to decline even in Kansas where lesser prairie-chicken populations are declining but more robust than in other States.

In summary, conversion of the native grassland habitats used by lesser prairie-chickens for agricultural uses has resulted in the permanent, and in some limited instances, temporary loss or alteration of habitats used for feeding, sheltering, and reproduction. Consequently, populations of lesser prairie-chickens likely have been extirpated or significantly reduced, underscoring the degree of impact that historical conversion of native grasslands has posed to the species. We expect a very large proportion of the land area that is currently in agricultural production will likely remain so over the foreseeable future because we have no information to suggest that agricultural

practices are likely to change. While persistent drought and declining supplies of water for irrigation may lead to conversion of some croplands to a noncropland state, we anticipate that the majority of cropland will continue to be used to produce a crop. Because considerable areas of suitable arable lands have already been converted to agricultural production, we do not expect significant additional, future habitat conversion to agriculture within the range of the lesser prairie-chicken. However, as implementation of certain agricultural conservation programs like the CRP change programmatically, some continued conversion of grassland back into cultivation is still expected to occur. Conservation Reserve Program contracts, as authorized and outlined by regulation, are of limited, temporary duration, and the program is subject to funding by Congress. We also recognize that the historical large-scale conversion of grasslands to agricultural production has resulted in fragmented grassland and shrubland habitats used by lesser prairie-chickens such that currently occupied lands are not adequate to provide for the conservation of the species into the foreseeable future, particularly when cumulatively considering the threats to the lesser prairie-chicken.

Conservation Reserve Program (CRP)

The loss of lesser prairie-chicken habitat due to conversion of native grasslands to cultivated agriculture has been mitigated somewhat by the CRP. Authorization and subsequent implementation of the CRP began under the 1985 Food Security Act and, since that time, has facilitated restoration of millions of acres of marginal and highly

erosive cropland to grassland, shrubland, and forest habitats (Riffell and Burger 2006, p. 6). The CRP is administered by the USDA's Farm Service Agency and was established primarily to control soil erosion on cropland by converting cropped areas to a vegetative cover such as perennial grassland. Under the general signup process, lands are enrolled in CRP using a competitive selection process. However, certain environmentally desirable lands can be enrolled at any time under a continuous signup process.

Additional programs, such as the Conservation Reserve Enhancement Program and designation as a Conservation Priority Area can be used to target enrollment of CRP. Participating producers receive an annual rental payment for the duration of a multiyear CRP contract. Cost sharing is provided to assist in the establishment of the vegetative cover practices. Once the CRP contract expires, typically after 10 to 15 years, landowners have the option to reenroll in the program, convert lands back to cropland, or leave lands in a noncropland state.

In 2009, the enrollment authority or acreage cap for CRP was reduced from 15.9 million ha (39.2 million ac) nationwide to 12.9 million ha (32.0 million ac) through fiscal year 2012, with 1.8 million ha (4.5 million ac) allocated to targeted (continuous) signup programs. Future enrollment authority is unknown and dependent on passage of a new Farm Bill and subsequent funding by Congress. Within a given county, no more than 25 percent of that county's cropland acreage may be enrolled in CRP and the Wetland Reserve Program. A waiver of this acreage cap may be granted under certain circumstances. These caps influence the maximum amounts of cropland that may exist in

CRP at any one time. Since 2004, midcontract management has been required on contracts executed after fiscal year 2004 and is voluntary for contracts accepted before that time. Typically these management activities, such as prescribed burning, tree thinning, disking, or herbicide application to control invasive species, are generally prohibited during the primary avian nesting and brood rearing season. Under the CRP, several forms of limited harvest, haying, and grazing are authorized, including emergency haying and grazing. Emergency haying and grazing may be granted on CRP lands to provide relief to ranchers in areas affected by drought or other natural disaster to minimize loss or culling of livestock herds. Haying and grazing under both managed and emergency conditions have the potential to significantly negatively impact vegetation if the amount of forage removed is excessive and prolonged, or if livestock numbers are sufficient to contribute to soil compaction. Additionally, the installation of wind turbines, windmills, wind monitoring devices, or other wind-powered generation equipment may be installed on CRP acreage on a case-by-case basis. Up to 2 ha (5 ac) of wind turbines per contract may be approved.

Lands enrolled in CRP encompasses a significant portion of currently occupied range in several lesser prairie-chicken States, but particularly in Kansas where an increase in the lesser prairie-chicken population is directly related to the amount of land that was enrolled in the CRP and planted to native grasses. Enrollment information is publically available from the Farm Services Agency at the county level. However, specific locations of individual CRP acreages are not publically available due to needs to

protect privacy of the individual landowner. The Playa Lakes Joint Venture has an agreement with the Farm Services Agency that allows them to use available data on individual CRP allotments for conservation purposes, provided the privacy of the landowner is protected. The Playa Lakes Joint Venture, using this information, has been able to determine the extent of CRP lands within the estimated occupied range of the lesser prairie-chicken over all five lesser prairie-chicken States (McLachlan *et al.* 2011, p. 24). In conducting this analysis, they restricted their analysis to only those lands that were planted to a grass type of conservation cover and they evaluated all lands within the estimated occupied range, including a 16 km (10 mi) buffer surrounding the occupied areas. Based on this analysis, Kansas was determined to have the most land enrolled in CRP with a grass cover type. Kansas has some 600,000 ha (1,483,027 ac) followed by Texas with some 496,000 ha (1,227,695 ac) of grassland CRP. Enrolled acreages in Colorado, New Mexico, and Oklahoma are 193,064 ha (477,071 ac), 153,000 ha (379,356 ac), and 166,000 ha (410,279 ac), respectively. The amount of grass type CRP within the estimated occupied range totals just over 1.6 million ha (3.9 million ac). While the extent of CRP may have changed slightly due to recent enrollments and re-enrollments and any contract expirations that may have occurred since the study was conducted, the figures serve to highlight the importance of CRP for lesser prairie-chickens. Based on the estimated amount of occupied habitat remaining in these States, CRP fields having a grass type of conservation cover in Kansas comprise some 20.6 percent of the occupied lesser prairie-chicken range, 45.8 percent of the occupied range in Colorado, and 40.9 percent of the occupied range in Texas. New Mexico and

Oklahoma have smaller percentages of CRP within the occupied range, 17.9 and 15.1 percent, respectively. When the sizes of the CRP fields were examined, Kansas had some 53 percent, on average, of the enrolled lands that constituted large habitat blocks, as defined. A large block was defined as areas that were at least 5,000 acres in size with minimal amounts of woodland, roads, and developed areas (McLachlan *et al.* 2011, p. 14). All of the other States had 15 percent or less of the enrolled CRP in a large block configuration.

The importance of CRP habitat to the status and survival of lesser prairie-chicken was recently emphasized by Rodgers and Hoffman (2005, pp. 122–123). They determined that the presence of CRP lands planted with native species of grasses facilitated the expansion of lesser prairie-chicken range in Colorado, Kansas, and New Mexico. The range expansion in Kansas resulted in strong population increases there (Rodgers and Hoffman 2005, pp. 122–123). However, in Oklahoma, Texas, and some portions of New Mexico, many CRP fields were planted with a monoculture of introduced grasses. Where introduced grasses were planted, lesser prairie-chickens did not demonstrate a range expansion or an increase in population size (Rodgers and Hoffman 2005, p. 123). An analysis of lesser prairie-chicken habitat quality within a subsample of 1,019 CRP contracts across all five lesser prairie-chicken States was recently conducted by the Rocky Mountain Bird Observatory (Ripper and VerCauteren 2007, entire). They found that, particularly in Oklahoma and Texas, contracts executed during earlier signup periods allowed planting of monocultures of exotic grasses, such as

Bothriochloa sp. (old-world bluestem) and *Eragrostis curvula* (weeping lovegrass), which provide poor-quality habitat for lesser prairie-chicken (Ripper and VerCauteren 2007, p. 11). Correspondingly, a high-priority conservation recommendation from this study intended to benefit lesser prairie-chickens was to convert existing CRP fields planted in exotic grasses into fields supporting taller, native grass species and to enhance the diversity of native forbs and shrubs used under these contracts. Generally, pure stands of grass lack the habitat heterogeneity and structure preferred by lesser prairie-chickens. Subsequent program adjustments have encouraged the planting of native grass species on CRP enrollments.

Predicting the fate of the CRP and its influence on the lesser prairie-chicken into the future is difficult. The expiration of a contract does not automatically trigger a change in land use. The future of CRP lands is dependent upon three sets of interacting factors: the long-term economies of livestock and crop production, the characteristics and attitudes of CRP owners and operators, and the direct and indirect incentives of existing and future agricultural policy (Heimlich and Kula 1990, p. 7). As human populations continue to grow, the worldwide demands for livestock and crop production are likely to continue to grow. If demand for U.S. wheat and feed grains is high, pressure to convert CRP lands back to cropland will be strong. However, in 1990, all five States encompassing the historical range of the lesser prairie-chicken were among the top 10 States expected to retain lands in grass following contract expiration (Heimlich and Kula 1990, p. 10). A survey of the attitudes of existing CRP contract holders in Kansas, where

much of the existing CRP land occurs, revealed that slightly over 36 percent of landowners with an existing contract had made no plans or were uncertain about what they would do once the CRP contract expired (Diebel *et al.* 1993, p. 35). An equal percentage stated that they intended to keep lands in grass for livestock grazing (Diebel *et al.* 1993, p. 35). Some 24 percent of enrolled landowners expected they would return to annual crop production in accordance with existing conservation compliance provisions (Diebel *et al.* 1993, p. 35). The participating landowners stated that market prices for crops and livestock was the most important factor influencing their decision, with availability of cost sharing for fencing and water development for livestock also being an important consideration. However, only a small percentage, about 15 percent, were willing to leave their CRP acreages in permanent cover after contract expiration where incentives were lacking (Diebel *et al.* 1993, p. 8).

Although demand for agricultural commodities and the opinions of the landowners are important, existing and future agricultural policy is expected to have the largest influence on the fate of CRP (Heimlich and Kula 1990, p.10). The CRP was most recently renewed under the Food, Conservation, and Energy Act of 2008 and is due for reauthorization in 2012. The most recent CRP general signup for individual landowners began March 12, 2012, and expired April 13, 2012. The extent to which existing CRP lands were reenrolled or new lands enrolled into the program is unknown. A new Farm Bill, which will establish the guidelines for CRP over the next five years, is currently

under development and the ramifications of this policy on the future of CRP are unknown.

The possibility exists that escalating grain prices due to the recent emphasis on generating domestic energy from biofuels, such as ethanol from corn, grain sorghum, and switchgrass, combined with Federal budget reductions that reduce or eliminate CRP enrollments and renewals, will result in an unprecedented conversion of existing CRP acreage within the Great Plains back to cropland (Babcock and Hart 2008, p. 6). In 2006, the USDA Farm Service Agency provided a small percentage of current CRP contract holders whose contracts were set to expire during 2007 to 2010, with an opportunity (termed REX) to reenroll (10–15 year terms) or extend (2–5 year terms) their contracts. The opportunity to reenroll or extend their contracts was based on the relative environmental benefits of each contract. In March of 2007, the USDA expected that some 9.7 million ha (23.9 million ac) out of the total 11.3 million ha (28 million ac) of eligible CRP contracts would be reenrolled. The remaining 1.7 million ha (4.1 million ac) would be eligible for conversion to crop production or other uses.

Should large-scale loss or reductions in CRP acreages occur, either by reduced enrollments or by conversion back to cultivation upon expiration of existing contracts, the loss of CRP acreage would further diminish the amount of suitable lesser prairie-chicken habitat. This concern is particularly relevant in Kansas where CRP acreages planted to native grass mixtures facilitated an expansion of the occupied lesser prairie-

chicken range in that State. In States that planted a predominance of CRP to exotic grasses, loss of CRP in those States would not be as significant as it would in Kansas where CRP largely was planted to native grass and exists in relatively larger habitat blocks. A reduction in CRP acreage could lead to contraction of the currently occupied range and reduced numbers of lesser prairie-chicken rangewide and poses a threat to the status of existing lesser prairie-chicken populations. While the CRP program has had a beneficial effect on the lesser prairie-chicken, particularly in Kansas, the contracts are short term in nature and, given current government efforts to reduce the Federal budget deficit, additional significant new enrollments in CRP are not anticipated. However, we anticipate that some CRP grassland acreages would be reenrolled in the program once contracts expire, subject to the established acreage cap.

A recent analysis of CRP by the National Resources Conservation Service (J. Ungerer and C. Hagen, 2012, Personal Communication) revealed that between 2008 and 2011, some 675,000 acres of CRP contracts expired within the estimated occupied range, the majority located in Kansas. However many of those expired lands remained in grass. Values varied from a low of 72.4 percent remaining in grass in Colorado to a high of 97.5 percent in New Mexico. Kansas was estimated to have some 90.2 percent of the expired acres during this period still in grass. Values for Oklahoma and Texas had not yet been determined. We expect that many of the acreages that remain in grass in New Mexico are likely composed of exotic species of grasses. Despite a small overall loss in CRP acreage, we are encouraged by the relatively high percentage of CRP that remains in

grass. However, we remain concerned that the potential for significant loss of CRP acreages remains, particularly considering the attitudes of Kansas landowners as previously discussed above. The importance of CRP to lesser prairie-chickens, particularly in Kansas, is high and continued loss of CRP within the occupied range would be detrimental to lesser prairie-chicken conservation.

We also remain concerned about the future value of these grasslands to the lesser prairie-chicken. We assume that many of these CRP grasslands that remain in grass after their contract expires could be influenced by factors addressed elsewhere in this proposed rule. Encroachment by woody vegetation, fencing, wind power development, and construction of associated transmission lines have the potential to reduce the value of these areas even if they continue to remain in grass. Unless specific efforts are made to target enrollment of CRP in areas important to lesser prairie-chickens, future enrollments likely will do little to reduce fragmentation or enhance connectivity between existing populations. Considering much of the existing CRP in Kansas was identified as supporting large blocks of suitable habitat, as discussed above, fracturing of these blocks into smaller, less suitable parcels by the threats identified in this proposed rule would reduce the value of these grasslands for lesser prairie-chickens.

In summary, we recognize that lands already converted to cultivated agriculture are located throughout the current and historical range of the lesser prairie-chicken and are, therefore, perpetuating habitat fragmentation within the range of the lesser prairie-

chicken. We expect that CRP will continue to provide a means of temporarily restoring cropland to grassland and provide habitat for lesser prairie-chickens where planting mixtures and maintenance activities are appropriate. However, we expect that, in spite of the at least temporary benefits provided by CRP, most of the areas already in agricultural production will remain so into the foreseeable future. While CRP has contributed to restoration of grassland habitats and has influenced abundance and distribution of lesser prairie-chickens in some areas, we expect these lands to be subject to conversion back to cropland as economic conditions change in the foreseeable future possibly reducing the overall benefit of the CRP to the landowner. We do not anticipate that CRP, at current and anticipated funding levels, will cause significant, permanent increases in the extent of native grassland within the range of the lesser prairie-chicken (Coppedge *et al.* 2001, p. 57). Consequently, CRP grasslands alone are not adequate to provide for the long-term persistence of the species, particularly when the known threats to the lesser prairie-chicken are considered cumulatively.

Livestock Grazing

Habitats used by the lesser prairie-chicken are dominated naturally by a diversity of drought-tolerant perennial grasses and shrubs. Grazing has long been an ecological driving force within the ecosystems of the Great Plains (Stebbins 1981, p. 84), and much of the untilled grasslands within the range of the lesser prairie-chicken continue to be grazed by livestock and other animals. The evolutionary history of the mixed-grass

prairie has produced endemic bird species adapted to an ever-changing mosaic of lightly to severely grazed grasslands (Bragg and Steuter 1996, p. 54; Knopf and Samson 1997, pp. 277–279, 283). As such, grazing by domestic livestock is not inherently detrimental to lesser prairie-chicken management. However, recent grazing practices have produced habitat conditions that differ in significant ways from the historical mosaic, such as by reducing the amount of ungrazed to lightly grazed habitat. These altered conditions are less suitable for the lesser prairie-chicken (Hamerstrom and Hamerstrom 1961, pp. 289–290; Davis *et al.* 1979, pp. 56, 116; Taylor and Guthery 1980a, p. 2; Bidwell and Peoples 1991, pp. 1–2).

Livestock grazing most clearly affects lesser prairie-chickens when it alters the composition and structure of mixed-grass habitats used by the species. Domestic livestock and native ungulates differentially alter native prairie vegetation, in part through different foraging preferences (Steuter and Hidinger 1999, pp. 332–333; Towne *et al.* 2005, p. 1557). Additionally, domestic livestock grazing, particularly when confined to small pastures, often is managed in ways that produces more uniform utilization of forage and greater total utilization of forage, in comparison to conditions produced historically by free-ranging plains bison (*Bison bison*) herds. For example, grazing by domestic livestock tends to be less patchy, particularly when livestock are confined to specific pastures. Such management practices and their consequences may actually exceed the effect produced by differences in forage preferences (Towne *et al.* 2005, p. 1558) but, in any case, produce an additive effect on plant community characteristics.

The effects of livestock grazing, particularly overgrazing or overutilization, are most readily observed through changes in plant community composition and other vegetative characteristics (Fleischner 1994, pp. 630–631; Stoddart *et al.* 1975, p. 267). Typical vegetative indicators include changes in the composition and proportion of desired plant species and overall reductions in forage. Plant height and density may decline, particularly when plant regeneration is hindered, and community composition shifts to show increased proportions of less desirable species.

Grazing management favorable to persistence of the lesser prairie-chicken must ensure that a diversity of plants and cover types, including shrubs, remain on the landscape (Taylor and Guthery 1980a, p. 7; Bell 2005, p. 4), and that utilization levels leave sufficient cover in the spring to ensure that lesser prairie-chicken nests are adequately concealed from predators (Davis *et al.* 1979, p. 49; Wisdom 1980, p. 33; Riley *et al.* 1992, p. 386; Giesen 1994a, p. 98). Where grazing regimes leave limited residual cover in the spring, protection of lesser prairie-chicken nests may be inadequate and desirable food plants can be scarce (Bent 1932, p. 280; Cannon and Knopf 1980, pp. 73–74; Crawford 1980, p. 3). Because lesser prairie-chickens depend on medium and tall grass species that are preferentially grazed by cattle, in regions of low rainfall, the habitat is easily overgrazed in regard to characteristics needed by lesser prairie-chickens (Hamerstrom and Hamerstrom 1961, p. 290). In addition, when grasslands are in a deteriorated condition due to overgrazing and overutilization, the soils have less water-

holding capacity, and the availability of succulent vegetation and insects utilized by lesser prairie-chicken chicks is reduced. Many effects of overgrazing and overutilization on habitat quality are similar to effects produced by drought and likely are exacerbated by actual drought conditions (Davis *et al.* 1979, p. 122; Merchant 1982, pp. 31–33) (see separate discussion under “Drought” in “Extreme Weather Events” below).

Fencing is a fundamental tool of livestock management but often leads to structural fragmentation of the landscape. Fencing and related structural fragmentation can be particularly detrimental to the lesser prairie-chicken in areas, such as western Oklahoma, where initial settlement patterns favored larger numbers of smaller parcels for individual settlers (Patten *et al.* 2005b, p. 245). Fencing also can cause direct mortality through forceful collisions, by creation of raptor perch sites, and by creation of enhanced movement corridors for predators (Wolfe *et al.* 2007, pp. 96–97, 101). However, not all fences present the same mortality risk to lesser prairie-chickens. Mortality risk would appear to be dependent on factors such as fencing design (height, type, number of strands), landscape topography, and proximity to habitats, particularly leks, used by lesser prairie chickens. Other factors such as the length and density of fences also appear to influence the effects of these structures on lesser prairie-chickens. However, studies on the impacts of different fencing designs and locations with respect to collision mortality in lesser prairie-chickens have not been conducted. Additional discussion related to impacts of collisions with fences and similar linear features are found in the “Collision Mortality” section below.

Recent rangeland management includes influential elements besides livestock species selection, grazing levels, and fencing, such as applications of fire (usually to promote forage quality for livestock) and water management regimes (usually to provide water supplies for livestock). Current grazing management strategies are commonly implemented in ways that are vastly different and less variable than historical conditions (Knopf and Sampson 1997, pp. 277–79). These practices have contributed to overall changes in the composition and structure of mixed-grass habitats, often making them less suitable for the lesser prairie-chicken.

Livestock are known to inadvertently flush lesser prairie-chickens and trample lesser prairie-chicken nests. This can cause direct mortality to lesser prairie-chicken eggs or chicks or may cause adults to permanently abandon their nests, again resulting in loss of young. For example, Pitman *et al.* (2006a, pp. 27–29) estimated nest loss from trampling by cattle to be about 1.9 percent of known nests. Additionally, even brief flushings of adults from nests can expose eggs and chicks to predation. Although documented, the significance of direct livestock effects on the lesser prairie-chicken is largely unknown.

Detailed, rangewide information is lacking on the extent, intensity, and forms of recent grazing, and associated effects on the lesser prairie-chicken. However, livestock grazing occurs over such a large portion of the area currently occupied by lesser prairie-

chickens that any degradation of habitat it causes is likely to produce population-level impacts on the lesser prairie-chicken. Where uniform grazing regimes have left inadequate residual cover in the spring, detrimental effects to lesser prairie-chicken populations have been observed (Bent 1932, p. 280; Davis *et al.* 1979, pp. 56, 116; Cannon and Knopf 1980, pp. 73–74; Crawford 1980, p. 3; Bidwell and Peoples 1991, pp. 1–2; Riley *et al.* 1992, p. 387; Giesen 1994a, p. 97). Some studies have shown that overgrazing in specific portions of the lesser prairie-chicken's occupied range has been detrimental to the species. Taylor and Guthery (1980a, p. 2) believed overgrazing explained the demise of the lesser prairie-chicken in portions of Texas but thought lesser prairie-chickens could maintain low populations in some areas with high-intensity, long-term grazing. In New Mexico, Patten *et al.* (2006, pp. 11, 16) found that grazing did not have an overall influence on where lesser prairie-chickens occurred within their study areas, but there was some evidence that the species did not nest in portions of the study area subjected to cattle grazing. In some areas within lesser prairie-chicken range, long-term high-intensity grazing results in reduced availability of lightly grazed habitat available to support successful nesting (Jackson and DeArment 1963, p. 737; Davis *et al.* 1979, pp. 56, 116; Taylor and Guthery 1980a, p. 12; Davies 1992, pp. 8, 13).

In summary, domestic livestock grazing (including management practices commonly used to benefit livestock production) has altered the composition and structure of mixed-grass habitats historically used by the lesser prairie-chicken. Much of the remaining remnants of mixed-grass prairie and rangeland, while still important to the

lesser prairie-chicken, exhibit conditions quite different from those that prevailed prior to EuroAmerican settlement. These changes have considerably reduced the suitability of remnant areas as habitat for lesser prairie-chickens. Where habitats are no longer suitable for lesser prairie-chicken, these areas can contribute to fragmentation within the landscape even though they may remain in native prairie. Where improper livestock grazing has degraded native grasslands and shrublands, we do not expect those areas to significantly contribute to persistence of the lesser prairie-chicken, particularly when considered cumulatively with the influence of the other known threats.

Collision Mortality

Wire fencing is ubiquitous throughout the Great Plains as the primary means of confining livestock to ranches and pastures or excluding them from areas not intended for grazing, such as CRP lands, agricultural fields, and public roads. As a result, thousands of miles of fencing, primarily barbed wire, have been constructed throughout lesser prairie-chicken range. Like most grassland wildlife throughout the Great Plains, the lesser prairie-chicken evolved in open habitats free of vertical structures or flight hazards, such as linear wires. Until recently, unnatural linear features such as fences, power lines, and similar wire structures were seldom perceived as a significant threat at the population level (Wolfe *et al.* 2007, p. 101). Information on the influence of vertical structures is provided elsewhere in this document.

Mortality of prairie grouse caused by collisions with power lines has been occurring for decades, but the overall extent is largely unmonitored. Leopold (1933, p. 353) mentions a two-cable transmission line in Iowa where the landowner would find as many as a dozen dead or injured greater prairie-chickens beneath the line annually. Prompted by recent reports of high collision rates in species of European grouse (Petty 1995, p. 3; Baines and Summers 1997, p. 941; Bevanger and Broseth 2000, p. 124; Bevanger and Broseth 2004, p. 72) and seemingly unnatural rates of mortality in some local populations of lesser prairie-chicken, the Sutton Center began to investigate collision mortality in lesser prairie-chickens. From 1999 to 2004, researchers recovered 322 carcasses of radio-marked lesser prairie-chickens in New Mexico, Oklahoma, and portions of the Texas panhandle. For lesser prairie-chickens in which the cause of death could be determined, 42 percent of mortality in Oklahoma was attributable to collisions with fences, power lines, or automobiles. In New Mexico, only 14 percent of mortality could be traced to collision. The difference in rates of observed collision between States was attributed to differences in the amount of fencing on the landscape resulting from differential land settlement patterns in the two States (Patten *et al.* 2005b, p. 245).

With between 14 and 42 percent of adult lesser prairie-chicken mortality currently attributable to collision with human-induced structures, Wolfe *et al.* (2007, p. 101) assert that fence collisions will negatively influence long-term population viability for lesser prairie-chickens. Precisely quantifying the scope of the impact of fence collisions rangewide is difficult due to a lack of relevant information. However, we suspect that

hundreds of miles of fences are constructed annually within the historical range of the lesser prairie-chicken. Frequently these fences replace existing fence lines and often new fences are constructed. We suspect that only rarely are old fences removed due to labor involved in removing unneeded fences. While we are unable to quantify the amount of new fencing being constructed, collision with fences and other linear features is likely an important source of mortality for lesser prairie-chicken, particularly in some localized areas.

Fence collisions are known to be a significant source of mortality in other grouse. Moss (2001, p. 256) modeled the estimated future population of capercaillie grouse (*Tetrao urogallus*) in Scotland and found that, by removing fence collision risks, the entire Scotland breeding population would consist of 1,300 instead of 40 females by 2014. Similarly, recent experiments involving fence marking to increase visibility resulted in a 71 percent overall reduction in grouse collisions in Scotland (Baines and Andrew 2003, p. 174). Additionally, proximity to power lines has been associated with extirpations of Gunnison and greater sage-grouse (Wisdom *et al.* 2011, pp. 467–468).

As previously discussed, collision and mortality risk appears to be dependent on factors such as fencing design (height, type, number of strands), length, and density, as well as landscape topography and proximity of fences to habitats used by lesser prairie-chickens. Although single-strand, electric fences may be a suitable substitute for barbed-wire fences, we have no information demonstrating such is the case. However, marking

the top two strands of barbed-wire fences increases their visibility and may help minimize incidence of collision (Wolfe *et al.* 2009, entire).

In summary, power lines and unmarked wire fences are known to cause injury and mortality of lesser prairie-chickens, although the specific rangewide impact on lesser prairie-chickens is largely unquantified. However, the prevalence of fences and power lines within the species' range suggests these structures may have at least localized, if not widespread, detrimental effects. While some conservation programs have emphasized removal of unneeded fences, we believe that, without substantially increased removal efforts, a majority of existing fences will remain on the landscape indefinitely. Existing fences likely operate cumulatively with other mechanisms described in this proposed rule to diminish the ability of the lesser prairie-chicken to persist, particularly in areas with a high density of fences.

Shrub Control and Eradication

Shrub control and eradication are additional forms of habitat alteration that can influence the availability and suitability of habitat for lesser prairie-chickens (Jackson and DeArment 1963, pp. 736–737). Herbicide applications (primarily 2,4-D and tebuthiuron) to reduce or eliminate shrubs from native rangelands is a common ranching practice throughout much of lesser prairie-chicken range, primarily intended to increase forage production for livestock. Through foliar (2,4-D) or pelleted (tebuthiuron)

applications, these herbicides are designed to suppress or kill, by repeated defoliation, dicotyledonous plants such as forbs, shrubs, and trees, while causing no significant damage to monocotyledon plants such as grasses.

As defined here, control includes efforts that are designed to have a relatively short-term, temporary effect, generally less than 4 to 5 years, on the target shrub. Eradication consists of efforts intended to have a more long-term or lasting effect on the target shrub. Control and eradication efforts have been applied to both shinnery oak and sand sagebrush dominated habitats, although most shrub control and eradication efforts are primarily focused on shinnery oak. Control or eradication of sand sagebrush occurs within the lesser prairie-chicken range (Rodgers and Sexson 1990, p. 494), but the extent is unknown. Control or eradication of sand sagebrush appears to be more prevalent in other parts of the western United States. Other species of shrubs, such as skunkbush sumac or *Prunus angustifolia* (Chicksaw plum), also have been the target of treatment efforts.

Shinnery oak is toxic to cattle when it first produces leaves in the spring, and it also competes with more palatable grasses and forbs for water and nutrients (Peterson and Boyd 1998, p. 8). In areas where *Gossypium* spp. (cotton) is grown, shinnery oak often is managed for the control of boll weevil (*Anthonomus grandis*), which can destroy cotton crops (Slosser *et al.* 1985, entire). Boll weevils overwinter in areas where large amounts of leaf litter accumulate but tend not to overwinter in areas where grasses

predominate (Slosser *et al.* 1985, p. 384). Fire is typically used to remove the leaf litter, and then tebuthiuron, an herbicide, is used to remove shinnery oak (Plains Cotton Growers 1998, pp. 2–3). Prior to the late 1990s, approximately 40,469 ha (100,000 ac) of shinnery oak in New Mexico and 404,685 ha (1,000,000 ac) of shinnery oak in Texas were lost due to the application of tebuthiuron and other herbicides for agriculture and range improvement (Peterson and Boyd 1998, p. 2).

The shinnery oak vegetation type is endemic to the southern Great Plains and is estimated to have historically covered an area of 2.3 million ha (over 5.6 million ac), although its current range has been considerably reduced through eradication (Mayes *et al.* 1998, p. 1609). The distribution of shinnery oak overlaps much of the historical lesser prairie-chicken range in New Mexico, southwestern Oklahoma, and Texas panhandle region (Peterson and Boyd 1998, p. 2). Sand sagebrush tends to be the dominant shrub in lesser prairie-chicken range in Kansas and Colorado as well as portions of northwestern Oklahoma, the northeast Texas panhandle, and northeastern New Mexico.

Once shinnery oak is eradicated, it is unlikely to recolonize treated areas. Shinnery oak is a rhizomatous shrub that reproduces very slowly and does not invade previously unoccupied areas (Dhillion *et al.* 1994, p. 52). Shinnery oak rhizomes do not appear to be viable in sites where the plant was previously eradicated, even decades after treatment. While shinnery oak has been germinated successfully in a laboratory setting (Pettit 1986, pp. 1, 3), little documentation exists that shinnery oak acorns successfully

germinate in the wild (Wiedeman 1960, p. 22; Dhillion *et al.* 1994, p. 52). In addition, shinnery oak produces an acorn crop in only about 3 of every 10 years (Pettit 1986, p. 1).

While lesser prairie-chickens are found in Colorado and Kansas where preferred habitats lack shinnery oak, the importance of shinnery oak as a component of lesser prairie-chicken habitat has been demonstrated by several studies (Fuhlendorf *et al.* 2002, pp. 624–626; Bell 2005, pp. 15, 19–25). In a study conducted in west Texas, Haukos and Smith (1989, p. 625) documented strong nesting avoidance by lesser prairie-chickens of shinnery oak rangelands that had been treated with the herbicide tebuthiuron. Similar behavior was confirmed by three recent studies in New Mexico examining aspects of lesser prairie-chicken habitat use, survival, and reproduction relative to shinnery oak density and herbicide application to control shinnery oak.

First, Bell (2005, pp. 20–21) documented strong thermal selection for and dependency of lesser prairie-chicken broods on dominance of shinnery oak in shrubland habitats. In this study, lesser prairie-chicken hens and broods used sites within the shinnery oak community that had a statistically higher percent cover and greater density of shrubs. Within these sites, microclimate differed statistically between occupied and random sites, and lesser prairie-chicken survival was statistically higher in microhabitat that was cooler, more humid, and less exposed to the wind. Survivorship was statistically higher for lesser prairie-chickens that used sites with greater than 20 percent cover of shrubs than for those choosing 10–20 percent cover; in turn, survivorship was statistically

higher for lesser prairie-chickens choosing 10–20 percent cover than for those choosing less than 10 percent cover. Similarly, Copelin (1963, p. 42) stated that he believed the reason lesser prairie-chickens occurred in habitats with shrubby vegetation was due to the need for summer shade.

In a second study, Johnson *et al.* (2004, pp. 338–342) observed that shinnery oak was the most common vegetation type in lesser prairie-chicken hen home ranges. Hens were detected more often than randomly in or near pastures that had not been treated to control shinnery oak. Although hens were detected in both treated and untreated habitats in this study, 13 of 14 nests were located in untreated pastures, and all nests were located in areas dominated by shinnery oak. Areas immediately surrounding nests also had higher shrub composition than the surrounding pastures. This study suggested that herbicide treatment to control shinnery oak adversely impacts nesting lesser prairie-chicken.

Finally, a third study showed that over the course of 4 years and five nesting seasons, lesser prairie-chicken in the core of occupied range in New Mexico distributed themselves non-randomly among shinnery oak rangelands treated and untreated with tebuthiuron (Patten *et al.* 2005a, pp. 1273–1274). Lesser prairie-chickens strongly avoided habitat blocks treated with tebuthiuron but were not influenced by presence of cattle grazing. Further, herbicide treatment explained nearly 90 percent of the variation in occurrence among treated and untreated areas. Over time, radio-collared lesser prairie-

chickens spent progressively less time in treated habitat blocks, with almost no use of treated pastures in the fourth year following herbicide application (25 percent in 2001, 16 percent in 2002, 3 percent in 2003, and 1 percent in 2004).

In contrast, McCleery *et al.* (2007, pp. 2135–2136) argued that the importance of shinnery oak habitats to lesser prairie-chickens has been overemphasized, primarily based on occurrence of the species in areas outside of shinnery oak dominated habitats. We agree that shinnery oak may not be a rigorously required component of lesser prairie-chicken habitat rangewide. However, we believe that shrubs are important to lesser prairie-chickens. Recently, Timmer (2012, pp. 38, 73–74) found that lesser prairie-chicken lek density peaked when approximately 50 percent of the landscape was composed of shrubland patches consisting of shrubs less than 5 m (16 ft) tall and comprising at least 20 percent of the total vegetation. Shrubs are an important component of suitable habitat and where shinnery oak occurs, lesser prairie-chickens use it both for food and cover. We believe that where shinnery oak historically, and still currently, occurs, it provides suitable habitat for lesser prairie-chickens. The loss of these habitats likely contributed to observed population declines in lesser prairie-chickens. Mixed-sand sagebrush and shinnery oak rangelands are well documented as preferred lesser prairie-chicken habitat, and long-term stability of shrubland landscapes has been shown to be particularly important to the species (Woodward *et al.* 2001, p. 271).

On BLM lands, where the occurrence of the dunes sagebrush lizard and lesser prairie-chicken overlaps, their Resource Management Plan Amendment (RMPA) states that tebuthiuron may only be used in shinnery oak habitat if there is a 500-m (1,600-ft) buffer around dunes, and that no chemical treatments should occur in suitable or occupied dunes sagebrush lizard habitat (BLM 2008, p. 4–22). In this RMPA (BLM 2008, pp. 16–17), BLM will allow spraying of shinnery oak in lesser prairie-chicken habitat where it does not overlap with the dunes sagebrush lizard. Additionally, the New Mexico State Lands Office and private land owners continue to use tebuthiuron to remove shinnery oak for cattle grazing and other agricultural purposes (75 FR 77809, December 14, 2010). The NRCS's herbicide spraying has treated shinnery oak in at least 39 counties within shinnery oak habitat (Peterson and Boyd 1998, p. 4).

The BLM, through the Restore New Mexico program, also treats mesquite with herbicides to restore grasslands to a more natural condition by reducing the extent of brush. While some improvement in livestock forage occurs, the areas are rested from grazing for two growing seasons and no increase in stocking rate is allowed. Because mesquite is not readily controlled by fire, herbicides often are necessary to treat its invasion. The BLM has treated some 148,257 ha (366,350 ac) and has plans to treat an additional 128,375 ha (317,220 ac). In order to treat encroaching mesquite, BLM aerially treats with a mix of the herbicides Remedy (triclopyr) and Reclaim (clopyralid). Although these chemicals are used to treat the adjacent mesquite, some herbicide drift into shinnery oak habitats can occur during application. Oaks are also included on the list

of plants controlled by Remedy, and one use for the herbicide is treatment specifically for sand shinnery oak suppression, as noted on the specimen label (Dow AgroSciences 2008, pp. 5, 7). While Remedy can be used to suppress shinnery oak, depending on the concentration, the anticipated impacts of herbicide drift into non-target areas are expected to be largely short-term due to differences in application rates necessary for the desired treatments. Forbs are also susceptible to Remedy, according to the specimen label, and may be impacted by these treatments, at least temporarily (Dow AgroSciences 2008, p. 2). Typically, shinnery oak and mesquite occurrences don't overlap due to inherent preferences for sandy versus tighter soils. Depending on the density of mesquite, these areas may or may not be used by lesser prairie-chickens prior to treatment.

Lacking germination of shinnery oak acorns, timely recolonization of treated areas, or any established propagation or restoration method, the application of tebuthiuron at rates approved for use in most States can eliminate high-quality lesser prairie-chicken habitat. Large tracts of shrubland communities are decreasing, and native shrubs drive reproductive output for ground-nesting birds in shinnery oak rangelands (Guthery *et al.* 2001, p. 116).

In summary, we conclude that the long-term to permanent removal of shinnery oak is an ongoing threat to the lesser prairie-chicken in New Mexico, Oklahoma, and Texas. Habitat in which shinnery oak is permanently removed may fail to meet basic needs of the species, such as foraging, nesting, predator avoidance, and thermoregulation.

Permanent conversion of shinnery oak and other types of shrubland to other land uses contributes to habitat fragmentation and poses a threat to population persistence.

Insecticides

To our knowledge, no studies have been conducted examining potential effects of agricultural insecticide use on lesser prairie-chicken populations. However, impacts from pesticides to other prairie grouse have been documented. Of approximately 200 greater sage grouse known to be feeding in a block of alfalfa sprayed with dimethoate, 63 were soon found dead, and many others exhibited intoxication and other negative symptoms (Blus *et al.* 1989, p. 1139). Because lesser prairie-chickens are known to selectively feed in alfalfa fields (Hagen *et al.* 2004, p. 72), the Service believes there may be cause for concern that similar impacts could occur. Additionally some control efforts, such as grasshopper suppression in rangelands by the USDA Animal and Plant Health Inspection Service, treat economic infestations of grasshoppers with insecticides. Treatment could cause reductions in insect populations used by lesser prairie-chickens. However, in the absence of more conclusive evidence, we do not currently consider application of insecticides for most agricultural purposes to be a threat to the species.

Altered Fire Regimes and Encroachment by Invasive Woody Plants

Preferred lesser prairie-chicken habitat is characterized by expansive regions of treeless grasslands interspersed with patches of small shrubs (Giesen 1998, pp. 3–4). Prior to extensive EuroAmerican settlement, frequent fires and grazing by large, native ungulates helped confine trees like *Juniperus virginiana* (eastern red cedar) to river and stream drainages and rocky outcroppings. However, settlement of the southern Great Plains altered the historical disturbance regimes and contributed to habitat fragmentation and conversion of native grasslands. The frequency and intensity of these disturbances directly influenced the ecological processes, biological diversity, and patchiness typical of Great Plains grassland ecosystems, which evolved with frequent fire and ungulate herbivory and that provided ideal habitat for lesser prairie-chickens (Collins 1992, pp. 2003–2005; Fuhlendorf and Smeins 1999, pp. 732, 737).

Once these historical fire and grazing regimes were altered, the processes which helped maintain extensive areas of grasslands ceased to operate effectively. Following EuroAmerican settlement, fire suppression allowed trees, like eastern red cedar, to begin invading or encroaching upon neighboring grasslands. Increasing fire suppression that accompanied settlement, combined with government programs promoting eastern red cedar for windbreaks, erosion control, and wildlife cover, increased availability of eastern red cedar seeds in grassland areas (Owensby *et al.* 1973, p. 256). Once established, wind breaks and cedar plantings for erosion control contribute to fragmentation of the prairie landscape. Because eastern red cedar is not well adapted to survive most grassland fires due to its thin bark and shallow roots (Briggs *et al.* 2002b, p. 290), the lack of frequent

fire greatly facilitated encroachment by eastern red cedar. Once trees began to invade these formerly treeless prairies, the resulting habitat became increasingly unsuitable for lesser prairie-chickens.

Similar to the effects of artificial vertical structures, the presence of trees causes lesser prairie-chickens to cease using areas of otherwise suitable habitat. Woodward *et al.* (2001, pp. 270–271) documented a negative association between landscapes with increased woody cover and lesser prairie-chicken population indices. Similarly, Fuhlendorf *et al.* (2002, p. 625) examined the effect of landscape structure and change on population dynamics of lesser prairie-chicken in western Oklahoma and northern Texas. They found that landscapes with declining lesser prairie-chicken populations had significantly greater increases in tree cover types (riparian, windbreaks, and eastern red cedar encroachment) than landscapes with sustained lesser prairie-chicken populations.

Tree encroachment into grassland habitats has been occurring for numerous decades, but the extent has been increasing rapidly in recent years. Tree invasion in native grasslands and rangelands has the potential to render significant portions of remaining occupied habitat unsuitable within the future. Once a grassland area has been colonized by eastern red cedar, the trees are mature within 6 to 7 years and provide a plentiful source of seed in which adjacent areas can readily become infested. Although specific information documenting the extent of eastern red cedar infestation within the historical range of the lesser prairie-chicken is unavailable, limited information from

Oklahoma and portions of Kansas help demonstrate the significance of this threat to lesser prairie-chicken habitat.

In Riley County, Kansas, within the tallgrass prairie region known as the Flint Hills, the amount of eastern red cedar coverage increased over 380 percent within a 21-year period (Price and Grabow 2010, as cited in Beebe *et al.* 2010, p. 2). In another portion of the Flint Hills of Kansas, transition from a tallgrass prairie to a closed canopy (where tree canopy is dense enough for tree crowns to fill or nearly fill the canopy layer so that light cannot reach the floor beneath the trees) eastern red cedar forest occurred in as little as 40 years (Briggs *et al.* 2002a, p. 581). Similarly, the potential for development of a closed canopy (crown closure) in western Oklahoma is very high (Engle and Kulbeth 1992, p. 304), and eastern red cedar encroachment in Oklahoma is occurring at comparable rates. Estimates developed by NRCS in Oklahoma revealed that some 121,406 ha (300,000 ac) a year are being infested by eastern red cedar (Zhang and Hiziroglu 2010, p. 1033). Stritzke and Bidwell (1989, as cited in Zhang and Hiziroglu 2010, p. 1033) estimated that the area infested by eastern red cedar increased from over 600,000 ha (1.5 million ac) in 1950 to over 1.4 million ha (3.5 million ac) by 1985. By 2002, the NRCS estimated that eastern red cedar had invaded some 3.2 million ha (8 million ac) of prairie and cross timbers habitat in Oklahoma (Drake and Todd 2002, p. 24). Eastern red cedar encroachment in Oklahoma is expected to exceed 5 million ha (12.6 million ac) by 2013 (Zhang and Hiziroglu 2010, p. 1033). While the area infested by eastern red cedar in Oklahoma is not restricted to the historical or occupied range of

the lesser prairie-chicken, the problem appears to be the worst in northwestern and southwestern Oklahoma (Zhang and Hiziroglu 2010, p. 1032). Considering that southwestern Kansas and the northeastern Texas panhandle have comparable rates of precipitation, fire exclusion, and grazing pressure as western Oklahoma, this rate of infestation is likely occurring in many areas of occupied and historical lesser prairie-chicken range.

Eastern red cedar is not the only woody species known to be encroaching in prairies used by lesser prairie-chicken. Within the southern- and western-most portions of the historical range in New Mexico and Texas, mesquite is the most common woody invader within these grasslands and can preclude nesting and brood use by lesser prairie-chickens (Riley 1978, p. vii). Mesquite is an ideal woody invader in grassland habitats due to its ability to produce abundant, long-lived seeds that can germinate and establish in a variety of soil types and moisture and light regimes (Archer *et al.* 1988, p. 123). Much of the remaining historical grasslands and rangelands in the southern portions of the Texas panhandle have been invaded by mesquite.

Although the precise extent and rate of mesquite invasion is difficult to determine rangewide, the ecological process by which mesquite and related woody species invades these grasslands has been described by Archer *et al.* (1988, pp. 111–127) for the Rio Grande Plains of Texas. In this study, once a single mesquite tree colonized an area of grassland, this plant acted as the focal point for seed dispersal of woody species that

previously were restricted to other habitats (Archer *et al.* 1988, p. 124). Once established, factors such as overgrazing, reduced fire frequency, and drought interacted to enable mesquite and other woody plants to increase in density and stature on grasslands (Archer *et al.* 1988, p. 112). On their study site near Alice, Texas, they found that woody plant cover significantly increased from 16 to 36 percent between 1941 and 1983, likely facilitated by heavy grazing (Archer *et al.* 1988, p. 120). The study site had a history of heavy grazing since the late 1800s. However, unlike eastern red cedar, mesquite is not as readily controlled by fire. Wright *et al.* (1976, pp. 469–471) observed that mesquite seedlings older than 1.5 years were difficult to control with fire unless they had first been top killed with an herbicide, and the researchers observed that survival of 2- to 3-year-old mesquite seedlings was as high as 80 percent even following very hot fires.

Prescribed burning is often the best method to control or preclude tree invasion of native grassland and rangeland. However, burning of native prairie is often perceived by landowners to be destructive to rangelands, undesirable for optimizing cattle production, and likely to create wind erosion or “blowouts” in sandy soils. Often, prescribed fire is employed only after significant invasion has already occurred and landowners consider forage production for cattle to have diminished. Consequently, fire suppression is common, and relatively little prescribed burning occurs on private land. Additionally, in areas where grazing pressure is heavy and fuel loads are reduced, a typical grassland fire may not be intense enough to eradicate eastern red cedar (Briggs *et al.* 2002a, p. 585; Briggs *et al.* 2002b, pp. 293; Bragg and Hulbert 1976, p. 19). Briggs *et al.* (2002a, p.

582) found that grazing reduced potential fuel loads by 33 percent, and the reduction in fuel load significantly reduced mortality of eastern red cedar post-fire. While establishment of eastern red cedar reduces the abundance of herbaceous grassland vegetation, grasslands have a significant capacity to recover rapidly following cedar control efforts (Pierce and Reich 2010, p. 248). However, both Van Auken (2000, p. 207) and Briggs *et al.* (2005, p. 244) stated that expansion of woody vegetation into grasslands will continue to pose a threat to grasslands well into the future.

In summary, invasion of native grasslands by certain woody species like eastern red cedar cause otherwise suitable habitats to no longer be used by lesser prairie-chickens and contribute to fragmentation of native grassland habitats. We expect that efforts to control invasive woody species like eastern red cedar and mesquite will continue but that treatment efforts likely will be insufficient to keep pace with rates of expansion, especially when considering the environmental changes resulting from climate change (see discussion below). Therefore, encroachment by invasive woody plants contributes to further habitat fragmentation and poses a threat to population persistence.

Climate Change

The effects of ongoing and projected changes in climate are appropriate for consideration in our analyses conducted under the Act. The Intergovernmental Panel on Climate Change (IPCC) has concluded that warming of the climate in recent decades is

unequivocal, as evidenced by observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level (Solomon *et al.* 2007, p.1). The term “climate”, as defined by the IPCC, refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a, p. 78). The IPCC defines the term “climate change” to refer to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007a, p. 78).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; and Solomon *et al.* 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is “very likely” (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al.* 2007, pp. 21–35). Further confirmation of the role of greenhouse gasses comes from

analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of greenhouse gas emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (e.g., Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the intensity and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that greenhouse gas emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century and that the extent and rate of change will be influenced substantially by the extent of greenhouse gas emissions (IPCC 2007a, pp. 44–45; Meehl *et al.* 2007, pp. 760–764 and 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). (See IPCC 2007b, p. 8, for a summary of other global projections of climate-related changes, such as frequency of heat waves and

changes in precipitation. Also, see IPCC (2012, entire) for a summary of observations and projections of extreme climate events.)

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007a, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis.

Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, intensity, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al.* 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al.* 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

As is the case with all stressors that we assess, even if we conclude that a species is currently affected or is likely to be affected in a negative way by one or more climate-related impacts, it does not necessarily follow that the species meets the definition of an “endangered species” or a “threatened species” under the Act. If a species is listed as endangered or threatened, knowledge regarding the vulnerability of the species to, and

known or anticipated impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

Some species of grouse have already exhibited significant and measurable negative impacts attributed to climate change. For example, capercaillie grouse in Scotland have been shown to nest earlier than in historical periods in response to warmer springs yet reared fewer chicks (Moss *et al.* 2001, p. 58). The resultant lowered breeding success as a result of the described climactic change was determined to be the major cause of the decline of the Scottish capercaillie (Moss *et al.* 2001, p. 58).

Within the Great Plains, average temperatures have increased and projections indicate this trend will continue over this century (Karl *et al.* 2009, p. 1). Precipitation within the southern portion of the Great Plains is expected to decline, with extreme events such as heat waves, sustained droughts, and heavy rainfall becoming more frequent (Karl *et al.* 2009, pp. 1–2). Seager *et al.* (2007, pp. 1181, 1183–1184) suggests that ‘dust bowl’ conditions of the 1930s could be the new climatology of the American Southwest, with droughts being much more extreme than most droughts on record.

As a result of changing conditions, the distribution and abundance of grassland bird species will be affected (Niemuth *et al.* 2008, p. 220). Warmer air and surface soil temperatures and decreased soil moisture near nest sites have been correlated with lower survival and recruitment in some ground-nesting birds such as the bobwhite quail

(Guthery *et al.* 2001, pp. 113–115) and the lesser prairie-chicken (Bell 2005, pp. 16, 21). On average, lesser prairie-chickens avoid sites that were hotter, drier, and more exposed to the wind (Patten *et al.* 2005a, p. 1275). Specific to lesser prairie chickens, an increased frequency of heavy rainfall events could affect their reproductive success (Lehmann 1941 as cited in Peterson and Silvy 1994, p. 223; Morrow *et al.* 1996, p. 599) although the deleterious effects of increased precipitation have been disputed by Peterson and Silvy (1994, pp. 227–228).

Additionally, more extreme droughts, in combination with existing threats, will have detrimental implications for the lesser prairie-chicken (see Drought discussion in “Extreme Weather Events” below). Boal *et al.* (2010, p. 4) suggests that increased temperatures, as projected by climate models, may lead to egg death or nest abandonment of lesser prairie-chickens. Furthermore, the researchers suggest that if lesser prairie-chickens shift timing of reproduction (to later in the year) to compensate for lower precipitation, then temperature impacts could be exacerbated.

In 2010, the Service evaluated three different climate change vulnerability models to determine their usefulness as potential tools for examining the effects of climate change (U.S. Environmental Protection Agency 2009, *draft review*; NatureServe 2010; USDA Rocky Mountain Research Station 2010, *in development*). Outcomes from our assessment of each of these models for the lesser prairie-chicken suggested that the lesser prairie-chicken is highly vulnerable to, and will be negatively affected by, projected

climate change. Factors identified in the models that increase the vulnerability of the lesser prairie chicken to climate change include, but are not limited to the following: (1) The species' limited distribution and relatively small declining population, (2) the species' physiological sensitivity to temperature and precipitation change, (3) specialized habitat requirements, and (4) the overall limited ability of the habitats occupied by the species to shift at the same rate as the species in response to climate change.

Increasing temperatures, declining precipitation, and extended, severe drought events would be expected to adversely alter habitat conditions, reproductive success, and survival of the lesser prairie-chicken. While populations of lesser prairie-chicken in the southwestern part of their range are likely to be most acutely affected, populations throughout their range into Colorado and Kansas likely will be impacted as well. Based on current climate change projections of increased temperatures, decreased rainfall, and an increase of severe events such as drought and rainfall within the southern Great Plains, the lesser prairie-chicken is likely to be adversely impacted by the effects of climate changes, especially when considered in combination with other known threats and the anticipated vulnerability of the species.

Additionally, many climate scientists predict that numerous species will shift their geographical distributions in response to warming of the climate (McLaughlin *et al.* 2002, p. 6070). In mountainous areas, species may shift their range altitudinally, in flatter areas, ranges may shift latitudinally (Peterson 2003, p. 647). Such shifts may

result in localized extinctions over portions of the range, and, in other portions of their distributions, the occupied range may expand, depending upon habitat suitability. Changes in geographical distributions can vary from subtle to more dramatic rearrangements of occupied areas (Peterson 2003, p. 650). Species occupying flatland areas such as the Great Plains generally were expected to undergo more severe range alterations than those in montane areas (Peterson 2003, p. 651). Additionally, populations occurring in fragmented habitats can be more vulnerable to effects of climate change and other threats, particularly for species with limited dispersal abilities (McLaughlin *et al.* 2002, p. 6074). Species inhabiting relatively flat lands will require corridors that allow north-south movements, presuming suitable habitat exists in these areas. Where existing occupied range is bounded by areas of unsuitable habitat, the species' ability to move into suitable areas is reduced and the amount of occupied habitat could shrink accordingly. In some cases, particularly when natural movement has a high probability of failure, assisted migration may be necessary to ensure populations persist ((McLachlan *et al.* 2007, entire).

We do not currently know how the distribution of lesser prairie-chickens may change geographically under anticipated climate change scenarios. Certainly the presence of suitable grassland habitats created under CRP may play a key role in how lesser prairie-chickens respond to the effects of climate change. Additionally, species that are insectivorous throughout all or a portion of their life cycle, like the lesser prairie-chicken, may have increased risks where a phenological mismatch exists between their

biological needs and shifts in insect abundance due to vulnerability of insects to changes in thermal regimes (Parmesan 2006, pp. 638, 644, 657; McLachlan *et al.* 2011, p. 5). McLachlan *et al.* (2011, pp. 15, 26) predicted that lesser prairie-chicken carrying capacity would decline over the next 60 years due to climate change, primarily the result of decreased vegetation productivity (reduced biomass); however, they could not specifically quantify the extent of the decline. They estimated the current carrying capacity to be 49,592 lesser prairie-chickens (McLachlan *et al.* 2011, p. 25). Based on their analysis, McLachlan *et al.* (2011, p. 29) predicted that the lesser prairie-chicken may be facing significant challenges to long-term survival over the next 60 years due to climate-related changes in native grassland habitat. We anticipate that climate-induced changes in ecosystems, including grassland ecosystems used by lesser prairie-chickens, coupled with ongoing habitat loss and fragmentation will interact in ways that will amplify the individual negative effects of these and other threats identified in this proposed rule (Cushman *et al.* 2010, p. 8).

Extreme Weather Events

Weather-related events such as drought and hail storms influence habitat quality or result in direct mortality of lesser prairie-chicken. Although hail storms typically only have a localized effect, the effects of snow storms and drought can often be more widespread and can affect considerable portions of the occupied range.

Drought—Drought is considered a universal ecological driver across the Great Plains (Knopf 1996, p. 147). Annual precipitation within the Great Plains is considered highly variable (Wiens 1974a, p. 391) with prolonged drought capable of causing local extinctions of annual forbs and grasses within stands of perennial species, and recolonization is often slow (Tilman and El Haddi 1992, p. 263). Net primary production in grasslands is strongly influenced by annual precipitation patterns (Sala *et al.* 1988, pp. 42–44; Weltzin *et al.* 2003, p. 944) and drought, in combination with other factors, is thought to limit the extent of shrubby vegetation within grasslands (Briggs *et al.* 2005, p. 245). Grassland bird species, in particular, are impacted by climate extremes such as extended drought, which acts as a bottleneck that allows only a few species to survive through the relatively harsh conditions (Wiens 1974a, pp. 388, 397; Zimmerman 1992, p. 92). Drought also can influence many of the factors previously addressed in this proposed rule, such as exaggerating and prolonging the effect of fires and overgrazing.

The Palmer Drought Severity Index (Palmer 1965, entire) is a measure of the balance between moisture demand (evapotranspiration driven by temperature) and moisture supply (precipitation) and is widely used as an indicator of the intensity of drought conditions (Alley 1984, entire). This index is standardized according to local climate (i.e., climate divisions established by the National Oceanic and Atmospheric Administration) and is most effective in determining magnitude of long-term drought occurring over several months. The index uses zero as normal with drought shown in terms of negative numbers. Positive numbers imply excess precipitation.

The droughts of the 1930s and 1950s are some of the most severe on record (Schubert *et al.* 2004, p. 485). During these periods, the Palmer Drought Severity Index exceeded negative 4 and 5 in many parts of the Great Plains, which would be classified as extreme to exceptional drought. The drought that impacted much of the occupied lesser prairie-chicken range in 2011 also was classified as severe to extreme, particularly during the months of May through August (National Climatic Data Center 2012). This time period is significant because the period of May through September generally overlaps the lesser prairie-chicken nesting and brood-rearing season. Review of the available records for the Palmer Drought Severity Index during the period from May through September 2011, for many of the climate divisions within the lesser prairie-chicken occupied range, revealed that the index exceeded negative 4 over most of the occupied range. Climate division 4 in westcentral Kansas was the least impacted by drought in 2011, with a Palmer Drought Severity Index of negative 2.29. The most severe drought occurred in the Texas panhandle.

Based on an evaluation of the Palmer Drought Severity Index for May through July of 2012, several of the climate divisions which overlap the occupied range are currently experiencing extreme to exceptional drought. Colorado, New Mexico, and Texas are experiencing the worst conditions, based on index values varying from a low of negative 5.8 in Colorado to a high index value of negative 4.1 in Texas and New Mexico. Drought is least severe in Oklahoma, although climate division 4 is currently at negative

2.4. Index values for Kansas are in the severe range and vary from negative 2.7 to negative 3.3. Such persistent drought conditions will impact vegetative cover for nesting and can reduce insect populations needed by growing chicks. Additionally, drought impacts forage needed by livestock and continued grazing under such conditions can rapidly degrade native rangeland.

During times of severe to extreme drought, suitable livestock forage may become unavailable or considerably reduced due to a loss of forage production on existing range and croplands. Through provisions of the CRP, certain lands under existing contract can be used for emergency haying and grazing, provided specific conditions are met, to help relieve the impacts of drought by temporarily providing livestock forage. Typically, emergency haying and grazing is allowed only on those lands where appropriate Conservation Practices (CP), already approved for managed haying and grazing, have been applied to the CRP field. For example, CRP fields planted to either introduced grasses (CP-1) or native grasses (CP-2) are eligible. However, during the widespread, severe drought of 2012, some additional CPs that were not previously eligible to be hayed or grazed were approved for emergency haying and grazing only during 2012. Typically any approved emergency haying or grazing must occur outside of the primary nesting season. The duration of the emergency haying can be no longer than 60 calendar days, and the emergency grazing period cannot extend beyond 90 calendar days, and both must conclude by September 30th of the current growing season. Generally areas that

were emergency hayed or grazed in 1 year are not eligible the following 2 years. Other restrictions also may apply.

In most years, the amounts of land that are hayed or grazed are low, typically less than 15 percent of eligible acreage, likely because the producer must take a 25 percent reduction in the annual rental payment, based on the amount of lands that are hayed or grazed. However, during the 2011 drought, requests for emergency haying and grazing were larger than previously experienced. For example, in Oklahoma, more than 103,200 ha (255,000 ac) or roughly 30 percent of the available CRP lands statewide were utilized. Within those counties that encompass the occupied range, almost 55,400 ha (137,000 ac) or roughly 21 percent of the available CRP in those counties were hayed or grazed. In Kansas, there were almost 95,900 ha (237,000 ac) under contract for emergency haying or grazing within the occupied range. The number of contracts for emergency haying and grazing within occupied range is about 18 percent of the total number of contracts within occupied range. Within New Mexico in 2011, there were approximately 25,900 ha (64,100 ac) under contract for emergency grazing, 97 percent of which were in counties that are either entirely or partially within the historical range of the lesser prairie-chicken. Texas records do not differentiate between managed CRP grazing and haying and that conducted under emergency provisions. Within the historical range in 2011, some 65 counties had CRP areas that were either hayed or grazed. The average percent of areas used was 22 percent. Within the occupied counties, the average percent grazed was the same, 22 percent.

As of the close of July 2012, the entire occupied and historical range of the lesser prairie-chicken was classified as abnormally dry or worse (Farm Service Agency 2012, p. 14). The abnormally dry category roughly corresponds to a Palmer Drought Index of minus 1.0 to minus 1.9. Based on new provisions announced by USDA on July 23, 2012, the entire historical and currently occupied range of the lesser prairie-chicken is eligible for emergency haying and grazing. Additionally, the reduction in the annual rental payment has been reduced from 25 percent to 10 percent. Although the actual extent of emergency haying and grazing that occurs will not be known until after September 30, 2012, we expect that the effect will be significant. The extent of emergency haying in the 2012 season and its impact on lesser prairie-chicken habitat will be analyzed as part of our final listing determination. In many instances, areas that were grazed or hayed under the emergency provisions of 2011 have not recovered due to the influence of the ongoing drought. Additionally, current provisions will allow additional fields to be eligible for emergency haying and grazing that have previously not been eligible, including those classified as rare and declining habitat (CP-25). Conservation Practice 25 provides for very specific habitat components beneficial to ground-nesting birds such as lesser prairie-chickens. The overall extent of relief provided to landowners could result in more widespread implementation of the emergency provisions than has been observed in previous years. Widespread haying and grazing of CRP under drought conditions may compromise the ability of these grasslands to provide year-round escape cover and thermal cover during winter, at least until normal precipitation patterns return (see

sections “**Summary of Recent and Ongoing Conservation Actions**” and “Conservation Reserve Program” for additional information related to CRP).

Although the lesser prairie-chicken has adapted to drought as a component of its environment, drought and the accompanying harsh, fluctuating conditions have influenced lesser prairie-chicken populations. Following extreme droughts of the 1930s and 1950s, lesser prairie-chicken population levels declined and a decrease in their overall range was observed (Lee 1950, p. 475; Schwilling 1955, pp. 5–6; Hamerstrom and Hamerstrom 1961, p. 289; Copelin 1963, p. 49; Crawford 1980, pp. 2–5; Massey 2001, pp. 5, 12; Hagen and Giessen 2005, unpaginated; Ligon 1953 *as cited in* New Mexico Lesser Prairie Chicken/Sand Dune Lizard Working Group 2005, p. 19). More recently, a reduction in lesser prairie-chicken population indices was documented after drought conditions in 2006 followed by severe winter conditions in 2006 and early 2007. For example, Rodgers (2007b, p. 3) stated that lesser prairie-chicken lek indices from surveys conducted in Hamilton County, Kansas, declined by nearly 70 percent from 2006 levels and were the lowest on record. In comparison to the 2011 drought, the Palmer Drought Severity Index for the May through September period in Kansas during the 2006 drought was minus 2.83 in climate division 4 and minus 1.51 in climate division 7. Based on the Palmer Drought Severity Index, drought conditions in 2011 were slightly worse than those observed in 2006.

Drought impacts the lesser prairie-chicken through several mechanisms. Drought affects seasonal growth of vegetation necessary to provide suitable nesting and roosting cover, food, and opportunity for escape from predators (Copelin 1963, pp. 37, 42; Merchant 1982, pp. 19, 25, 51; Applegate and Riley 1998, p. 15; Peterson and Silvy 1994, p. 228; Morrow *et al.* 1996, pp. 596–597). Lesser prairie-chicken home ranges will temporarily expand during drought years (Copelin 1963, p. 37; Merchant 1982, p. 39) to compensate for scarcity in available resources. During these periods, the adult birds expend more energy searching for food and tend to move into areas with limited cover in order to forage, leaving them more vulnerable to predation and heat stress (Merchant 1982, pp. 34–35; Flanders-Wanner *et al.* 2004, p. 31). Chick survival and recruitment may also be depressed by drought (Merchant 1982, pp. 43–48; Morrow 1986, p. 597; Giesen 1998, p. 11; Massey 2001, p. 12), which likely affects population trends more than annual changes in adult survival (Hagen 2003, pp. 176–177). Drought-induced mechanisms affecting recruitment include decreased physiological condition of breeding females (Merchant 1982, p. 45); heat stress and water loss of chicks (Merchant 1982, p. 46); and effects to hatch success and juvenile survival due to changes in microclimate, temperature, and humidity (Patten *et al.* 2005a, pp. 1274–1275; Bell 2005, pp. 20–21; Boal *et al.* 2010, p. 11). Precipitation, or lack thereof, appears to affect lesser prairie-chicken adult population trends with a potential lag effect (Giesen 2000, p. 145). That is, rain in one year promotes more vegetative cover for eggs and chicks in the following year, which enhances their survival.

Although lesser prairie-chickens have persisted through droughts in the past, the effects of such droughts are exacerbated by 19th–21st century land use practices such as heavy grazing, overutilization, and land cultivation (Merchant 1982, p. 51; Hamerstrom and Hamerstrom 1961, pp. 288–289; Davis *et al.* 1979, p. 122; Taylor and Guthery 1980a, p. 2), which have altered and fragmented existing habitats. In past decades, fragmentation of lesser prairie-chicken habitat likely was less extensive than current conditions, and connectivity between occupied habitats was more prevalent, allowing populations to recover more quickly. As lesser prairie-chicken populations decline and become more fragmented, their ability to rebound from prolonged drought is diminished. This reduced ability to recover from drought is particularly concerning given that future climate projections suggest that droughts will only become more severe. Projections based on an analysis using 19 different climate models revealed that southwestern North America, including the entire historical range of the lesser prairie-chicken, will consistently become drier throughout the 21st century (Seager *et al.* 2007, p. 1181). Severe droughts should continue into the future, particularly during persistent La Niña events, but they are anticipated to be more severe than most droughts on record (Seager *et al.* 2007, pp. 1182–1183).

Storms—Very little published information is available on the effects of certain isolated weather events, like storms, on lesser prairie-chicken. However, hail storms are known to cause mortality of prairie grouse, particularly during the spring nesting season. Fleharty (1995, p. 241) provides an excerpt from the May 1879 Stockton News that

describes a large hailstorm near Kirwin, Kansas, as responsible for killing prairie-chickens (likely greater prairie-chicken) and other birds by the hundreds. In May of 2008, a hailstorm was known to have killed six lesser prairie-chickens in New Mexico. Although such phenomena are undoubtedly rare, the effects can be significant, particularly if they occur during the nesting period. We are especially interested in documenting the occurrence and significance of such events on the lesser prairie-chicken.

A severe winter snowstorm in 2006, centered over southeastern Colorado, resulted in heavy snowfall, no cover, and little food in southern Kiowa, Prowers, and most of Baca Counties for over 60 days. The storm was so severe that more than 10,000 cattle died in Colorado alone from this event, in spite of the efforts of National Guard and other flight missions that used cargo planes and helicopters to drop hay to stranded cattle (Che *et al.* 2008, pp. 2, 6). Lesser prairie-chicken numbers in Colorado experienced a 75 percent decline from 2006 to 2007, from 296 birds observed to only 74. Active leks also declined from 34 leks in 2006 to 18 leks in 2007 (Verquer 2007, p. 2). Most strikingly, no active leks have been detected since 2007 in Kiowa County, which had six active leks in the several years prior to the storm. The impacts of the severe winter weather, coupled with drought conditions observed in 2006, probably account for the decline in the number of lesser prairie-chickens observed in 2007 in Colorado (Verquer 2007, pp. 2–3).

In summary, extreme weather events can have a significant impact on individual populations of lesser prairie-chickens. These impacts are especially significant in

considering the status of the species as a whole if the impacted population is isolated from individuals in other nearby populations that may be capable of recolonizing or supplementing the impacted population.

Wind Power and Energy Transmission Operation and Development

Wind power is a form of renewable energy that is increasingly being used to meet electricity demands in the United States. The U.S. Energy Information Administration has estimated that the demand for electricity in the United States will grow by 39 percent between 2005 and 2030 (U.S. Department of Energy (DOE) 2008, p. 1). Wind energy, under one scenario, would provide 20 percent of the United States' estimated electricity needs by 2030 and require at least 250 gigawatts of additional land-based wind power capacity to achieve predicted levels (DOE 2008, pp. 1, 7, 10). The forecasted increase in production would require some 125,000 turbines based on the existing technology and equipment in use and assuming a turbine has a generating capacity of 2 megawatts (MW). Achieving these levels also would require expansion of the current electrical transmission system. Financial incentives, including grants and tax relief, are available to help encourage development of renewable energy sources.

Wind farm development begins with site monitoring and collection of meteorological data to characterize the available wind regime. Turbines are installed after the meteorological data indicate appropriate siting and spacing. The tubular towers

of most commercial, utility-scale onshore wind turbines are between 65 m (213 ft) and 100 m (328 ft) tall. The most common system uses three rotor blades and can have a diameter of as much as 100 m (328 ft). The total height of the system is measured when a turbine blade is in the 12 o'clock position and will vary depending on the length of the blade. With blades in place, a typical system will easily exceed 100 m (328 ft) in height. A wind farm will vary in size depending on the size of the turbines and amount of land available. Typical wind farm arrays consist of 30 to 150 towers each supporting a single turbine. The individual permanent footprint of a single turbine unit, about 0.3 to 0.4 ha (0.75 to 1 ac), is relatively small in comparison with the overall footprint of the entire array (DOE 2008, pp. 110–111). Spacing between each turbine is usually 5 to 10 rotor diameters to avoid interference between turbines. Roads are necessary to access the turbine sites for installation and maintenance. One or more substations, where the generated electricity is collected and transmitted, also may be built depending on the size of the wind farm. The service life of a single turbine is at least 20 years (DOE 2008, p. 16).

Siting of commercially viable wind energy developments is largely based on wind intensity and consistency, and requires the ability to transmit generated power to the users. Any discussion of the effects of wind energy development on the lesser prairie-chicken also must take into consideration the influence of the transmission lines critical to distribution of the energy generated by wind turbines. Transmission lines can traverse long distances across the landscape and can be both above ground and underground.

Most of the impacts associated with transmission lines are with the aboveground systems. Support structures vary in height depending on the size of the line. Most high-voltage powerline towers are 30 to 38 m (98 to 125 ft) high but can be higher if the need arises. Local distribution lines are usually much shorter in height but can still contribute to fragmentation of the landscape. Financial investment in the transmission of electrical power has been steadily climbing since the late 1990s and includes not only the cost of maintaining the existing system but also includes costs associated with increasing reliability and development of new transmission lines (DOE 2008, p. 94). Manville (2005, p. 1052) reported that there are at least 804,500 km (500,000 mi) of transmission lines (lines carrying greater than 115 kilovolts (kV)) within the United States. Recent transmission-related activities within the historical range include the creation of Competitive Renewable Energy Zones in Texas and the “X plan” under consideration by the Southwest Power Pool.

All 5 lesser prairie-chicken States are within the top 12 States nationally for potential wind capacity, with Texas ranking second for potential wind energy capacity and Kansas ranking third (American Wind Energy Association 2012b, entire). The potential for wind development within the historical range of the lesser prairie-chicken is apparent from the wind potential estimates developed by the DOE’s National Renewable Energy Laboratory and AWS Truewind. These estimates present the predicted mean annual wind speeds at a height of 80 m (262 ft). Areas with an average wind speed of 6.5 m/s (21.3 ft/s) and greater at a height of 80 m (262 ft) are generally considered to have a

suitable wind resource for development. All of the historical and current range of the lesser prairie-chicken occurs in areas determined to have 6.5 m/s (21.3 ft/s) or higher average windspeed (DOE National Renewable Energy Laboratory 2010b, p. 1). The vast majority of the occupied range lies within areas of 7.5 m/s (24.6 ft/s) or higher windspeeds.

Wind energy developments already exist within the historical range of the lesser prairie-chicken, some of which have impacted occupied habitat. The 5 lesser prairie-chicken States are all within the top 20 States nationally for installed wind capacity (American Wind Energy Association 2012a, p. 6). By the close of 1999, the installed capacity, in MW, of wind power facilities within the five lesser prairie-chicken States was 209 MW; the majority, 184 MW, was provided by the State of Texas (DOE National Renewable Energy Laboratory 2010a, p. 1). At the close of the first quarter of 2012, the installed capacity within the five lesser prairie-chicken States had grown to 16,516 MW (American Wind Energy Association 2012a, p. 7). Although not all of this installed capacity is located within the historical range of the lesser prairie-chicken, and includes offshore wind projects in Texas, there is considerable overlap between the historical range and those areas having good to excellent wind potential, as determined by the DOE's National Renewable Energy Laboratory (DOE National Renewable Energy Laboratory 2010b, p. 1). Areas having good to excellent wind potential represent the highest priority sites for wind power development.

Within the estimated occupied range in Colorado, existing wind projects are located in Baca, Bent, and Prowers Counties. Colorado's installed wind capacity grew by 39 percent in 2011 (American Wind Energy Association 2012b, entire). In Kansas, Barber, Ford, Gray, Kiowa, and Wichita Counties have existing wind projects. Kansas is expected to double their existing capacity in 2012 and leads the United States with the most wind power under construction (American Wind Energy Association 2012b, entire). Curry, Roosevelt, and Quay Counties in the New Mexico portion of the estimated occupied range currently have operating wind projects. There are some 14,136 MW (roughly 5,654 2.5 MW turbines) in the queue awaiting construction (American Wind Energy Association 2012b, entire). In Oklahoma, Custer, Dewey, Harper, Roger Mills, and Woodward Counties have existing wind farms. Some 393 MW are under construction and there is another 14,667 MW in the queue awaiting construction. In Texas, no wind farms have been constructed within the currently occupied counties (American Wind Energy Association 2012b, entire).

Most published literature on the effects of wind development on birds focuses on the risks of collision with towers or turbine blades. Until recently, there was very little published research specific to the effects of wind turbines and transmission lines on prairie grouse and much of that focuses on avoidance of the infrastructure associated with renewable energy development (see previous discussion on vertical structures in the "Causes of Habitat Fragmentation Within Lesser Prairie-Chicken Range" section above and discussion that follows). We suspect that many wind power facilities are not

monitored consistently enough to detect collision mortalities and the observed avoidance of and displacement influenced by the vertical infrastructure observed in prairie grouse likely minimizes the opportunity for such collisions to occur. However, Vodenal *et al.* (2011, unpaginated) has observed both greater prairie-chickens and plains sharp-tailed grouse (*Tympanuchus phasianellus jamesi*) lekking near the Ainsworth Wind Energy Facility in Nebraska since 2006. The average distance of the observed display grounds to the nearest wind turbine tower was 1,430 m (4,689 ft) for greater prairie-chickens and 1,178 m (3,864 ft) for sharp-tailed grouse.

While both lesser and greater prairie-chickens appear to be more tolerant of these structures than some other species of prairie grouse, Hagen (2004, p. 101) cautions that occurrence near these structures may be due to strong site fidelity or continued use of suitable habitat remnants and that these populations actually may not be able to sustain themselves without immigration from surrounding populations (i.e., population sink).

Currently, we have no documentation of any collision-related mortality in wind farms for lesser prairie-chickens. Similarly, no deaths of gallinaceous birds (upland game birds) were reported in a comprehensive review of avian collisions and wind farms in the United States; the authors hypothesized that the average tower height and flight height of grouse minimized the risk of collision (Erickson *et al.* 2001, pp. 8, 11, 14, 15). However, Johnson and Erickson (2011, p. 17) monitored commercial scale wind farms in the Columbia Plateau of Washington and Oregon and observed that about 13 percent of the

observed collision mortalities were nonnative upland game birds: ring-necked pheasant, gray partridge (*Perdix perdix*), and chukar (*Alectoris chukar*). Although the risk of collision with individual wind turbines appears low, commercial wind energy developments can directly alter existing habitat, contribute to habitat and population fragmentation, and cause more subtle alterations that influence how species use habitats in proximity to these developments (National Research Council 2007, pp. 72–84).

Electrical transmission lines can directly affect prairie grouse by posing a collision hazard (Leopold 1933, p. 353; Connelly *et al.* 2000, p. 974; Patten *et al.* 2005b, pp. 240, 242) and can indirectly lead to decreased lek recruitment, increased predation, and facilitate invasion by nonnative plants. The physical footprint of the actual project is typically much smaller than the actual impact of the transmission line itself. Lesser prairie-chickens exhibit strong avoidance of tall vertical features such as utility transmission lines (Pitman *et al.* 2005, pp. 1267–1268). In typical lesser prairie-chicken habitat where vegetation is low and the terrain is relatively flat, power lines and power poles provide attractive hunting, loafing, and roosting perches for many species of raptors (Steenhof *et al.* 1993, p. 27). The elevated advantage of transmission lines and power poles serve to increase a raptor's range of vision, allow for greater speed during attacks on prey, and serve as territorial markers. Raptors actively seek out power lines and poles in extensive grassland areas where natural perches are limited. While the effect of this predation on lesser prairie-chickens undoubtedly depends on raptor densities, as the number of perches or nesting features increase, the impact of avian predation will

increase. Additional discussion concerning the influence of vertical structures on predation of lesser prairie-chickens can be found in the “Causes of Habitat Fragmentation Within Lesser Prairie-Chicken Range” section above, and additional information on predation is provided in a separate discussion under “*Predation*” below.

Transmission lines, particularly due to their length, can be a significant barrier to dispersal of prairie grouse, disrupting movements to feeding, breeding, and roosting areas. Both lesser and greater prairie-chickens avoided otherwise suitable habitat near transmission lines and crossed these power lines much less often than nearby roads, suggesting that power lines are a particularly strong barrier to movement (Pruett *et al.* 2009a, pp. 1255–1257). Because lesser prairie-chickens avoid tall vertical structures like transmission lines and because transmission lines can increase predation rates, leks located in the vicinity of these structures may see reduced recruitment of new males to the lek (Braun *et al.* 2002, pp. 339–340, 343–344). Lacking recruitment, leks may disappear as the number of older males decline due to death or emigration. Linear corridors such as road networks, pipelines, and transmission line rights-of-way can create soil conditions conducive to the spread of invasive plant species, at least in semiarid sagebrush habitats (Knick *et al.* 2003, p. 619; Gelbard and Belnap 2003, pp. 424–425), but the scope of this impact within the range of the lesser prairie-chicken is unknown. Spread of invasive plants is most critical where established populations of invasive plants begin invading areas of native grassland vegetation.

Electromagnetic fields associated with transmission lines alter the behavior, physiology, endocrine systems, and immune function in birds, with negative consequences on reproduction and development (Ferne and Reynolds 2005, p. 135). Birds are diverse in their sensitivities to electromagnetic field exposure with domestic chickens known to be very sensitive. Although many raptor species are less affected by these fields (Ferne and Reynolds 2005, p. 135), no specific studies have been conducted on lesser prairie-chickens. However electromagnetic fields associated with powerlines and telecommunication towers may explain, at least in part, avoidance of such structures by sage grouse (Wisdom *et al.* 2011, pp. 467–468).

Identification of the actual number of proposed wind energy projects that will be built in any future timeframe is difficult to accurately discern. An analysis of the Federal Aviation Administration's obstacle database provides some insight into the number of existing and proposed wind generation towers. The Federal Aviation Administration is responsible for ensuring wind towers and other vertical structures are constructed in a manner that ensures the safety and efficient use of the navigable airspace. In accomplishing this mission, they evaluate applications submitted by the party responsible for the proposed construction and alteration of these structures. Included in the application is information on the precise location of the proposed structure. This information can be used, in conjunction with other databases, to determine the number of existing and proposed wind generation towers within the historical and occupied range of the lesser prairie-chicken. Analysis of this information, as available in April 2010,

reveals that 6,279 constructed towers are within the historical range of the lesser prairie-chicken. Some 8,501 towers have been approved for construction, and another 1,693 towers were pending approval within the historical range of the lesser prairie-chicken. While not all of these structures are wind generation towers, the vast majority are. Other structures included within the database are radio, meteorological, telecommunication, and similar types of towers.

A similar analysis was conducted on lesser prairie-chicken occupied range. As of April 2010, the occupied range included 173 towers. Some 1,950 towers had been approved for construction, and another 250 towers were awaiting approval. In January of 2012, the Federal Aviation Administration's obstacle database showed that there are some 405 existing wind turbines in or within 1.6 km (1 mi) of the estimated occupied range. In March of 2012, there were 4,887 wind turbines awaiting construction, based on this database. Additionally, the Southwest Power Pool provides public access to its Generation Interconnection Queue (<https://studies.spp.org/GenInterHomePage.cfm>), which provides all of the active requests for connection from new energy generation sources requiring Southwest Power Pool approval prior to connecting with the transmission grid. The Southwest Power Pool is a regional transmission organization which overlaps all or portions of nine States and functions to ensure reliable supplies of power, adequate transmission infrastructure, and competitive wholesale prices of electricity exist. In 2010, within the Southwest Power Pool portion of Kansas, New Mexico, Oklahoma, and Texas, there were 177 wind generation interconnection study

requests totaling 31,883 MW awaiting approval. A maximum development scenario, assuming all of these projects are built and they install all 2.3 MW wind turbines, would result in approximately 13,862 wind turbines being erected in these four States.

The possible scope of this anticipated wind energy development on the status of the lesser prairie-chicken can readily be seen in Oklahoma where the locations of many of the current and historically occupied leks are known. Most remaining large tracts of untilled native rangeland, and hence lesser prairie-chicken habitat, occur on topographic ridges. Leks, the traditional mating grounds of prairie grouse, are consistently located on elevated grassland sites with few vertical obstructions (Flock 2002, p. 35). Because of the increased elevation, these ridges also are prime sites for wind turbine development. In cooperation with ODWC, Service personnel in 2005 quantified the potential degree of wind energy development in relation to existing populations of lesser prairie-chicken in Oklahoma. Using ArcView mapping software, all active and historical lesser prairie-chicken lek locations in Oklahoma, as of the mid 1990s ($n = 96$), and the current occupied range, were compared with the Oklahoma Neural Net Wind Power Development Potential Model map created by the Oklahoma Wind Power Assessment project. The mapping analysis revealed that 35 percent of the recently occupied range in Oklahoma is within areas designated by the Oklahoma Wind Power Assessment as “excellent” for wind energy development. When both the “excellent” and “good” wind energy development classes are combined, some 55 percent of the lesser prairie-chicken’s occupied range in Oklahoma lies within those two classes.

When leks were examined, the same analysis revealed a nearly complete overlap on all known active and historical lek locations, based on the known active leks during the mid 1990s. Roughly 91 percent of the known lesser prairie-chicken lek sites in Oklahoma are within 8 km (5 mi) of land classified as “excellent” for wind development (O’Meilia 2005). Over half (53 percent) of all known lek sites in Oklahoma occur within 1.6 km (1 mi) of lands classified as “excellent” for commercial wind energy development. This second metric is particularly relevant given the average home range for a lesser prairie-chicken is about 10 sq km (4 sq mi) and that a majority of lesser prairie-chicken nesting generally occurs, on average, within 3.4 km (2.1 mi) of active leks (Hagen and Giesen 2005, p. 2). Using Robel’s (2002) estimate derived for the greater prairie-chicken of the zone of avoidance for a single commercial-scale wind turbine (1.6 km or 1 mi), development of commercial wind farms likely will have a significant adverse influence on reproduction of the lesser prairie-chicken, provided lesser prairie-chickens avoid nesting within 1.6 km (1 mi) of each turbine.

Unfortunately, similar analyses are not available for the other States due to a lack of comparable information on the location of lek sites. Considering western Kansas currently supports the largest number and distribution of lesser prairie-chickens of all five States, the influence of wind energy development on the lesser prairie-chicken in Kansas would likely be just as significant. In 2006, the Governor of Kansas initiated the Governor’s 2015 Renewable Energy Challenge, an objective of which is to have 1,000

MW of renewable energy capacity in Kansas by 2015 (Cita *et al.* 2008, p. 1). A cost-benefit study (Cita *et al.* 2008, Appendix B) found that wind power was the most likely and most cost effective form of renewable energy resource for Kansas. Modestly assuming an average of 2 MW per turbine—most commercial scale turbines are between 1.5 and 2.5 MW—some 500 turbines would be erected in Kansas if this goal is to be met.

While not all of those turbines would be placed in occupied habitat, and some overlap in avoidance would occur if turbines were oriented in a typical wind farm array, the potential impact could be significant. First, the best wind potential in Kansas occurs in the western two-thirds of the State and largely overlaps the currently occupied lesser prairie-chicken range (DOE, National Renewable energy Laboratory 2010b, p. 1). Additionally, Kansas has a voluntary moratorium on the development of wind power in the Flint Hills of eastern Kansas, which likely will shift the focus of development into the central and western portions of the State. Taking these two factors into consideration, construction of much of the new wind power anticipated in the Governor's 2015 Renewable Energy Challenge likely would occur in the western two-thirds of Kansas. If we assume that even one-half of the estimated 500 turbines are placed in lesser prairie-chicken range, 250 turbines would individually impact over 101,000 ha (250,000 ac), based on an avoidance distance of 1.6 km (1 mi). The habitat loss resulting from the above scenario would further reduce the extent of large, unfragmented parcels and influence connectivity between remaining occupied blocks of habitat, reducing the amount of suitable habitat available to the lesser prairie-chicken. Consequently, siting of

wind energy arrays and associated facilities, including electrical transmission lines, appears to be a serious threat to lesser prairie-chickens in western Kansas within the near future (Rodgers 2007a).

In Colorado, the DOE, National Renewable Energy Laboratory (2010b, p. 1) rated the southeastern corner of Colorado as having good wind resources, the largest area of Colorado with that ranking. The area almost completely overlaps the currently occupied range of the lesser prairie-chicken in Colorado. The CPW reported that commercial wind development is occurring in Colorado, but that most of the effort is currently centered north of the occupied range of lesser prairie-chicken in southeastern Colorado.

Wind energy development in New Mexico is a lower priority than in other States within the range of the lesser prairie-chicken. In New Mexico, the suitability for wind energy development in the currently occupied range of the lesser prairie-chicken is only rated as fair (DOE, National Renewable Energy Laboratory 2010b, p. 1). However, some parts of northeastern New Mexico within lesser prairie-chicken historical range have been rated as excellent. Northeastern New Mexico is important to lesser prairie-chicken conservation because this area is vital to efforts to reestablish or reconnect the New Mexico lesser prairie-chicken population to those in Colorado and the Texas panhandle.

In Texas, the Public Utility Commission recently directed the Electric Reliability Council of Texas (ERCOT) to develop transmission plans for wind capacity to

accommodate between 10,000 and 25,000 MW of power (American Wind Energy Association 2007b, pp. 2–3). ERCOT is a regional transmission organization with jurisdiction over most of Texas. The remainder of Texas, largely the Texas panhandle, lies within the jurisdiction of the Southwest Power Pool. A recent assessment from ERCOT identified more than 130,000 MW of high-quality wind sites in Texas, more electricity than the entire State currently uses. The establishment of Competitive Renewable Energy Zones by ERCOT within the State of Texas will facilitate wind energy development throughout western Texas. The top four Competitive Renewable Energy Zones, based on the development priority of each zones are located within occupied and historical lesser prairie-chicken habitat in the Texas panhandle. There is a high level of overlap between lesser prairie-chicken currently occupied range in Texas and the Competitive Renewable Energy Zones, which are designated for future wind energy development in the Texas panhandle.

Wind energy and associated transmission line development in the Texas panhandle and portions of west Texas represent a threat to extant lesser prairie-chicken populations in the State. Once established, wind farms and associated transmission features would severely hamper future efforts to restore population connectivity and gene flow (transfer of genetic information from one population to another) between existing populations that are currently separated by incompatible land uses in the Texas panhandle.

Development of high-capacity transmission lines is critical to the development of the anticipated wind energy resources in ensuring that the generated power can be delivered to the consumer. According to ERCOT (American Wind Energy Association 2007a, p. 9), every \$1 billion invested in new transmission capacity enables the construction of \$6 billion of new wind farms. We estimate, based on a spatial analysis prepared by The Nature Conservancy under their license agreement with Ventyx Energy Corporation, that there are some 35,220 km (21,885 mi) of transmission lines, having a capacity of 69 kilovolts (kV) or larger, in service within the historical range of the lesser prairie-chicken. Within the estimated currently occupied range, this analysis estimated that about 3,610 km (2,243 mi) of transmission lines with a capacity of 69kV and larger are currently in service. Within the currently occupied range, this same analysis revealed that an additional 856 km (532 mi) of 69kV or higher transmission line is anticipated to be in service within the near future.

The Southwest Power Pool has information about several proposed electric transmission line upgrades. This organization identified approximately 423 km (263 mi) of proposed new transmission lines, commonly referred to as the “X Plan”, that were being evaluated during the transmission planning process. Transmission planning continues to move forward, and numerous alternatives are being evaluated, many of which will connect transmission capacity throughout all or portions of occupied lesser prairie-chicken range and serve to catalyze extensive wind energy development throughout much of the remaining occupied lesser prairie-chicken range in Kansas,

Oklahoma, and Texas. Additionally, Clean Line Energy is planning to build a major direct current transmission line that would originate within the western portion of the Oklahoma panhandle, travel the length of the panhandle region, and then drop south to near Woodward, Oklahoma, before continuing eastward across Oklahoma and Arkansas.

A similar direct current transmission line, known as the Grain Belt Express, is planned for Kansas. The line would originate in west-central Kansas and continue to its endpoint in the upper Midwestern United States. Very little opportunity to interconnect with these lines exists due to the anticipated high cost associated with development of an appropriate interconnecting substation. Consequently, most of the anticipated wind power that will be transmitted across the Oklahoma and Kansas projects likely will occur near the western terminals associated with these two lines. Assuming a fairly realistic build-out scenario for these transmission lines, in which wind power projects would most likely be constructed within 170 km (105 mi) of the western end points of each line, would place most of the estimated occupied range in Colorado, Kansas, Oklahoma, and northeast Texas within the anticipated development zone. Although both of these projects are still relatively early in the planning process, and the specific environmental impacts have yet to be determined, a reasonably likely wind power development scenario would place much of the occupied range at risk of development.

In summary, wind energy and associated infrastructure development is occurring now and is expected to continue into the foreseeable future within occupied portions of

lesser prairie-chicken habitat. Proposed transmission line improvements will serve to facilitate further development of additional wind energy resources. Future wind energy developments, based on the known locations of areas with excellent to good wind energy development potential, likely will have substantial overlap with known lesser prairie-chicken populations. There is little published information on the specific effects of wind power development on lesser prairie-chickens. Most published reports on the effects of wind power development on birds focus on the risks of collision with towers or turbine blades. However, we do not expect that significant numbers of collisions with spinning blades would be likely to occur due to avoidance of the wind towers and associated transmission lines by lesser prairie-chickens. The most significant impact of wind energy development on lesser prairie-chickens is caused by the presence of vertical structures (turbine towers and transmission lines) within suitable habitat. Avoidance of these vertical structures by lesser prairie-chickens can be as much as 1.6 km (1 mi), resulting in large areas (814 ha (2,011 ac) for a single turbine) of unsuitable habitat relative to the overall footprint of a single turbine. Where such development has occurred or is likely to occur, these areas are no longer suitable for lesser prairie-chicken even though many of the typical habitat components used by lesser prairie-chicken remain. Therefore, considering the scale of current and future wind development that is likely within the range of the lesser prairie-chicken and the significant avoidance response of the species to these developments, we conclude that wind energy development is a threat to the species, especially when considered in combination with other habitat fragmenting activities.

Roads and Other Similar Linear Features

Similar to transmission lines, roads are a linear feature on the landscape that can contribute to loss and fragmentation of suitable habitat, and can fragment populations as a result of behavioral avoidance. The observed behavioral avoidance associated with roads is likely due to noise, visual disturbance, and increased predator movements paralleling roads. For example, roads are known to contribute to lek abandonment when they disrupt the important habitat features associated with lek sites (Crawford and Bolen 1976b, p. 239). The presence of roads allows human encroachment into habitats used by lesser prairie-chickens, further causing fragmentation of suitable habitat patches. Some mammalian species known to prey on lesser prairie-chickens, such as red fox, raccoons, and striped skunks, have greatly increased their distribution by dispersing along roads (Forman and Alexander 1998, p. 212; Forman 2000, p. 33; Frey and Conover 2006, pp. 1114–1115).

Traffic noise from roads may indirectly impact lesser prairie-chickens. Because lesser prairie-chickens depend on acoustical signals to attract females to leks, noise from roads, oil and gas development, wind turbines, and similar human activity may interfere with mating displays, influencing female attendance at lek sites and causing young males not to be drawn to the leks. Within a relatively short period, leks can become inactive due to a lack of recruitment of new males to the display grounds.

Roads also may influence lesser prairie-chicken dispersal, likely dependent upon the volume of traffic, and thus disturbance, associated with the road. However, roads likely do not constitute a significant barrier to dispersal. Lesser prairie-chickens have been shown to avoid areas of suitable habitat near larger, multiple-lane, paved roads (Pruett *et al.* 2009a, pp. 1256, 1258). Generally, roads were between 4.1 and 5.3 times less likely to occur in areas used by lesser prairie-chickens than areas that were not used and can influence habitat and nest site selection (Hagen *et al.* 2011, pp. 68, 71-72). Lesser prairie-chickens are thought to avoid major roads due to disturbance caused by traffic volume and, perhaps behaviorally, to avoid exposure to predators that may use roads as travel corridors. Similar behavior has been documented in sage grouse (Oyler-McCance *et al.* 2001, p. 330). When factors believed to have contributed to extirpation of sage grouse were examined, Wisdom *et al.* (2011, p. 467) found that extirpated range contained almost 27 times the human density, was 60 percent closer to highways, and had 25 percent higher density of roads, in contrast to occupied range.

Roads also can cause direct mortality due to collisions with automobiles and possibly increased predation. Although individual mortality resulting from collisions with moving vehicles does occur, the mortalities typically are not monitored or recorded. Therefore we cannot determine the importance of direct mortality from roads on lesser prairie-chicken populations.

Using the data layers provided in StreetMap USA, a product of ESRI Corporation and intended for use with ArcGIS, we can estimate the scope of the impact of roads on lesser prairie-chickens. Within the entire historical range, there are 622,061 km (386,581 mi) of roads. This figure includes major Federal and state highways as well as county highways and smaller roads. Within the currently occupied range, some 81,874 km (50,874 mi) of roads have been constructed. While we don't anticipate significant expansion of the number of existing roads, these roads have already contributed to significant habitat fragmentation within the historical and occupied range of the lesser prairie-chicken. This fragmentation in combination with other causes described in this document further reduces the habitat available to support lesser prairie-chicken populations. The resultant fragmentation is detrimental to lesser prairie-chickens because they rely on large, expansive areas of contiguous rangeland and grassland to complete their life cycle.

In summary, roads occur throughout the range of the lesser prairie-chicken and contribute to the threat of cumulative habitat fragmentation to the species.

Petroleum Production

Petroleum production, primarily oil and gas development, is occurring over much of the historical and current range of the lesser prairie-chicken. Oil and gas development involves activities such as surface exploration, exploratory drilling, field development,

and facility construction. Ancillary facilities can include compressor stations, pumping stations, and electrical generators. Activities such as well pad construction, seismic surveys, access road development, power line construction, and pipeline corridors can directly impact lesser prairie-chicken habitat. Indirect impacts from noise, gaseous emissions, and human presence also influence habitat quality in oil and gas development areas. These activities affect lesser prairie-chickens by disrupting reproductive behavior (Hunt and Best 2004, p. 41) and through habitat fragmentation and conversion (Hunt and Best 2004, p. 92). Smith *et al.* (1998, p. 3) observed that almost one-half, 13 of 29, of the abandoned leks examined in southeastern New Mexico in an area of intensive oil and gas development had a moderate to high level of noise. Hunt and Best (2004, p. 92) found that abandoned leks in southeastern New Mexico had more active wells, more total wells, and greater length of access road than active leks. They concluded that petroleum development at intensive levels, with large numbers of wells in close proximity to each other necessitating large road networks and an increase in the number of power lines, is likely not compatible with life-history requirements of lesser prairie-chickens (Hunt and Best 2004, p. 92)

Impacts from oil and gas development and exploration is the primary reason thought to be responsible for the species' near absence throughout previously occupied portions of the Carlsbad BLM unit in southeastern New Mexico (Belinda 2003, p. 3). This is supported by research examining lesser prairie-chicken losses over the past 20 years on Carlsbad BLM lands (Hunt and Best 2004, pp. 114–115). In this study, factor

analysis (a statistical method used to describe variability among observed variables in reference to a number of unobserved variables) of characters associated with active and abandoned leks was conducted to determine which potential causes were associated with the population decline. Those variables associated with oil and gas development explained 32 percent of observed lek abandonment (Hunt and Best 2004) and the consequent population extirpation.

Although the Service presently lacks the information to specifically quantify and analyze drilling activity throughout the entire historical and occupied range of the lesser prairie-chicken, known activity within certain areas of the historical range demonstrates the significance of the threat. For example, the amount of habitat fragmentation due to oil and gas extraction in the Texas panhandle and western Oklahoma associated with the Buffalo Wallow oil and gas field within the Granite Wash formation of the Anadarko Basin has steadily increased over time. In 1982, the rules for the Buffalo Wallow field allowed one well per 130 ha (320 ac). In late 2004, the Texas Railroad Commission changed the field rule regulations for the Buffalo Wallow oil and gas field to allow oil and gas well spacing to a maximum density of one well per 8 ha (20 ac) (Rothkopf *et al.* 2011, p. 1). When fully developed at this density, the region will have experienced a 16-fold increase in habitat fragmentation in comparison with the rates allowed prior to 2004.

In the BLM's Special Status Species Record of Decision and approved Resource Management Plan Amendment (RMPA), some limited protections for the lesser prairie-

chicken in New Mexico are provided by reducing the number of drilling locations, decreasing the size of well pads, reducing the number and length of roads, reducing the number of powerlines and pipelines, and implementing best management practices for development and reclamation (BLM 2008, pp. 5–31). The RMPA provides guidance for management of approximately 344,000 ha (850,000 ac) of public land and 121,000 ha (300,000 ac) of Federal minerals in Chaves, Eddy, Lea, and Roosevelt Counties in New Mexico. Implementation of these restrictions, particularly curtailment of new mineral leases, would be concentrated in the Core Management and Primary Population Areas (BLM 2008, pp. 9–11). The Core Management and Primary Population Areas are located in the core of the lesser prairie-chicken occupied range in New Mexico. The effect of these best management practices on the status of the lesser prairie-chicken is unknown, particularly considering about 60,000 ha (149,000 ac) have already been leased in those areas (BLM 2008, p. 8). The plan stipulates that measures designed to protect the lesser prairie-chicken and dunes sagebrush lizard may not allow approval of all spacing unit locations or full development of the lease (BLM 2008, p. 8).

Oil and gas development and exploration is ongoing in the remaining States although the precise extent is currently unknown. Some development is anticipated in Baca County, Colorado, although the timeframe for initiation of those activities is uncertain (CPW 2007, p. 2). In Oklahoma, oil and gas exploration statewide continues at a high level. Since 2002, the average number of active drilling rigs in Oklahoma has steadily risen (Boyd 2009, p. 1). Since 2004, the number of active drilling rigs has

remained above 150, reflecting the highest level of sustained activity since the ‘boom’ years from the late 1970s through the mid-1980s in Oklahoma (Boyd 2007, p. 1).

Wastewater pits associated with energy development are not anticipated to be a major threat to lesser prairie-chickens primarily due to the presence of infrastructure and the lack of suitable cover near these pits. In formations with high levels of hydrogen sulfide gas, the presence of this gas can cause mortality.

In summary, infrastructure associated with current petroleum production contributes to the current threat of habitat fragmentation to the lesser prairie-chicken. Reliable information about future trends for petroleum production is not known for the entire range of the species; however, information for portions of Oklahoma, New Mexico, and Texas indicate petroleum production is a significant threat to the species into the foreseeable future.

Predation

Lesser prairie-chickens have coevolved with a variety of predators, but none are lesser prairie-chicken specialists. Prairie falcon (*Falco mexicanus*), northern harrier (*Circus cyaneus*), Cooper’s hawk (*Accipiter cooperii*), great-horned owl (*Bubo virginianus*), other unspecified birds of prey (raptors), and coyote (*Canis latrans*) have been identified as predators of lesser prairie-chicken adults and chicks (Davis *et al.* 1979,

pp. 84–85; Merchant 1982, p. 49; Haukos and Broda 1989, pp. 182–183; Giesen 1994a, p. 96). Predators of nests and eggs also include Chihuahuan raven (*Corvus cryptoleucus*), striped skunk (*Mephitis mephitis*), ground squirrels (*Spermophilus* spp.), and bullsnakes (*Pituophis melanoleucus*), as well as coyotes and badgers (*Taxidea taxus*) (Davis *et al.* 1979, p. 51; Haukos 1988, p. 9; Giesen 1998, p. 8).

Lesser prairie-chicken predation varies in both form and frequency throughout the year. In Kansas, Hagen *et al.* (2007, p. 522) attributed some 59 percent of the observed mortality of female lesser prairie-chickens to mammalian predators and between 11 and 15 percent, depending on season, to raptors. Coyotes were reported to be responsible for some 64 percent of the nest depredations observed in Kansas (Pitman *et al.* 2006a, p. 27). Observed mortality of male and female lesser prairie-chickens associated with raptor predation reached 53 percent in Oklahoma and 56 percent in New Mexico (Wolfe *et al.* 2007, p. 100). Predation by mammals was reported to be 47 percent in Oklahoma and 44 percent in New Mexico (Wolfe *et al.* 2007, p. 100). In Texas, over the course of three nonbreeding seasons, Boal and Pirius (2012, p. 8) assessed cause-specific mortality for 13 lesser prairie-chickens. Avian predation was identified as the cause of death in 10 of those individuals, and mammalian predation was responsible for 2 deaths. The cause of death could not be identified in one of those individuals. Behney *et al.* (2012, p. 294) suspected that mammalian and reptilian predators had a greater influence on lesser prairie-chicken mortality during the breeding season than raptors.

Predation is a naturally occurring phenomenon and generally does not pose a risk to wildlife populations unless the populations are extremely small or have an abnormal level of vulnerability to predation. The lesser prairie-chicken's cryptic plumage and behavioral adaptations allow the species to persist under normal predation pressures. Birds may be most susceptible to predation while on the lek when birds are more conspicuous. Both Patten *et al.* (2005b, p. 240) and Wolfe *et al.* (2007, p. 100) reported that raptor predation increased coincident with lek attendance. Patten *et al.* (2005b, p. 240) stated that male lesser prairie-chickens are more vulnerable to predation when exposed during lek displays than they are at other times of the year and that male lesser prairie-chicken mortality was chiefly associated with predation. However, during 650 hours of lek observations in Texas, raptor predation at leks was considered to be uncommon and an unlikely factor responsible for declines in lesser prairie-chicken populations (Behney *et al.* 2011, pp. 336–337). But Behney *et al.* (2012, p. 294) observed that the timing of lekking activities in their study area corresponded with the lowest observed densities of raptors and that lesser prairie-chickens contend with a more abundant and diverse assemblage of raptors in other seasons.

Predation and related disturbance of mating activities by predators may impact reproduction in lesser prairie-chickens. For females, predation during the nesting season likely would have the most significant impact on lesser prairie-chicken populations, particularly if that predation resulted in total loss of a particular brood. Predation on lesser prairie-chicken may be especially significant relative to nest success. Nest success

and brood survival of greater prairie-chickens accounted for most of the variation in population finite rate of increase (Wisdom and Mills 1997, p. 308). Bergerud (1988, pp. 646, 681, 685) concluded that population changes in many grouse species are driven by changes in breeding success. An analysis of Attwater's prairie-chicken supported this conclusion (Peterson and Silvy 1994, p. 227). Recent demographic research on lesser prairie-chicken in southwestern Kansas confirmed that changes in nest success and chick survival, two factors closely associated with vegetation structure, have the largest impact on population growth rates and viability (Hagen *et al.* 2009, p. 1329).

Rates of predation on lesser prairie-chicken likely are influenced by certain aspects of habitat quality such as fragmentation or other forms of habitat degradation (Robb and Schroeder 2005, p. 36). As habitat fragmentation increases, suitable habitats become more spatially restricted and the effects of terrestrial nest predators on grouse populations may increase (Braun *et al.* 1978, p. 316). Nest predators typically have a positive response (e.g., increased abundance, increased activity, and increased species richness) to fragmentation, although the effects are expressed primarily at the landscape scale (Stephens *et al.* 2003, p. 4). Similarly, as habitat quality decreases through reduction in vegetative cover due to grazing or herbicide application, predation of lesser prairie-chicken nests, juveniles, and adults are all expected to increase. For this reason, ensuring adequate shrub cover and removing raptor perches such as trees, power poles, and fence posts may lower predation more than any conventional predator removal methods (Wolfe *et al.* 2007, p. 101). As discussed at several locations within this

document, existing and foreseeable development of transmission lines, fences, and vertical structures will either contribute to additional predation on lesser prairie-chickens or cause areas of suitable habitat to be abandoned due to behavior avoidance by lesser prairie-chickens. Increases in the encroachment of trees into the native prairies also will contribute to increased incidence of predation by providing additional perches for avian predators. Because predation has a strong relationship with certain anthropogenic factors, such as fragmentation, vertical structures, and roads, continued development is likely to increase the effects of predation on lesser prairie-chickens beyond natural levels. As a result, predation is likely to contribute to the declining status of the species.

Disease

Giesen (1998, p. 10) provided no information on ectoparasites or infectious diseases in lesser prairie-chicken, although several endoparasites, including nematodes and cestodes, are known to infect the species. In Oklahoma, Emerson (1951, p. 195) documented the presence of the external parasites (biting lice-Order Mallophaga) *Goniodes cupido* and *Lagopoecus* sp. in an undisclosed number of lesser prairie-chickens. Between 1997 and 1999, Robel *et al.* (2003, p. 342) conducted a study of helminth parasites in lesser prairie-chicken from southwestern Kansas. Of the carcasses examined, 95 percent had eye worm (*Oxyuris petrowi*), 92 percent had stomach worm (*Tetrameres* sp.), and 59 percent had cecal worm (*Subulura* sp.) (Robel *et al.* 2003, p. 341). No adverse impacts to the lesser prairie-chicken population they studied were

evident as a result of the observed parasite burden. Addison and Anderson (1969, p. 1223) also found eyeworm (*O. petrowi*) from a limited sample of lesser prairie-chickens in Oklahoma. The eyeworm also has been reported from lesser prairie-chickens in Texas (Pence and Sell 1979, p. 145). Pence and Sell (1979, p. 145) also observed the roundworm *Heterakis isolonche* and the tapeworm *Rhabdometra odiosa* from lesser prairie-chickens in Texas. Smith *et al.* (2003, p. 347) reported on the occurrence of blood and fecal parasites in lesser prairie-chickens in eastern New Mexico. Eight percent of the examined birds were infected with *Eimeria tympauchi*, an intestinal parasite, and 13 percent were infected with *Plasmodium pedioecetii*, a hematozoan. Stabler (1978, p. 1126) first reported *Plasmodium pedioecetii* in the lesser prairie-chicken from samples collected from New Mexico and Texas. In the spring of 1997, a sample of 12 lesser prairie-chickens from Hemphill County, Texas, were tested for the presence of disease and parasites. No evidence of viral or bacterial diseases, hemoparasites, parasitic helminths, or ectoparasites was found (Hughes 1997, p. 2).

Peterson *et al.* (2002, p. 835) reported on an examination of 24 lesser prairie-chickens from Hemphill County, Texas, for several disease agents. Lesser prairie-chickens were seropositive for both the Massachusetts and Arkansas serotypes of avian infectious bronchitis, a type of coronavirus. All other tests were negative.

Reticuloendotheliosis is a viral disease documented from poultry, which has been found to cause serious mortality in captive Attwater's prairie-chickens and greater

prairie-chickens. Researchers surveyed blood samples from 184 lesser prairie-chickens from three States during 1999 and 2000, for the presence of reticuloendotheliosis. All samples were negative, suggesting that reticuloendotheliosis may not be a serious problem for most wild populations of lesser prairie-chicken (Wiedenfeld *et al.* 2002, p. 143).

The impact of West Nile virus on lesser prairie-chickens is unknown. Recently scientists at Texas Tech University detected West Nile virus in a small percentage (1.3 percent) of the lesser prairie-chicken blood samples they analyzed. Other grouse, such as ruffed grouse (*Bonasa umbellus*), have been documented to harbor West Nile virus infection rates similar to some corvids (crows, jays, and ravens). For 130 ruffed grouse tested in 2000, all distant from known West Nile virus epicenters, 21 percent tested positive. This was remarkably similar to American crows (*Corvus brachyrhynchos*) and blue jays (*Cyanocitta cristata*) (23 percent for each species), species with known susceptibility to West Nile virus (Bernard *et al.* 2001, p. 681). Recent analysis of the degree of threat to prairie grouse from parasites and infectious disease concluded that microparasitic infections that cause high mortality across a broad range of galliform (wildfowl species such as turkeys, grouse, and chickens) hosts have the potential to extirpate small, isolated prairie grouse populations (Peterson 2004, p. 35).

Nonparasitic diseases caused by mycotoxins, as well as pesticides and other toxic compounds, also have the potential to influence population dynamics. However, the

incidence of disease or parasite infestations in regulating populations of the lesser prairie-chicken is unknown. The Lesser Prairie-Chicken Interstate Working Group (Mote *et al.* 1999, p. 12) concluded that, while density-dependent transmission of disease was unlikely to have a significant effect on lesser prairie-chicken populations, a disease that was transmitted independently of density could have drastic effects. Further research is needed to establish whether parasites regulate prairie grouse populations. Peterson (2004, p. 35) urged natural resource decisionmakers to be aware that macro- and micro-parasites cannot be safely ignored as populations of species such as the lesser prairie-chicken become smaller, more fragmented, and increasingly vulnerable to the effects of disease. Some degree of impact of parasites and disease is a naturally occurring phenomenon for most species and one element of compensatory mortality that occurs among many species. There is no information that indicates parasites or disease are causing, or contributing to, the decline of any lesser prairie-chicken populations, and, at this time, we have no basis for concluding that disease or parasite loads are a threat to any lesser prairie-chicken populations. Consequently, we do not consider disease or parasite infections to be a significant factor in the decline of the lesser prairie-chicken. However, if populations continue to decline or become more fragmented, even small changes in habitat abundance or quality could have more significant consequences.

Hunting and Other Forms of Recreational, Educational, or Scientific Use

In the late 19th century, lesser prairie-chickens were subject to market hunting (Jackson and DeArment 1963, p. 733; Fleharty 1995, pp. 38–45; Jensen *et al.* 2000, p. 170). Harvest has been regulated since approximately the turn of the 20th century (Crawford 1980, pp. 3–4). Currently, the lesser prairie-chicken is classified as a game species in Kansas, New Mexico, Oklahoma, and Texas, although authorized harvest is allowed only in Kansas. In March of 2009, Texas adopted a temporary, indefinite suspension of their current 2-day season until lesser prairie-chicken populations recover to huntable levels. Previously in Texas, lesser prairie-chicken harvest was not allowed except on properties with an approved wildlife management plan specifically addressing the lesser prairie-chicken. When both Kansas and Texas allowed lesser prairie-chicken harvest, the total annual harvest for both States was fewer than 1,000 birds annually.

In Kansas, the current bag limit is one bird daily for lesser prairie-chickens located south of Interstate 70 and two birds for lesser prairie-chickens located north of Interstate 70. The season typically begins in early November and runs through the end of December in southwestern Kansas. In the northwestern portion of the State, the season typically extends through the end of January. During the 2006 season, hunters in Kansas expended 2,020 hunter-days and harvested approximately 340 lesser prairie-chickens. In 2010, 2,863 hunter-days were expended and an estimated 633 lesser prairie-chickens were harvested in Kansas (Pitman 2012a). Given the low number of lesser prairie-chickens harvested per year in Kansas relative to the population size, the statewide

harvest is probably insignificant at the population level. There are no recent records of unauthorized harvest of lesser prairie-chickens in Kansas (Pitman 2012b).

Two primary hypotheses exist regarding the influence of hunting on harvested populations—hunting mortality is either additive to other sources of mortality or nonhunting mortality compensates for hunting mortality, up to some threshold level. The compensatory hypothesis essentially implies that harvest by hunting removes only surplus individuals, and individuals that escape hunting mortality will have a higher survival rate until the next reproductive season. Both Hunt and Best (2004, p. 93) and Giesen (1998, p. 11) do not believe hunting has an additive mortality on lesser prairie-chickens, although, in the past, hunting during periods of low population cycles may have accelerated declines (Taylor and Guthery 1980b, p. 2). However, because most remaining lesser prairie-chicken populations are now very small and isolated, and because they naturally exhibit a clumped distribution on the landscape, they are likely vulnerable to local extirpations through many mechanisms, including harvest by humans. Braun *et al.* (1994, p. 435) called for definitive experiments that evaluate the extent to which hunting is additive at different harvest rates and in different patch sizes. They suggested conservative harvest regimes for small or fragmented grouse populations because fragmentation likely decreases the resilience of populations to harvest. Sufficient information to determine the rate of localized harvest pressure is unavailable and, therefore, the Service cannot determine whether such harvest contributes to local population declines. We do not consider hunting to be a threat to the species at this time.

However, as populations become smaller and more isolated by habitat fragmentation, their resiliency to the influence of hunting pressure will decline, likely increasing the degree of threat that hunting may pose to the species.

An additional activity that has the potential to negatively affect individual breeding aggregations of lesser prairie-chickens is the growing occurrence of public and guided bird watching tours of leks during the breeding season. The site-specific impact of recreational observations of lesser prairie-chicken at leks is currently unknown but daily human disturbance could reduce mating activities, possibly leading to a reduction in total production. However, disturbance effects are likely to be minimal at the population level if disturbance is avoided by observers remaining in vehicles or blinds until lesser prairie-chickens naturally disperse from the lek and observations are confined to a limited number of days and leks. Solitary leks comprising fewer than ten males are most likely to be affected by repeated recreational disturbance. Suminski (1977, p. 70) strongly encouraged avoidance of activities that could disrupt nesting activities. Research is needed to quantify this potential threat to local populations of lesser prairie-chickens.

In summary, it is possible that harvest of lesser prairie-chickens through sport hunting might be contributing to a decline of some populations, but we have no information that shows whether this is actually occurring and no basis on which to estimate whether hunting is contributing to decline in some areas. However, as populations continue to decline and become more fragmented, the influence of sport

harvest likely will increase the degree of threat. Public viewing of leks tends to be limited, primarily due to a general lack of public knowledge of lek locations and difficulty accessing leks located on private lands. We expect the States will continue to conduct annual lek counts, which contributes to a temporary disturbance when the birds are flushed during attempts to count birds attending the leks. However these disturbances are intermittent and do not occur repeatedly throughout the lekking period. Research on lesser prairie-chickens may result in some capture and handling of the species. Capture-induced stress may occur and could lead to isolated instances of mortality or injury to individual birds. But such research is not widespread and likely does not cause significant population-level impacts. Research is not anticipated to result in loss of habitat, leading to impacts from habitat fragmentation. We are not aware of any other forms of utilization that are negatively impacting lesser prairie-chicken populations. There is currently no known, imminent threat of take attributed to collection or illegal harvest for this species, Consequently, we conclude that overutilization at current population and harvest levels does not pose a threat to the species.

Other Factors

A number of other factors, although they do not directly contribute to habitat loss or fragmentation, can influence the survival of the lesser prairie-chicken. These factors, in combination with habitat loss and fragmentation, likely influence the persistence of the species.

Nest Parasitism and Competition by Exotic Species

Ring-necked pheasants (*Phasianus colchicus*) are nonnative species that overlap the occupied range of the lesser prairie-chicken in Kansas and portions of Colorado, Oklahoma, Texas (Johnsgard 1979, p. 121), and New Mexico (Allen 1950, p. 106). Hen pheasants have been documented to lay eggs in the nests of several bird species, including lesser prairie-chicken and greater prairie-chicken (Hagen *et al.* 2002, pp. 522–524; Vance and Westemeier 1979, p. 223; Kimmel 1987, p. 257; Westemeier *et al.* 1989, pp. 640–641; Westemeier *et al.* 1998, 857–858). Consequences of nest parasitism vary, and may include abandonment of the host nest, reduction in number of host eggs, lower hatching success, and parasitic broods (Kimmel 1987, p. 255). Because pheasant eggs hatch in about 23 days, the potential exists for lesser prairie-chicken hens to cease incubation, begin brooding, and abandon the nest soon after the first pheasant egg hatches. Nests of greater prairie-chickens parasitized by pheasants have been shown to have lower egg success and higher abandonment than unparasitized nests, suggesting that recruitment and abundance may be impacted (Westemeier *et al.* 1998, pp. 860–861). Predation rates also may increase with incidence of nest parasitism (Vance and Westemeier 1979, p. 224). Further consequences are hypothesized to include the imprinting of the pheasant young from the parasitized nest to the host species, and later attempts by male pheasants to court females of the host species (Kimmel 1987, pp. 256–257). Male pheasants have been observed disrupting the breeding behavior of greater

prairie-chickens on leks (Sharp 1957, pp. 242–243; Follen 1966, pp. 16–17; Vance and Westemeier 1979, p. 222). In addition, pheasant displays toward female prairie-chickens almost always cause the female to leave the lek (Vance and Westemeier 1979, p. 222). Thus, an attempt by a male pheasant to display on a prairie-chicken lek could disrupt the normal courtship activities of prairie-chickens.

Few published accounts of lesser prairie-chicken nest parasitism by pheasants exist (Hagen *et al.* 2002, pp. 522–524), although biologists from KPWD, ODWC, Sutton Center, TPWD, and the Oklahoma Cooperative Fish and Wildlife Research Unit have given more than 10 unpublished accounts of such occurrences. Westemeier *et al.* (1998, p. 858) documented statistically that for a small, isolated population of greater prairie-chickens in Illinois, nest parasitism by pheasants significantly reduced the hatchability of nests. Based on their findings, they submit that, in areas with high pheasant populations, the survival of isolated, remnant flocks of prairie-chicken may be enhanced by management intervention to reduce nest parasitism by pheasants (Westemeier *et al.* 1998, p. 861). While Hagen *et al.* (2002, p. 523) documented a rate of only 4 percent parasitism (3 of 75 nests) of lesser prairie-chicken nests in Kansas, the sample size was small and may not reflect actual impacts across larger time, geographic, and precipitation scales. Competition with and parasitism by pheasants may be a potential factor that could negatively affect vulnerable lesser prairie-chicken populations at the local level, particularly if remaining native rangelands become increasingly fragmented (Hagen *et al.*

2002, p. 524). More research is needed to understand and quantify impacts of pheasants on lesser prairie-chicken populations range wide.

Hybridization

The sympatric (overlapping) occupation of habitat and leks by greater prairie-chickens and lesser prairie-chickens in portions of central and northwestern Kansas may pose a limited but potential threat to the species in that region. Hybridization could lead to introgression (infiltration of the genes of one species into the gene pool of another through repeated backcrossing) and reduced reproductive potential; however, hybridization has not been confirmed in these two species (Bain and Farley 2002, pp. 684, 686). Historical records document that the species' ranges overlapped, but that habitat partitioning was clearly evident based on the abundance of sand-adapted vegetation. The relative frequency of natural hybridization prior to EuroAmerican settlement is unknown. Currently, the incidence of hybridization between greater prairie-chickens and lesser prairie-chickens appears very low, typically less than 1 percent. The occurrence of hybridization also is restricted to a small portion, about 250,000 ha (617,000 ac), of the overall current range (Bain and Farley 2002, p. 684). Because current populations north of the Arkansas River in Kansas are generally characterized as low density and very dependent upon the residual habitat structure of fragmented tracts of CRP lands, those populations may be ephemeral depending on implementation of CRP projects and stochastic environmental factors. Low population density also may increase

the susceptibility of lesser prairie-chickens to hybridization and exacerbate the potentially negative effects of hybridization. To date, the fertility of hybrid individuals throughout subsequent generations has not been rigorously tested. The immediate and long-term influence of hybridization on the species is unknown and warrants investigation.

Reduced Population Size and Lek Mating System

A number of harmful effects, such as reduced reproductive success and loss of genetic variation and diversity, become more evident as population sizes decline. These effects may be exacerbated by the lek mating system characteristic of many prairie grouse species. Factors such as high visibility, good auditory projection, and lack of ambient noise are known to influence selection of lek sites by prairie chickens, and such factors likely assist females in locating the mating grounds (Gregory et al. 2011, p. 29). Johnsgard (2002, p. 129) stressed that the mating system used by prairie grouse works most effectively when populations are dense enough to provide the visual and acoustic stimuli necessary to attract prebreeding females to the lek. Once established, the lek must then be large enough to assure that the matings will be performed by the most physically and genetically fit males. Lek breeding already tends to promote inbreeding owing to the limitations caused by relatively few males siring offspring. The tendency of female lesser prairie-chicken and other prairie grouse to typically nest near a lek other than the one on which they mated is an innate mechanism that can help reduce the effects of inbreeding. The remaining small and fragmented lesser prairie-chicken populations

which exist over portions of the currently occupied range indicate that such harmful effects may already be, or soon will be, occurring.

Anthropogenic habitat deterioration and fragmentation not only leads to range contractions and population extinctions but also may also have significant genetic and, thus, evolutionary consequences for the surviving populations. As populations contract and distances between populations increase, opportunities for gene flow are reduced. Specifically, Pruett *et al.* (2009b, p. 258) discussed the influence of population connectivity, or lack thereof, on the lesser prairie-chicken. They concluded that lesser prairie-chicken populations were connected historically, as evidenced by the lack of geographic variation in morphology and the available genetic information which suggests that the populations were contiguous and gene flow occurred among the extant populations. However, Johnson (2008, p. 171) reported that his results indicate that gene flow is currently restricted between lesser prairie-chicken populations in New Mexico and Oklahoma. These findings are not unexpected given information on lesser prairie-chicken movements. Pruett *et al.* (2009b, p. 258) report findings by the Sutton Center that lesser prairie-chickens in Oklahoma were observed to move as much as 20 to 30 km (12 to 19 mi), but the extant lesser prairie-chicken populations in New Mexico and Oklahoma are separated by more than 200 km (124 mi). Given the limited movements of individual lesser prairie-chickens and the distance between these two populations, Pruett *et al.* (2009b, p. 258) considered interaction between these populations to be highly unlikely. Johnson (2008, p. 171) speculated that the observed estimate of gene flow

between the New Mexico and Oklahoma populations could be due to effects of recent genetic drift (change in the genetic composition of a population due to chance events) as habitat fragmentation and isolation developed between the New Mexico and Oklahoma populations. Further examination of the viability of existing lesser prairie-chicken populations will be needed to thoroughly describe the effects of small population size and isolation on persistence of the lesser prairie-chicken.

Surface Water Impoundments

Dams have been constructed on streams within the range of the lesser prairie-chicken to produce impoundments for flood control, water supply, and other purposes. The impounded waters flood not only affected stream segments and riparian areas, but also adjacent areas of grassland and shrubland habitats. Although lesser prairie-chickens may make use of free-standing water, as is retained in surface impoundments, its availability is not critical for survival of the birds (Giesen 1998, p. 4).

The historical range of the lesser prairie-chicken contains approximately 25 large impoundments with a surface area greater than 1,618 ha (4,000 ac), the largest 20 of these (and their normal surface acreage) are listed from largest to smallest in Table 3, below.

Table 3.—Impoundments with surface acreage greater than 1,618 ha (4,000 ac) within the historical range of the lesser prairie-chicken.

| Impoundment | Surface Acreage | State |
|-------------------------|------------------------|--------------|
| John Martin Reservoir | 8,302 ha (20,515 ac) | Colorado |
| O. H. Ivie Lake | 7,749 ha (19,149 ac) | Texas |
| Lake Meredith | 6,641 ha (16,411 ac) | Texas |
| Lake Kemp | 6,309 ha (15,590 ac) | Texas |
| Lake Arrowhead | 6,057 ha (14,969 ac) | Texas |
| E. V. Spence Reservoir | 6,050 ha (14,950 ac) | Texas |
| Hubbard Creek Reservoir | 6,038 ha (14,922 ac) | Texas |
| Twin Buttes Reservoir | 3,965 ha (9,800 ac) | Texas |
| Cheney Reservoir | 3,859 ha (9,537 ac) | Kansas |
| Wilson Lake | 3,642 ha (9,000 ac) | Kansas |
| Foss Lake | 3,561 ha (8,800 ac) | Oklahoma |
| Great Salt Plains Lake | 3,516 ha (8,690 ac) | Oklahoma |
| Ute Reservoir | 3,318 ha (8,200 ac) | New Mexico |
| Canton Lake | 3,201 ha (7,910 ac) | Oklahoma |
| J. B. Thomas Reservoir | 2,947 ha (7,282 ac) | Texas |
| Cedar Bluff Reservoir | 2,779 ha (6,869 ac) | Kansas |
| Lake Brownwood | 2,626 ha (6,490 ac) | Texas |
| Tom Steed Lake | 2,590 ha (6,400 ac) | Oklahoma |
| Lake Altus-Lugert | 2,533 ha (6,260 ac) | Oklahoma |

| | | |
|---------------|------------------------|-------|
| Lake Kickapoo | 2,439 ha (6,028 ac) | Texas |
| Total | 88,129 ha (217,772 ac) | |

(Sources: Kansas Water Office 2012, New Mexico State Parks 2012, Texas Parks and Wildlife Department 2012, Texas State Historical Association 2012, U.S. Army Corps of Engineers 2012, U.S. Bureau of Reclamation 2012)

In addition, the historical range of the lesser prairie-chicken contains many smaller impoundments, such as municipal reservoirs and upstream flood control projects. For example, beginning in the mid-1900s, the USDA constructed hundreds of small impoundments (floodwater retarding structures) within the historical range of the lesser prairie-chicken, through the Watershed Protection and Flood Prevention Program. The program was implemented to its greatest extent in Oklahoma (Oklahoma Conservation Commission 2005), and, within the portion of the lesser prairie-chicken's historical range in that State, the USDA constructed 574 floodwater retarding structures, totaling 6,070 ha (15,001 ac) (Elsener 2012). Similarly, within the portion of the lesser prairie-chicken's historical range in Texas, the USDA constructed 276 floodwater retarding structures, totaling 8,293 surface acres (Bednarz 2012). In Kansas, considerably fewer floodwater retarding structures were constructed within the historical range, totaling some 857 ha (2,118 ac) (Gross 2012). Even fewer such structures were constructed in Colorado and New Mexico.

Cumulatively, the total area of historical lesser prairie-chicken range lost due to construction of large, medium, and small impoundments is about 98,413 ha (243,184 ac), yet likely less than the amount of habitat lost or degraded by other factors discussed in this proposed rule (e.g., conversion of rangeland to cropland and overgrazing). The Service expects a large majority of existing reservoirs to be maintained over the long term. Therefore, these structures will continue to displace former areas of lesser prairie-chicken habitat, as well as fragment surrounding lands as habitat for the lesser prairie-chicken. However, because extensive new dam construction is not anticipated within the lesser prairie-chicken's range, the Service considers it unlikely that this threat will increase in the future.

In summary, several other natural or manmade factors are affecting the continued existence of the lesser prairie-chicken. Parasitism of lesser prairie-chicken nests by pheasants and hybridization with greater prairie chickens has been documented but the incidence remains low. The influence of the above factors on lesser prairie-chicken survival is expected to remain low unless populations continue to decline. Low population density can increase the susceptibility of lesser prairie-chicken to possible genetic effects and increase the negative effects of hybridization, nest parasitism, and competition. The effects of certain natural and manmade factors are considered a threat to the lesser prairie-chicken.

Effects of Existing Regulatory Mechanisms

Regulatory mechanisms, such as Federal, state, and local land use regulation or laws, may provide protection from some threats provided those regulations and laws are not discretionary and are enforceable.

In 1973, the lesser prairie-chicken was listed as a threatened species in Colorado under the State's Nongame and Endangered or Threatened Species Conservation Act. While this designation prohibits unauthorized take, possession, and transport, no protections are provided for destruction or alteration of lesser prairie-chicken habitat. In the remaining States, the lesser prairie-chicken is classified as a game species, although the legal harvest is now closed in New Mexico, Oklahoma, and Texas. Accordingly, the State conservation agencies have the authority to regulate possession of the lesser prairie-chicken, set hunting seasons, and issue citations for poaching. For example, Texas Statute prohibits the destruction of nests or eggs of game birds such as the lesser prairie-chicken. These authorities provide lesser prairie-chickens with protection from direct mortality caused by hunting and prohibit some forms of unauthorized take.

In July of 1997, the NMDGF received a formal request to commence an investigation into the status of the lesser prairie-chicken within New Mexico. This request began the process for potential listing of the lesser prairie-chicken under New Mexico's Wildlife Conservation Act. In 1999, the recommendation to list the lesser prairie-chicken as a threatened species under the Wildlife Conservation Act was

withdrawn until more information was collected from landowners, lessees, and land resource managers who may be affected by the listing or who may have information pertinent to the investigation. In late 2006, NMDGF determined that the lesser prairie-chicken would not be State-listed in New Mexico. New Mexico's Wildlife Conservation Act, under which the lesser prairie-chicken could have been listed, offers little opportunity to prevent otherwise lawful activities, including many of the activities previously discussed.

Regardless of each State's listing status, most occupied lesser prairie-chicken habitat throughout its current range occurs on private land (Taylor and Guthery 1980b, p. 6), where State conservation agencies have little authority to protect or direct management of the species' habitat. All five States in occupied range have incorporated the lesser prairie-chicken as a species of conservation concern and management priority in their respective State Wildlife Action Plans. While identification of the lesser prairie-chicken as a species of conservation concern does help heighten public awareness, this designation provides no protection from direct take or habitat destruction or alteration.

Some States, such as Oklahoma, have laws and regulations that address use of State school lands, primarily based on maximizing financial return from operation of these lands. However, the scattered nature of these lands and requirement to maximize financial returns minimize the likelihood that these lands will be managed to reduce degradation and fragmentation of habitat and ensure the conservation of the species.

Lesser prairie-chickens are not covered or managed under the provisions of the Migratory Bird Treaty Act (16 U.S.C. 703–712) because they are considered resident game species. The lesser prairie-chicken has an International Union for Conservation of Nature (IUCN) Red List Category of “vulnerable” (BirdLife International 2008), and NatureServe currently ranks the lesser prairie-chicken as G3—Vulnerable (NatureServe 2011, entire). The lesser prairie-chicken also is on the National Audubon Society’s WatchList 2007 Red Category, which is “for species that are declining rapidly or have very small populations or limited ranges, and face major conservation threats.” However, none of these designations provide any regulatory protection.

There are six National Grasslands located within the historical range of the lesser prairie-chicken. The National Grasslands are managed by the USFS, have been under Federal ownership since the late 1930s, and were officially designated as National Grasslands in 1960. The Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands are administered by the Cibola National Forest. The Kiowa National Grassland covers 55,659 ha (137,537 ac) and is located within Mora, Harding, Union, and Colfax Counties, New Mexico. The Rita Blanca National Grassland covers 37,631 ha (92,989 ac) and is located within Dallam County, Texas, and Cimarron County, Oklahoma. The Black Kettle National Grassland covers 12,661 ha (31,286 ac) and is located within Roger Mills County, Oklahoma, and Hemphill County, Texas. The McClellan Creek National Grassland covers 586 ha (1,449 ac) and is located in Gray

County, Texas. No breeding populations of lesser prairie-chickens are known to occur on these holdings.

The Comanche and Cimarron National Grasslands are under the administration of the Pike and San Isabel National Forest. The Comanche National Grassland covers 179,586 ha (443,765 ac) and is located within Baca, Las Animas, and Otero Counties, Colorado. The Cimarron National Grassland covers 43,777 ha (108,175 ac) and is located in Morton and Stevens Counties, Kansas. Both of these areas are known to support breeding lesser prairie-chickens.

The National Forest Management Act of 1976 and the associated planning rule in effect at the time of planning initiation are the principal law and regulation governing the planning and management of National Forests and National Grasslands by the USFS. In 2008, a new National Forest System Land Management Planning Rule (36 CFR Part 219) took effect and was used to guide the development of a Land and Resource Management Plan for the Comanche and Cimarron National Grasslands. That plan was one of the first plans developed and released under the 2008 planning rule. The predecisional review version of the Cimarron and Comanche National Grasslands Land Management Plan was made available to the public on October 17, 2008. The lesser prairie-chicken was included as a species-of-concern in accordance with guidance available in the existing planning rule (USFS 2008, p. 35). As defined in the 2008 planning rule, species-of-concern are species for which the Responsible Official determines that management

actions may be necessary to prevent listing under the Endangered Species Act (36 CFR 219.16). Identification of the lesser prairie-chicken as a species-of-concern in the Cimarron and Comanche National Grasslands Land Management Plan led to inclusion of planning objectives targeting improvement of the species' habitat, as described below.

Planning for the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands was well underway when the 2008 National Forest System Land Management Planning Rule was enjoined on June 30, 2009, by the United States District Court for the Northern District of California (*Citizens for Better Forestry v. United States Department of Agriculture*, 632 F. Supp. 2d 968 (N.D. Cal. June 30, 2009)). A new planning rule was finalized in 2012 (77 FR 67059) and became effective on May 9, 2012. The transition provisions of the 2012 planning rule (36 CFR 219.17(b)(3)) allow those National Forest System lands that had initiated plan development, plan amendments, or plan revisions prior to May 9, 2012, to continue using the provisions of the prior planning regulation. The Cibola National Forest elected to use the provisions of the 1982 planning rule, including the requirement to prepare an Environmental Impact Statement, to complete its plan development for the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands.

The Comanche and Cimarron National Grasslands currently manages the Comanche Lesser Prairie-chicken Habitat Zoological Area, now designated as a Colorado Natural Area, which encompasses an area of 4,118 ha (10,177 ac) that is managed to

benefit the lesser prairie-chicken. Current conditions on this area include existing oil and gas leases, two-track roads, utility corridors, and livestock grazing. Wildfires on the area have been suppressed over the last 30 years. The area provides a special viewing area for the lesser prairie-chicken, which has been closed to protect lekking activities. The plan specifies that the desired future condition of the area would be to retain habitat conditions suitable for the lesser prairie-chicken. Specifically, the objectives of the plan identify steps that would be taken over the next 15 years to achieve the desired conditions. One objective would be to retain a minimum of 6,665 ha (16,470 ac) of sand sagebrush prairie ecosystem for the lesser prairie-chicken. Within the Comanche Lesser Prairie-chicken Habitat Zoological Area, over the next 15 years, a minimum of 202 ha (500 ac) would be treated to increase native plant diversity.

Design criteria identified in the current Cimarron and Comanche National Grasslands Land Management Plan for management of the sand sagebrush prairie include: (1) limited construction of new structures or facilities typically within 3.2 km (2 mi) of known lesser prairie-chicken leks or populations if those structures and facilities would negatively impact the lesser prairie-chicken; (2) protection of leks, nesting habitat, and brood rearing habitat from surface disturbances (e.g., dog training, drilling, and various forms of construction) between March 15 to July 15; and (3) provision for adequate residual cover during nesting periods. Within the Comanche Lesser Prairie-Chicken Habitat Zoological Area, design criteria include limiting or using livestock grazing in a manner that does not negatively impact lesser prairie-chicken nesting habitat.

The USFS also committed to monitoring any changes in distribution and abundance of the lesser prairie-chicken on the National Grasslands.

Prior planning regulations included a requirement for the USFS to identify species as management indicator species, if their population changes were believed to be indicative of the effects of management activities (36 CFR 219.19). Under the 2008 regulations, the concept of management indicator species was not included in the final rule. The 2008 planning regulations instead chose to use “species-of-concern”. Species that were identified as proposed and candidate species under the Endangered Species Act were classified as species-of-concern. The primary purpose of identifying species-of-concern was to put in place provisions that would have contributed to keeping those species from being listed as threatened or endangered species. As explained above, the transition provisions (36 CFR 219.17(b)(3)) of the 2012 planning rule allow the use of the provisions of the 1982 planning rule, including the requirement that management indicator species be identified as part of the plan. Management indicator species serve multiple functions in forest planning: focusing management direction developed in the alternatives, providing a means to analyze effects on biological diversity, and serving as a reliable feedback mechanism during plan implementation. The latter often is accomplished by monitoring population trends in relationship to habitat changes. Although suitable habitat is present, no breeding populations of lesser prairie-chickens are known from the Kiowa, Rita Blanca, Black Kettle, and McClellan Creek National Grasslands. Consequently, the lesser prairie-chicken is not designated as a management

indicator species in the plan. Instead the lesser prairie-chicken is included on the Regional Forester's sensitive species list and as an At-Risk species.

The USFS also contracted with lesser prairie-chicken experts to prepare a succinct evaluation of species of potential viability concern, addressing eight factors pertinent to species viability. A Technical Conservation Assessment for the lesser prairie-chicken (Robb and Schroeder 2005, p. 8) was completed and confirms the need to retain sensitive species status designation for the lesser prairie-chicken. Species conservation assessments produced as part of the Species Conservation Project are designed to provide land managers, biologists, and the public with a thorough discussion of the biology, ecology, conservation, and management of the lesser prairie-chicken based on existing scientific knowledge. The assessment goals limit the scope of the work to summaries of scientific knowledge, discussion of broad implications of that knowledge, and outlines of information needs. The assessment does not seek to develop specific prescriptions for management of populations and habitats. Instead, it is intended to provide the ecological background upon which management should be based and focuses on the consequences of changes in the environment that result from management (i.e., management implications). This comprehensive document can be found on the internet at <http://www.fs.fed.us/r2/projects/scp/assessments/lesserprairiechicken.pdf>.

The other primary Federal surface ownership of lands occupied by the lesser prairie-chicken is administered by the BLM in New Mexico. In New Mexico, roughly 41

percent of the known historical and most of the currently occupied lesser prairie-chicken range occurs on BLM land. The BLM currently manages approximately 342,969 surface ha (847,491 ac) within lesser prairie-chicken range in eastern New Mexico. They also oversee another 120,529 ha (297,832 ac) of Federal minerals below private surface ownership. The core of currently occupied lesser prairie-chicken habitat in New Mexico is within the Roswell BLM Resource Area. However, the Carlsbad BLM Resource Area comprised much of the historical southern periphery of the species' range in New Mexico. The BLM's amended RMPA (BLM 2008, pp. 5–31) provides some limited protections for the lesser prairie-chicken in New Mexico by reducing the number of drilling locations, decreasing the size of well pads, reducing the number and length of roads, reducing the number of powerlines and pipelines, and implementing best management practices for development and reclamation. Implementation of these protective measures, particularly curtailment of new mineral leases, would be greatest in the Core Management Area and the Primary Population Area habitat management units (BLM 2008, pp. 9–11). The Core Management and Primary Population Areas are located in the core of the lesser prairie-chicken occupied range in New Mexico. The effect of these best management practices on the status of the lesser prairie-chicken is unknown, particularly considering some 60,000 ha (149,000 ac) have already been leased in those areas (BLM 2008, p. 8). The effectiveness of the amended RMPA is hampered by a lack of explicit measures designed to improve the status of the lesser prairie-chicken, limited certainty that resources will be available to carry out the management plan, limited regulatory or procedural mechanisms in place to carry out the efforts, lack of monitoring

efforts, and provision for exceptions to the best management practices under certain conditions, which could negate the benefit of the conservation measures.

The amended RMPA stipulates that implementation of measures designed to protect the lesser prairie-chicken and dunes sagebrush lizard may not allow approval of all spacing unit locations or full development of a lease (BLM 2008, p. 8). In addition, the RMPA prohibits drilling and exploration in lesser prairie-chicken habitat between March 1 and June 15 of each year (BLM 2008, p. 8). No new mineral leases will be issued on approximately 32 percent of Federal mineral acreage within the RMPA planning area (BLM 2008, p. 8), although some exceptions are allowed on a case-by-case basis (BLM 2008, pp. 9–11). Within the Core Management Area and Primary Population Area, new leases will be restricted in occupied and suitable habitat; however, if there is an overall increase in reclaimed to disturbed acres over a 5-year period, new leases in these areas will be allowed (BLM 2008, p. 11). Considering Hunt and Best (2004, p. 92) concluded that petroleum development at intensive levels likely is not compatible with populations of lesser prairie-chicken, additional development in the Core Management Area and Primary Population Area habitat management units may hinder long-term conservation of the species in New Mexico. The RMPA allows lease applicants to voluntarily participate in a power line removal credit to encourage removal of idle power lines (BLM 2008, pp. 2–41). In the southernmost habitat management units, the Sparse and Scattered Population Area and the Isolated Population Area, where lesser prairie-

chickens are now far less common than in previous decades (Hunt and Best 2004), new leases will not be allowed within 2.4 km (1.5 mi) of a lek (BLM 2008, p. 11).

The ineffectiveness of certain imposed energy development stipulations near leks for the purpose of protecting grouse on Federal lands has been recently confirmed for sage grouse. Holloran (2005, p. 57) and Naugle *et al.* (2006a, p. 3) documented that sage grouse avoid energy development (coalbed methane) not only in breeding and nesting habitats, but also in wintering habitats. They assert that current best management practices in use by Federal land management agencies that place timing stipulations or limit surface occupancy near greater sage-grouse leks result in a human footprint that far exceeds the tolerance limits of sage grouse. Ultimately, they recommended that effective conservation strategies for grouse must limit the cumulative impact of habitat disturbance, modification, and destruction in all habitats and at all times of the year (Holloran 2005, p. 58; Naugle *et al.* 2006b, p. 12). Additional research on the effect of petroleum development on lesser prairie-chicken is needed. However, available information on the lesser prairie-chicken (Suminski 1977, p. 70; Hagen *et al.* 2004, pp. 74–75; Hunt and Best 2004, p. 92; Pitman *et al.* 2005, pp. 1267–1268) indicates that the effect is often detrimental, particularly during the breeding season.

Because only about 4 percent of the species' overall range occurs on Federal lands, the Service recognizes that the lesser prairie-chicken cannot be fully recovered on Federal lands alone. However, no laws or regulations currently protect lesser prairie-

chicken habitat on private land, aside from State harvest restrictions. Therefore, the Service views decisions regarding the management and leasing of Federal lands and minerals within existing lesser prairie-chicken range as important to the future conservation and persistence of the species.

Since 2004, the construction of commercial wind energy projects near and within occupied lesser prairie-chicken habitat has raised concerns about the potential negative effects such projects may have on the species, if constructed at large scales in occupied range. As discussed previously, a rapid expansion of transmission lines and associated wind energy development throughout large portions of occupied lesser prairie-chicken range is occurring. Because most wind development activities are privately funded and are occurring on private land, wind energy siting, development, and operation falls outside the purview of the National Environmental Policy Act of 1969 (NEPA) and other Federal conservation statutes and regulatory processes. As a result, little opportunity for timely and appropriate environmental review and consultation by Federal, state, and local conservation entities exists.

The current lack of regulatory oversight and public notice requirements for the purchase of wind rights and construction of wind generation and related transmission facilities is a concern. Specifically, the Service is unaware of any state or Federal mechanisms that require potential wind energy producers to disclose the location, size, and anticipated construction date for pending projects or require analysis under the

provisions of the NEPA. Lacking the ability to obtain pertinent siting information or analyze alternative siting locations, neither the Service nor State conservation agencies have the ability to accurately influence the size or timing of wind generation construction activities within occupied lesser prairie-chicken habitat.

In summary, most occupied lesser prairie-chicken habitat occurs on private land, where State conservation agencies have little authority to protect lesser prairie-chicken or facilitate and monitor management of lesser prairie-chicken habitat beyond regulating recreational harvest. Because most lesser prairie-chicken habitat destruction and modification on private land occurs through otherwise lawful activities such as agricultural conversion, livestock grazing, energy development, and fire exclusion, few (if any) regulatory mechanisms are in place to substantially alter human land uses at a sufficient scale to protect lesser prairie-chicken populations and their habitat. While almost no regulatory protection is in place for the species, regulatory incentives, in the form of county, state, and national legislative actions, have been created to facilitate the expansion of activities that result in fragmentation of occupied lesser prairie-chicken habitat, such as that resulting from oil, gas, and wind energy development. For the remaining 4 percent of occupied habitat currently under Federal management, habitat quality depends primarily on factors related to multiple use mandates, such as livestock grazing and oil, gas, and wind power development activities. Because prior leasing commitments and management decisions on the majority of occupied parcels of Federal land offer little flexibility for reversal, any new regulatory protection for uncommitted

land units are important and will take time to achieve substantial benefits for the species in the long term.

We note that the existing regulatory mechanisms at the Federal and State level have not been sufficient to preclude the decline of the species. In spite of the existing regulatory mechanisms, the current and projected threat from the loss and fragmentation of lesser prairie-chicken habitat and range is still ongoing.

Proposed Listing Determination

As required by the Act, we considered the five factors in assessing whether the lesser prairie-chicken meets the definition of a threatened or endangered species. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the lesser prairie-chicken. Based on our review of the best available scientific and commercial information, we find the lesser prairie-chicken is likely to become in danger of extinction in the foreseeable future and therefore meets the definition of a threatened species.

The life history and ecology of the lesser prairie-chicken makes it exceptionally vulnerable to changes on the landscape. As discussed above, the lek breeding system which requires males and females to be able to hear and see each other over relatively wide distances, the need for large patches of habitat that include several types of

microhabitats, and the behavioral avoidance of vertical structures make the lesser prairie-chicken vulnerable to habitat impacts, especially at its currently reduced numbers. Specifically, its behavioral avoidance of vertical structures causes its habitat to be more functionally fragmented than another species' habitat would be. For example, a snake likely would continue to use habitat underneath a wind turbine, but the lesser prairie-chicken's predator avoidance behavior causes it to avoid a large area (estimated to be a mile) around a tall vertical object. The habitat within that 1.6-km (1-mi) buffer continues to be otherwise suitable for lesser prairie-chickens, but the entire area is avoided because of the vertical structure. As a result, the impact of any individual fragmenting feature is of higher magnitude than the physical footprint of that structure would suggest it should be.

The historical, current, and ongoing threats to the lesser prairie-chicken are widespread and of high magnitude. The lesser prairie-chicken is currently imperiled throughout all of its range due to historical, ongoing impacts and probable future impacts of the cumulative habitat loss and fragmentation. These impacts are the result of conversion of grasslands to agricultural uses, encroachment by invasive woody plants, wind energy development, petroleum production, roads, and presence of manmade vertical structures including towers, utility lines, fences, turbines, wells, and buildings. The historical and current impact of these fragmenting factors has reduced the status of the species to the point that individual populations are vulnerable to extirpation as a result of stochastic events such as extreme weather events. Additionally, these populations are

more vulnerable to the effects of climate change, disease, and predation than they would have been at historical population levels. These threats are currently impacting lesser prairie-chickens throughout their range and are projected to continue and to increase in severity into the foreseeable future.

The range of the lesser prairie-chicken has been reduced by an estimated 84 percent. The vulnerability of lesser prairie-chickens to changes on the landscape is magnified compared to historical times due to its reduced population numbers, prevalence of isolated populations, and reduced range. There are few areas of large patches of unfragmented, suitable grassland remaining. Based on our analysis presented earlier, some 99.8 percent of the remaining suitable habitat patches were less than 2,023 ha (5,000 ac) in size. In order to thrive and colonize unoccupied areas, lesser prairie-chickens require large patches of functionally unfragmented habitat that include a variety of microhabitats needed to support lekking, nesting, brood rearing, feeding for young, and feeding for adults, among other things. Habitat patches that do not contain all of these microhabitats may support population persistence, but may not support thriving populations that can produce surplus males capable of colonizing new areas or recolonizing previously extirpated areas.

Due to its reduced population size and ongoing habitat loss and degradation, the species lacks sufficient redundancy and resiliency to recover from present and foreseeable future probable threats. As a result, the status of the species has been reduced

to the point that individual populations are vulnerable to extirpation due to a variety of stochastic events (e.g., drought, winter storms). These extirpations are especially significant because, in many places, there are no nearby, connected populations with robust numbers that can rescue the extirpated populations (i.e., be a source for recolonization). Without intervention, population numbers will continue to decline and the range of the species will continue to contract.

In summary, as a result of the significant reduction in numbers and range of lesser prairie-chickens resulting from cumulative ongoing habitat fragmentation, combined with the lack of sufficient redundancy and resiliency of current populations, we conclude that the lesser prairie-chicken is currently at risk of extinction or is likely to be in danger of extinction in the foreseeable future.

We must then assess whether the species is in danger of extinction now (i.e., an endangered species) or is likely to become in danger of extinction in the foreseeable future (i.e., a threatened species). In assessing the status of the lesser prairie-chicken, we applied the general understanding of “in danger of extinction” as discussed in the December 22, 2010, memo to the Polar Bear Listing Determination File, “Supplemental Explanation for the Legal Basis of the Department’s May 15, 2008, Determination of Threatened Status for the Polar Bear”, signed by then Acting Director Dan Ashe (hereafter referred to as Polar Bear Memo). As discussed in the Polar Bear Memo, a key statutory difference between a threatened species and an endangered species is the timing

of when a species may be in danger of extinction (i.e., currently on the brink of extinction), either now (endangered species) or in the foreseeable future (threatened species). A species that is in danger of extinction at some point beyond the foreseeable future does not meet the definition of either an endangered species or a threatened species.

As discussed in the Polar Bear Memo, because of the fact-specific nature of listing determinations, there is no single metric for determining if a species is “in danger of extinction” now. Nonetheless, the practice of the Service over the past four decades has been remarkably consistent. Species that the Service has determined to be in danger of extinction now, and therefore appropriately listed as an endangered species, generally fall into four basic categories. The best scientific data available indicates that the lesser prairie-chicken fits into the category: “Species with still relatively widespread distribution that have nevertheless suffered ongoing major reductions in its numbers, range, or both, as a result of factors that have not been abated.” However, the Polar Bear Memo goes on to explain that threatened species share some characteristics with this category of endangered species, “Whether a species in this situation is ultimately an endangered species or threatened species depends on the specific life history and ecology of the species, the natures of the threats, and population numbers and trends.”

As discussed above, the foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations

about the future conservation status of the species. For the lesser prairie-chicken, information about the primary ongoing and future threats is reasonably well-known and reliable. As suggested by the Polar Bear Memo, species like the lesser prairie-chicken that have suffered ongoing major reductions in numbers and range due to factors that have not been abated may be classified as a threatened species if some populations appear stable, which would indicate that the entity as a whole was not in danger of extinction now (i.e., not an endangered species). In the case of the lesser prairie-chicken, the best available information indicates that while there have been major range reductions (84 percent) as a result of factors that have not been abated (cumulative habitat fragmentation) and while there continues to be uncertainty around the current status of the species, particularly in the face of significant drought events in 2011 and 2012, there may be sufficient stable populations to allow the species to persist into the near future. The remaining populations are spread over a large geographical area and the current range of the species includes populations that represent the known diversity of ecological settings for the lesser prairie-chicken. As a result, it is unlikely that a single stochastic event (e.g., drought, winter storm) will affect all known extant populations equally or simultaneously, therefore, it would require several stochastic events over a number of years to bring the lesser prairie-chicken to the brink of extinction due to those factors alone. Similarly, the current and ongoing threats of conversion of grasslands to agricultural uses, encroachment by invasive woody plants, wind energy development, and petroleum production are not likely to impact all remaining populations significantly in the near term because these activities either move slowly across the landscape or take

several years to plan and implement. Therefore, because there may be sufficient stable populations to allow the lesser prairie-chicken to persist into the near future, it is not in danger of extinction throughout all of its range now, and more appropriately meets the definition of a threatened species (i.e., likely to become in danger of extinction in the foreseeable future).

In conclusion, as described above, the lesser prairie-chicken has experienced significant reductions in range and population numbers, is especially vulnerable to impacts due to its life history and ecology, and is subject to significant current and ongoing threats in the foreseeable future. However, there may be sufficient stable populations to allow the species to persist into the near future. Therefore, after a review of the best available scientific information as it relates to the status of the species and the five listing factors, we find the lesser prairie-chicken is likely to become in danger of extinction in the foreseeable future throughout its range.

CRITICAL HABITAT DESIGNATION FOR LESSER PRAIRIE-CHICKEN

Background

Critical habitat is defined in section 3 of the Act as:

(i) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features:

(I) Essential to the conservation of the species, and

(II) Which may require special management considerations or protection; and

(ii) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means using all methods and procedures deemed necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be relieved otherwise, may include regulated taking.

Critical habitat receives protection under section 7(a)(2) of the Act through the requirement that Federal agencies insure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not alter land

ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Instead, where a landowner seeks or requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the applicant is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of

the species. Primary constituent elements are the elements of physical or biological features that are the specific components that provide for a species' life-history processes, are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. For example, an area formerly occupied by the species but that was not occupied at the time of listing may be essential to the conservation of the species and may be included in a critical habitat designation. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its current occupied range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific and commercial data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106-554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act

and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas we should designate as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include articles published in peer-reviewed journals, conservation plans developed by States and Counties, scientific status surveys and studies, biological assessments, or other unpublished materials and expert opinion or personal knowledge.

Habitat is often dynamic, and species may move from one area to another over time. Furthermore, we recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species, considering additional scientific information may become available in the future. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) conservation actions implemented under section 7(a)(1) of the Act; (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to insure their actions are not likely to jeopardize the continued existence of any endangered or threatened species; and (3) the prohibitions of section 9 of the Act if

actions occurring in these areas may result in take of the species. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, HCPs, or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Prudency Determination

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time a species is determined to be an endangered or threatened species. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and the identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

There is currently no operative threat to lesser prairie-chickens attributed to unauthorized collection or vandalism, and identification and mapping of critical habitat is

not expected to initiate any such threat. Thus, we conclude designating critical habitat for the lesser prairie-chicken is not expected to create or increase the degree of threat to the species due to taking.

Conservation of lesser prairie-chickens and their essential habitats will focus on, among other things, habitat management, protection, and restoration, which will be aided by knowledge of habitat locations and the physical or biological features of the habitat. In the absence of finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, then a prudent finding is warranted. We conclude that the designation of critical habitat for the lesser prairie-chicken will benefit the species by serving to focus conservation efforts on the restoration and maintenance of ecosystem functions within those areas considered essential for achieving its recovery and long-term viability. Other potential benefits include: (1) Triggering consultation under section 7(a)(2) of the Act in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is or has become unoccupied or the occupancy is in question; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or County governments or private entities; and (4) preventing inadvertent harm to the species.

Therefore, because we have determined that the designation of critical habitat will not likely increase the degree of threat to the species and may provide some benefit, we find that designation of critical habitat is prudent for the lesser prairie-chicken.

Critical Habitat Determinability

Having determined that designation is prudent, under section 4(a)(3) of the Act we must find whether critical habitat for the species is determinable. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist:

- (i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or
- (ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. When critical habitat is not determinable, the Act allows the Service an additional year following publication of a final listing rule to publish a final critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

In accordance with section 3(5)(A)(i) and 4(b)(1)(A) of the Act and the regulations at 50 CFR 424.12, in determining which areas occupied by the species at the time of listing to designate as critical habitat, we consider the physical and biological features essential to the conservation of the species which may require special management considerations or protection. These include, but are not limited to:

- (1) Space for individual and population growth and for normal behavior;
 - (2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
 - (3) Cover or shelter;
 - (4) Sites for breeding, reproduction, and rearing (or development) of offspring;
- and
- (5) Habitats that are protected from disturbance or are representative of the historical geographical and ecological distributions of a species.

We are currently unable to identify critical habitat for the lesser prairie-chicken because important information on the geographical area occupied by the species, the physical and biological habitat features that are essential to the conservation of the species, and the unoccupied areas that are essential to the conservation of the species is not known at this time. A specific shortcoming of the currently available information is the lack of data about: (1) The specific physical and biological features essential to the conservation of the species; (2) how much habitat may ultimately be needed to conserve the species; (3) where the habitat patches occur that have the best chance of rehabilitation; and (4) where linkages between current and future populations may occur. Additionally, while we have reasonable general information about habitat features in areas occupied by lesser prairie-chickens, we do not know what specific features, or combinations of features, are needed to ensure persistence of stable, secure populations.

Several conservation actions are currently underway that will help inform this process and reduce some of the current uncertainty. Incorporation of the information from these conservation actions will give us a better understanding of the species' biological requirements and what areas are needed to support the conservation of the species.

The five State Conservation Agencies within the occupied range of the lesser prairie-chicken, through coordination with the Western Association of Fish and Wildlife Agencies Grassland Initiative, have been funded to develop a rangewide survey sampling framework and to implement aerial surveys during the spring (March through May) of 2012, and continuing into 2013. Implementation of these aerial surveys is important as they will enable biologists to determine location of leks that are too distant from public roads to be detected during standard survey efforts. Our critical habitat determination will benefit from this additional information and allow us to consider the most recent and best science in making our critical habitat determination.

Similarly, all five State Conservation Agencies within the occupied range of the lesser prairie-chicken have partnered with the Service and Playa Lakes Joint Venture, using funding from the DOE and the Western Governor's Association, to develop a decision support system that assists in evaluation of lesser prairie-chicken habitat, assists industry with nonregulatory siting decisions, and facilitates targeting of conservation activities for the species. The first iteration of that product, Phase I, went online in

September 2011 (<http://kars.ku.edu/geodata/maps/sgpchat/>). This decision support system is still being refined, and a second iteration of the product (Phase II), under oversight of the Western Association of Fish and Wildlife Agencies, will provide additional information that will help improve evaluation of lesser prairie-chicken habitat. The Steering Committee of the Great Plains Landscape Conservation Cooperative has made completion of Phase II one of their highest priorities for over the next 18 months. The Lesser Prairie-chicken Interstate Working Group will be identifying the research and data needs for moving Phase II forward. Outputs derived from this decision support tool will help us more precisely identify the location and distribution of features essential to the conservation of the lesser prairie-chicken.

Additionally, the Service is actively pursuing the development of a population viability analysis that we anticipate will significantly inform the development of a critical habitat proposal. A population viability analysis is a modeling effort that is intended to estimate the likelihood of persistence of a population or species into the future. The analysis can be used to assess appropriate population targets that would be expected to support long term persistence, and can be used to compare and contrast a variety of potential management options.

Finally, the five State Conservation Agencies also are working to develop a multi-State rangewide conservation strategy that likely will provide information on the location

of focal areas where targeted conservation is anticipated to contribute significantly to long-term viability of the lesser prairie-chicken.

Consequently, while we recognize that the Act requires us to use the best available scientific information available at any given time when developing a critical habitat designation, we believe these additional efforts that are ongoing over the next 6 months or more will be vital pieces of information that will support a more well-reasoned critical habitat designation that will better contribute to the conservation of the species. Therefore, we have concluded that critical habitat is not determinable for the lesser prairie-chicken at this time.

Peer Review

In accordance with our joint policy published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of such review is to ensure that our determination of status for this species is based on scientifically sound data, assumptions, and analyses. We will send peer reviewers copies of this proposed rule immediately following publication in the **Federal Register**. We will invite these peer reviewers to comment, during the public comment period, on our use and interpretation of the science used in developing our proposal to list the lesser prairie-chicken.

We will consider all comments and information we receive during the comment period on this proposed rule during preparation of a final rulemaking. Accordingly, the final decision may differ from this proposal.

Public Hearings

Four public hearings have been scheduled on this proposal (see information in **DATES** and **ADDRESSES** sections above). Persons needing reasonable accommodations to attend and participate in a public hearing should contact the Oklahoma Ecological Services Field Office at 918-581-7458, as soon as possible. To allow sufficient time to process requests, please call no later than 1 week before the hearing date. Information regarding this proposed rule is available in alternative formats upon request.

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

- (a) Be logically organized;
- (b) Use the active voice to address readers directly;

- (c) Use clear language rather than jargon;
- (d) Be divided into short sections and sentences; and
- (e) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*)

This rule does not contain any new collections of information that require approval by Office of Management and Budget under the Paperwork Reduction Act. This rule will not impose recordkeeping or reporting requirements on State or local governments, individuals, businesses, or organizations. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid Office of Management and Budget control number.

National Environmental Policy Act

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with regulations adopted under section 4(a)(1) of the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes.

By letter dated April 19, 2011, we contacted known tribal governments throughout the historical range of the lesser prairie-chicken. We sought their input on our

development of a proposed rule to list the lesser prairie-chicken and encouraged them to contact the Oklahoma Field Office if any portion of our request was unclear or to request additional information. We did not receive any comments regarding this request.

References Cited

A complete list of all references cited in this proposed rule is available on the internet at <http://www.regulations.gov>, or upon request from the Field Supervisor, Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT** section).

Authors

The primary authors of this proposed rule are the staff members of the Oklahoma Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 16 U.S.C. 1531-1544; 16 U.S.C. 4201-4245; Public Law 99-625, 100 Stat. 3500; unless otherwise noted.

2. Amend §17.11(h) by adding an entry for “Prairie-chicken, lesser” in alphabetical order under BIRDS to the List of Endangered and Threatened Wildlife to read as follows:

§17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

| Species | | Historic range | Vertebrate population where endangered or threatened | Status | When listed | Critical habitat | Special rules |
|-------------------------|-------------------------------------|-----------------------------|--|--------|-------------|------------------|---------------|
| Common name | Scientific name | | | | | | |
| * * * * * | | | | | | | |
| BIRDS | | | | | | | |
| * * * * * | | | | | | | |
| Prairie-chicken, lesser | <i>(Tympanuchus pallidicinctus)</i> | U.S.A. (CO, KS, NM, OK, TX) | Entire | T | | NA | NA |
| * * * * * | | | | | | | |

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Dated: November 26, 2012

Signed: Daniel M. Ashe

Director, Fish and Wildlife Service

~~[Endangered and Threatened Wildlife and Plants; Listing the Lesser Prairie-
Chicken as a Threatened Species]~~