



Assessment and Conservation Strategy for the Lesser Prairie-chicken (*Tympanuchus pallidicinctus*)

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CONSERVATION ASSESSMENT

I. INTRODUCTION

The purpose of the Lesser Prairie-chicken (LPC) (*Tympanuchus pallidicinctus*) Conservation Plan is to describe the current status of the LPC, identify potential threats to the population on a regional basis, and outline a plan of action with the goal of increasing the range-wide population and distribution of the LPC. Although the majority of the LPC population and habitat exist on private land, this plan is intended to address conservation measures for this species on both private and publicly owned lands.

This conservation plan is intended to be the first step toward a cooperative effort between state and federal agencies and private landowners to conserve LPC's and the habitat that supports them. This document represents the scientific community's best attempt at a first draft of a conservation plan. The authors believe that landowner involvement in the development of this document is crucial to the development of a successful plan. This plan will be subjected to the comments, criticisms, and changes of private landowners/managers and the general public and revised accordingly. The authors of this document acknowledge the fact that this is merely the first of possibly many future editions of this plan. It should be viewed as a dynamic plan, subject to periodic updates and changes as new information is obtained through research and public comment. A tremendous amount of effort will be expended for the purpose of including all stakeholders in the development and implementation of strategies described within this plan.

On October 6, 1995, the U.S Fish & Wildlife Service (Service) received a petition to list the LPC as threatened within its known historical range. Due to budgetary constraints and a moratorium placed upon federal listing activities, a ninety-day finding was not published in the Federal Register until July 8, 1997 (62 FR 36482). The Service stated in the 90-day finding that sufficient evidence was present in the petition to warrant further investigation. During this interim period, the five state wildlife agencies within the current range of the LPC, along with other state, federal, and private partners, formed the Lesser Prairie-chicken Interstate Working Group (LPCIWG) to address LPC conservation issues on a regional basis. Each of the five state wildlife agencies pledged their support for this effort through a letter to the Service (Appendix A). Membership of the working group consists of entities with the resources, ability, and willingness to implement the objectives, strategies, and activities detailed in this document. The Service

published the 12-Month Finding in the Federal Register on June 9, 1998 (63 FR 31400) stating that listing of the LPC is warranted but precluded which added the LPC to the Service's candidate species list. Currently, regulatory authority of the LPC rests entirely with the states. However, The USDA Forest Service (USFS) lists the LPC as a sensitive species on the National Grasslands and the Bureau of Land Management (BLM) considers the LPC as an emphasis species. Until such time as the LPC is listed as threatened, conservation activities described within this document will be coordinated through the LPCIWG in cooperation with other participating state, federal, and private land managers.

The USFWS uses 5 criteria by which to gauge a species' need for federal protection under the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1532 et seq.). These criteria include: (1) the present or threatened destruction, modification, or curtailment of a species' habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; (5) other natural or manmade factors affecting its continued existence.

The conservation plan attempts to address LPC conservation concerns by defining the issues in the Risk Assessment section of this plan and proposing a plan of action to address these concerns in the Conservation Strategy section. The primary concerns associated with LPC conservation were identified by the LPCIWG meeting participants and through public input. They are listed below and will be discussed in the context of the Service's 5 listing criteria:

Primary Concerns Associated With LPC Conservation

- Habitat Alteration
- Land Ownership Issues
- Climatic Factors
- Predation
- Disease
- Conservation Economics

Statement of Problem

The LPC has the smallest population size and most restricted distribution of all North American

prairie grouse species (Aldrich 1963, Johnsgard 1983, Giesen 1998). This species primarily inhabits shinnery oak- (*Quercus havardii*) and sand sagebrush- (*Artemisia filifolia*) dominated rangelands of the Southern Great Plains in Colorado, Kansas, Oklahoma, New Mexico, and Texas. Despite occurring in areas having low human populations relative to other parts of the nation, both distribution and population size have been markedly impacted by human activities. Excessive livestock grazing of rangelands and conversion of native rangelands to cropland and/or introduced pastures have significantly reduced LPC populations and distribution. Recurrent droughts have compounded the effects of these human induced impacts. Numbers of LPCs declined 97% range-wide since the 1800s, reflecting a 92% reduction in range, including a 78% decrease in occupied range since 1963 (Crawford 1980, Taylor and Guthery 1980). Major droughts in the 1930s, 1950s, and early 1990s markedly reduced populations. Favorable weather resulted in small population increases in the mid-1980s, but drought conditions in the early 1990s caused noticeable declines in numbers of active leks and numbers of males counted. These historical and recent declines in distribution and population size led to a petition to have this species listed under the Federal Endangered Species Act.

Habitat changes within the historical range of the LPC are characterized by conversion of native rangeland and loss of habitat quality (i.e. changes in vegetative vigor and species composition), due primarily to livestock grazing, rangeland manipulations, and herbicide treatments to reduce cover of shinnery oak and sand sagebrush (Doerr and Guthery 1980, Rodgers and Sexson 1990, Olawsky and Smith 1991). Limited conversion of rangeland into agricultural cropland may not be detrimental if crop residues provide additional food for LPCs and if at least 63% of the rangeland on a landscape level remains in good quality sand sagebrush or shinnery oak grassland (Crawford and Bolen 1976a).

Excessive livestock grazing appears detrimental to populations of LPCs when reduction in height and density of herbaceous cover results in decreased nest success and brood survival (Jones 1963a,b; Donaldson 1969, Candelaria 1979, Davis et al. 1979, Sell 1979, Ahlborn 1980, Haukos and Smith 1989, Giesen 1994b).

II. LIFE HISTORY

Description and Ecology

Taxonomy and Description. The LPC belongs to the Order Galliformes, Family Phasianidae, and subfamily Tetraoninae. The LPC is a medium-sized (~700-800 g) grouse, smaller and lighter brown or grayer than the Greater Prairie-chicken (*Tympanuchus cupido*) (Grange 1940, Hjorth 1970) and similar in size to Sharp-tailed grouse (*T. phasianellus*). Its total length is 38-41 cm (Johnsgard 1983, Olawsky 1987) and both sexes have similar plumage. Its plumage is characterized by having alternating dark brown and light buff cross barring bands on its back, breast, belly, and tail feathers. There are three brown bars on back feathers compared to a single black bar in the Greater Prairie-chicken (Copelin 1963). Its tail is short, rounded, and dark in appearance and is comprised of 18 rectrices and 16 upper tail coverts (Short 1967). Males display bright yellow supraorbital eyecombs and dull red esophageal "air sacs" during courtship (Copelin 1963, Sutton 1977, Johnsgard 1983). Long tufts of feathers called pinnae, are located on the sides of the male's neck. The pinnae are erected during courtship display. Lesser Prairie-chickens are similar in appearance to the Greater Prairie-chicken which has orange air sacs and darker plumage coloration. Downy young are similar to Greater Prairie-chickens (Short 1967) although slightly paler and having less brownish underparts (Sutton 1968).

Mating Behavior. Lesser Prairie-chickens are polygynous and have a lek mating system where relatively few males perform the majority of copulations on a lek (Sharpe 1968, Giesen 1998). Males have been reported attending leks from Jan-Jun and Sep-Nov (Jones 1964a), with display activity from mid-Feb through early May (Copelin 1963, Hoffman 1963, Jones 1964a, Donaldson 1969, Crawford and Bolen 1975, Suminski 1977, Davis et al. 1979). Male attendance is highest early in the breeding season, constant during hen attendance, and declines rapidly thereafter (Davis et al. 1979, Crawford and Bolen 1975, Haukos 1988, Giesen 1998). Males arrive on leks 30-60 min prior to sunrise and remain for 3-4 h (Copelin 1963, Sharpe 1968, Crawford and Bolen 1975, Giesen 1998). The average number of males attending leks is typically about 10-15, but varies seasonally and annually, and is influenced by habitat type, population density, and to a lesser degree, daily weather.

Males display on leks by exposing and enlarging the superciliary eye combs, elevating the tail to its highest extent, erecting pinnae feathers and positioning them forward and parallel to the ground, drooping the wings and spreading the primaries, extending the neck and head in a forward position, stamping the feet on ground and moving forward, and expanding the esophageal air sacs and producing a booming vocalization (Grange 1940, Copelin 1963, Sharpe 1968, Hjørth 1970, Johnsgard 1983, Haukos 1988). Intensity of male display is greatest when females are present on lek or territory (Donaldson 1969, Giesen 1998). Male booming or gobbling displays function to defend territories from neighboring males, advertise territory location to hens, serve as a phenotypic cue of vigor or fitness of individual males (Sharpe 1968, Haukos 1988) and facilitate copulation (Haukos 1988). Males sometimes display to females not on leks (Locke 1992) and some mating may occur off the lek, possibly in response to disturbances (Haukos 1988). Hens attend leks from late March through May with average dates of peak hen attendance on leks and copulation during the second and third weeks of April throughout their range (Davison 1940, Copelin 1963, Hoffman 1963, Jones 1964a, Snyder 1967, Donaldson 1969, Campbell 1972, Crawford and Bolen 1975, Suminski 1977, Riley 1978, Candelaria 1979, Davis et al. 1979, Ahlborn 1980, Haukos 1988, Giesen 1998). Successful copulation lasts only a few seconds after which females leave the lek (Sharpe 1968, Giesen 1998).

Nesting. Nests are typically found in shinnery oak or sand sagebrush grasslands having high canopy cover and moderate vertical and horizontal cover (Bent 1932, Donaldson 1969, Davis et al. 1979, Sell 1979, Giesen 1994b) and residual vegetation from the previous growing season consisting of tall bunchgrasses (Riley 1978, Wisdom 1980, Haukos and Smith 1989). Average distance between lek-of-capture and nest is 1.2-3.4 km, (range 0.2-13.9 km) (Suminski 1977, Riley 1978, Candelaria 1979, Davis et al. 1979, Sell 1979, Ahlborn 1980, Giesen 1994b), with females often nesting closer to a lek other than their lek-of-mating (Giesen 1994b). Average distance from nearest lek was similar for successful and unsuccessful nests; nests closer or farther than average from leks were less successful (Phillips 1990).

There is an average of 10-12 eggs in complete clutches (Bent 1932, Copelin 1963, Sutton 1968, Merchant 1982, Haukos 1988, Giesen 1998). Eggs vary from cream color to ivory yellow sprinkled with fine dots of pale brown or olive (Bent 1932, Short 1967) and are typically ovate, averaging 42.01 X 31.60 mm (Bent 1932, Giesen 1998). Females lay one egg/day with occasional skips of one day. Incubation is

by the female, lasts 24-26 days (Coats 1955, Sutton 1968), and begins after the last egg is laid.

Food Habits. Insects, seeds, leaves, buds, and cultivated grains dominate the annual diet (Copelin 1963; Jones 1963a, 1964b; Davis et al. 1979; Donaldson 1969; Crawford and Bolen 1976b; Olawsky 1987, Riley et al. 1993). The diet of New Mexico juveniles <10 weeks-of-age was primarily insects, especially short-horned grasshoppers (Acrididae), long-horned grasshoppers (Tettigoniidae), and beetles (Coleoptera)(Davis et al. 1979). The diet of two juveniles <2 weeks-of-age consisted primarily of treehoppers (Membracidae)(Davis et al. 1979). In Oklahoma the principal food of juveniles was insects, with >85% of the content of collected brood droppings consisting of insects (Jones 1963a, 1964b). The diet of New Mexico adults in summer was approximately 55% animal matter, primarily long-horned grasshoppers, short-horned grasshoppers, and treehoppers; 23% vegetative material, primarily leaves and flowers; and 21% mast and seeds, primarily shinnery oak acorns (Davis et al. 1979). The diet of LPCs from New Mexico in autumn was a mixture of seeds (43%), vegetative material (39%), and insects (15%) and primarily shinnery oak acorns (69%) and wild buckwheat (*Eriogonum annuum*)(14%) in winter (Riley et al. 1993). Shinnery oak acorns, leaves, catkins, and insect galls provided >50% of the fall and winter diet (Riley et al. 1993).

Historical and Current Range

Breeding range. Currently, occupied range is restricted to extreme southeast Colorado (Hoffman 1963, Giesen 1994a), southwest Kansas (Thompson and Ely 1989), western Oklahoma (Sutton 1967, Cannon and Knopf 1981, Wood and Schnell 1984), eastern New Mexico (Bailey 1928, Ligon 1961), and northern Texas (Oberholser 1974). Figure 1 depicts the generalized historical and current distribution of LPCs. This map represents the area outlined by the most extreme locations of reported LPCs from literature and museum specimens. More detailed maps of historical and current ranges are provided for each state in Appendix C. Historically, LPCs may have been migratory (Sharpe 1968), breeding in the northern part of their range and wintering farther south (Bent 1932). Litton (1978) reported estimates of 2 million LPCs in Texas prior to 1900, which may have represented the core of their wintering grounds. However, Taylor and Guthery (1980) argue that these were resident birds inhabiting vegetative communities similar to those used by breeding populations elsewhere. Some populations historically may

have wintered in southwest Missouri (Johnsgard 1983), suggesting an east-west migration pattern.

Habitat

The sand sagebrush-bluestem (*Andropogon* spp.) and shinnery oak-bluestem vegetation types (Kuchler 1964) coincide with the original distribution of LPC (Sharpe 1968). Currently, LPC habitat is most commonly affiliated with dwarf shrub-mixed grass vegetation associated with sandy soils, sometimes interspersed with shortgrass or mixed grass habitats on loamy or clayey soils (Taylor and Guthery 1980). In Colorado and Kansas this species is typically restricted to sand sagebrush communities dominated by sand dropseed (*Sporobolus cryptandrus*), sideoats grama (*Bouteloua curtipendula*), three-awn (*Aristida* spp.) and blue grama (*Bouteloua gracilis*) (Baker 1953, Hoffman 1963, Horak 1985, Giesen 1991, 1994a,b). LPCs in Oklahoma, Texas, and New Mexico use shinnery oak-bluestem habitats dominated with sand bluestem (*Andropogon hallii*), little bluestem (*Schizachyrium scoparium*), sand dropseed, three-awn, and blue grama in addition to sand sagebrush communities (Copelin 1963, Jackson and DeArment 1963, Jones 1963a,b, Litton 1978, Davis et al. 1979). In Oklahoma, densities of LPCs tend to be higher in shinnery oak habitats than in sand sagebrush habitats (Copelin 1963, Donaldson 1969, Cannon 1980). In Texas, Crawford and Bolen (1976a) considered shinnery oak rangeland with 5-37% small grain cropland better year-round habitat than 100% native rangeland. Areas with less than 63% native rangeland, however, appeared incapable of sustaining populations.

Breeding Habitat. Display grounds (lek sites) used for breeding are characterized by sparse vegetation (Davison 1940, Copelin 1963, Giesen 1998) and are typically located on knolls or ridges (Bent 1932, Hoffman 1963, Jones 1963b, Copelin 1963, Donaldson 1969, Cannon and Knopf 1979, Taylor and Guthery 1980, Giesen 1991). Selection for sparse vegetative cover may be more important than elevation (Hjorth 1970). Anthropogenic disturbances including roads, oil pads, or herbicide treatments may serve as focal areas for lek establishment (Crawford and Bolen 1976a, Sell 1979, Davis et al. 1979, Taylor 1979, Ahlborn 1980, Locke 1992). Traditional lek sites may change location in response to disturbances, including agricultural tillage or fires (Crawford and Bolen 1976c, Cannon and Knopf 1979).

Nesting Habitat. Vegetative height above nest bowls average 43-81 cm (Donaldson 1969, Suminski 1977, Davis et al. 1979, Riley 1978, Wisdom 1980, Haukoš and Smith 1989, Riley et al. 1992,

Giesen 1994b). Height and density of forbs and residual grasses are usually greater at nest sites than in surrounding rangeland (Davis et al. 1979, Haukos and Smith 1989, Riley et al. 1992, Giesen 1994b). Litter and bare ground may exceed 70-80% of the soil surface adjacent to the nest (Suminski 1977, Giesen 1994b). Nests are typically located in areas with average slopes <6% (Davis et al 1979.) and are frequently located on north or north-east facing slopes for protection from prevailing southwest winds and direct sunlight (Davis et al. 1979.)

Successful nests exhibit less variance in distance from the nearest active lek than do unsuccessful nests (Phillips 1990). Nesting success in drought years is lower than in years of average or above-average precipitation (Merchant 1982). Nest success was positively correlated with height, density, and abundance of residual grasses, especially sand bluestem, near nest sites (Riley 1978, Davis et al. 1979, Wisdom 1980, Riley et al. 1992). Nests within or adjacent to tall bunchgrasses or shrubs were more successful than nests in other vegetation (Riley 1978, Wisdom 1980, Riley et al. 1992). Successful nests were characterized by more litter and less bare ground than were unsuccessful nests (Davis et al. 1979). Livestock grazing may reduce nesting success when it results in less residual grass height and density, or less litter and more bare ground (Riley 1978, Davis et al. 1979, Wisdom 1980). Tebuthiuron (N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N-dimethyluria) herbicide treatments of shinnery oak in combination with heavy livestock grazing reduces nesting cover and may result in hens selecting untreated areas for nesting (Haukos and Smith 1989).

Brood Habitats. Habitats used for brood rearing are usually within 3 km of display grounds and have taller shrub, forb, and grass cover, greater basal area of shrubs and forbs, and greater vegetative canopy cover than surrounding areas (Jones 1963a,b; Donaldson 1969; Candelaria 1979; Davis et al. 1979; Sell 1979; Ahlborn 1980; Haukos and Smith 1989; Giesen 1994b). Taller trees and shrubs, including shinnery oak motts, sand sagebrush, fragrant sumac (*Rhus aromatica*), and sand chickasaw plum (*Prunus angustifolia watsoni*) are used for shade in summer (Copelin 1963).

III. RISK ASSESSMENT

Introduction

The purpose of this chapter of the LPC Conservation Strategy Plan is to identify potential threats to the species' continued existence. Reference to threats will be placed in the context of the five listing factors used to determine if a species is threatened or endangered under the Endangered Species Act. Potential strategies to avoid or lessen the potential threats identified are presented in the Conservation Strategy.

Five Listing Factors

The Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range. The primary habitat of the LPC is sand sagebrush -bluestem and shinnery oak-bluestem habitat types. Although these habitats constitute the bulk of LPC habitat in the southern Great Plains, several researchers have documented use of "non-traditional" habitats by LPCs. Kansas Department of Wildlife and Parks personnel have noted use of sand prairie habitat (R. Applegate, pers. comm.). Limited use of CRP fields by LPCs has also been documented in Colorado (J. Slater, pers. comm.), Oklahoma (J. Shackford pers. Comm.), and Texas (K. Mote, pers. Comm.), although most CRP fields do not provide all seasonal habitat components necessary to support year-round populations of LPCs.

Lack of adequate nesting cover is a common limiting factor for prairie grouse populations (Kirsch 1974). Several factors may be responsible for LPC habitat loss. These include conversion of native rangeland to agricultural crops or other uses, fragmentation of existing rangeland, improper range management, and oil and gas developments on native rangeland. Conversion of native rangeland to agricultural crops appears to be the most direct cause of habitat loss, and is the primary factor responsible for the loss of 92% of LPC habitat since the 1800s (Taylor and Guthery 1980). Conversion of native rangeland to agricultural crops directly eliminates nesting cover, as agricultural crops do not provide adequate nesting cover. Likewise, conversion from native to introduced grasses can reduce the value of the area for LPCs. Most introduced pastures do not contain the diversity of vegetation or the proper structural

vegetation characteristics preferred by LPCs. Therefore, nesting attempts as well as nesting success are diminished in these areas.

Fragmentation of existing habitat is another cause of concern for LPC managers. Although precise "threshold" values are not known, researchers generally agree that contiguous areas of at least 32 km² in size and having no less than 63% rangeland habitat are needed to support LPCs on a long-term basis (Crawford and Bolen 1976a, Taylor and Guthery 1980). As suitable habitat becomes more and more fragmented, local extinctions of LPCs may occur. CRP acreage planted to cover species capable of supporting LPCs may be able to ameliorate the fragmentation of existing ranges, but more research should be done to address this issue.

Range management practices that do not leave adequate residual cover contribute to the decline of nesting habitat (Bidwell et al. 1995). Intensive grazing that does not include sufficient rest at the end of the growing season can eliminate the residual cover necessary for nesting the following spring. Severe climatic events such as drought often magnify the effect of overutilization throughout the LPC range. While grazing can be used as a tool to maintain high quality LPC habitat (Bidwell et al. 1995), livestock grazing must be managed to provide for a mosaic of different cover types to meet the species' habitat needs. Early succession plants characteristic of heavily grazed areas is important as food and brood rearing cover (Litton et al. 1994). Conversely, areas managed with light to moderate grazing provide important nesting cover, which is comprised of the previous year's growth of native warm-season bunch grasses. Nesting success is positively correlated to the height, density, and abundance of residual cover near nest sites (Riley 1978, Davis et al. 1979, Riley et al. 1992). Residual (growth from the previous year) cover in the form of sand bluestem, little bluestem, switchgrass (*Panicum virgatum*), and other native warm-season grasses are the preferred nesting substrate for LPCs, and these grasses typically occur under light to moderate grazing intensities (Riley et al. 1992, Bidwell et al. 1995). When birds are forced to nest in isolated small pockets of suitable cover, or in areas of less than suitable cover, nesting success is greatly reduced. In these areas, nest failure due to predation is increased (Braun et al. 1978).

Brush management is another range management practice with important ramifications for LPC. Shinnery oak and sand sagebrush is utilized by LPCs for food, brood rearing and loafing areas, and, in the case of sand sagebrush, nesting cover (Hoffman 1963, Giesen 1994b). Skunkbush sumac (*Rhus aromatica*)

and Chickasaw plum (*Prunus angustifolia*) are also used to a lesser extent for these purposes (Jackson and DeArment 1963). Lesser prairie-chickens respond positively to increases in sand sagebrush cover, but negatively to increases in shinnery oak canopy cover in some circumstances (Cannon and Knopf 1981). Olawsky and Smith (1991) found similar densities of LPC's in Tebuthiuron-treated shinnery oak rangeland with 0.7% shinnery oak coverage and untreated areas with 47.6% coverage. A mosaic of areas incorporating this range of shinnery oak coverage values is recommended to meet the species' habitat needs (Olawsky and Smith 1991). Shinnery oak coverage values exceeding 50%, however, may be detrimental to LPC's (Haukos and Smith 1989).

One side effect of herbicidal brush control is the impact upon insects utilized by LPC's as food items. Several researchers (Best 1972, Potts 1984) have noted that insect populations, utilized by other grassland and shrub-steppe avian species, have been reduced by herbicidal brush control practices. These effects have been documented within the LPC range as well (Jackson and DeArment 1963, Rodgers and Sexson 1990).

Wildlife managers are unsure of the effects of oil and gas developments on lesser prairie-chicken populations, as most evidence pertaining to this factor is anecdotal in nature. Lesser prairie-chickens have been documented using abandoned drilling pads for lek sites (Taylor 1979), but the effects of disturbance from roads (Reijnen et al. 1995) and seismic exploration activities are unknown. The impact of these activities on lesser prairie-chicken breeding activities needs to be examined in further detail.

Overutilization. Although market hunting of LPCs was a common practice at the turn of the century (Jackson and DeArment 1963), it ended with the onset of modern wildlife law enforcement. Currently, only recreational utilization takes place in the range of the LPC, and utilization is limited to non-consumptive use (e.g., observation of lek activity by birding enthusiasts) and limited legal hunting. The effects of observer disturbances are unknown, although Crawford and Bolen (1976b) noted that lesser prairie-chicken leks located adjacent to heavily-traveled roads were abandoned at a greater rate than were leks located farther from human disturbance. As non-consumptive viewing of LPC leks becomes more popular, the effects of observer disturbance should be further quantified.

Hunter harvest of the LPC has been restricted for most of this century, but the effects of hunting on individual populations are not known. Crawford (1980) speculated that harvest is likely density-dependent

in good habitat, but may be density-independent in marginal habitat. Hunting of the LPC is currently allowed in two of the five states, Texas and Kansas. If hunting of the LPC is to continue managers need to gather data that will enable them to measure the level of harvest. The Texas Parks and Wildlife Department has instituted a free permit system to determine the amount of hunting pressure that the LPC receives, and Kansas instituted a more restrictive season in 1996. Before conclusions are drawn concerning the effect of hunting on LPCs, sufficient data, including number of birds harvested, number of hunters, and age and sex ratios, should be obtained from each of the states still conducting a hunting season.

Disease or Predation. The role of disease in regulating LPC populations is largely unknown due to the small number of studies that have been conducted to date. Stabler (1978) found evidence of hemoparasites (*Plasmodium sp.*) in 4 of 37 LPCs sampled in New Mexico and Texas, but the significance of these infestations at the population level is unknown. Pence and Sell (1979) found evidence of eye worms (*Oxyspirura petrowi*) in LPCs in the Texas Panhandle, and noted that ocular irritation caused by this species may inhibit foraging efficiency and possibly increase predation risk. Like infestations of hemoparasites, the population-level significance of eye worm infestations is unknown (M. Peterson, pers. comm.). The nematode *Heterakis sp.* has also been found in LPCs (Pence and Sell 1979), but the population-level effects of this parasite are also unknown. While the likelihood of density-dependent diseases having any pronounced effect on the LPC population appears minimal, a disease transmitted independently of population density could have drastic effects. Furthermore, as population declines and isolation continues the potential for loss of genetic variability increases. This loss of genetic variability could reduce disease-resistance and exacerbate the effects of disease.

Documented predation events involving LPCs are relatively rare, with the exception of five cases of northern harriers (*Circus cyaneus*) preying on LPCs near lek sites (Haukos and Broda 1989). Of greater importance to LPC populations, is the predation of hens incubating clutches (Giesen 1998). As habitat fragmentation increases, LPCs may be more susceptible to terrestrial nest predators (Braun et al. 1978). Increasing populations of nest predators (skunks (*Mephitis spp.*), raccoons (*Procyon lotor*), coyotes (*Canis latrans*), etc.) and a simultaneous loss of, or decrease in, high quality nesting cover appear to be factors that negatively impact nesting success. Small or isolated tracts of nesting cover also serve as travel and/or hunting corridors for predators. Nests located in these small isolated tracts of habitat can be more

susceptible to predation and therefore, such habitat acts as a natural trap for nesting birds. Two ongoing studies of nesting prairie grouse have shown a very high incidence of nest failure due to predators (D. Wolfe, pers. Comm., R. Applegate, pers. Comm.). Managers should strive to provide adequate nesting cover to conceal hens from potential nest predators, and should concentrate management efforts on large, contiguous blocks of suitable habitat.

Inadequacy of Existing Regulatory Mechanisms. At present, the greatest threat to LPC populations is the continued alteration/destruction of occupied habitat. This threat includes both private land and public land throughout the LPC range. For the threat of additional habitat degradation or destruction to be addressed, cooperation between private landowners, federal, state land management agencies, and state wildlife agency officials is critical. Through proactive, interagency strategies to improve LPC habitat, as well as landowner partnerships, the need for more restrictive regulatory mechanisms such as the ESA may be avoided.

Other Factors. Additional factors that may be contributing to the decline of the LPC include competition with ring-necked pheasants (*Phasianus colchicus*), the effects of pesticides, and disturbances caused by research activities. Although no published reports of LPC/ring-necked pheasant interactions exist, several instances of ring-necked pheasant harassment of LPC males on leks have been reported in recent years (T. Hinkle and J. Shackford, pers. comm.). Nest parasitism and lek disruptions by ring-necked pheasants have occurred in Greater Prairie-chicken range, and these events are considered major management problems for restoration efforts in Illinois (Vance and Westemeier 1979). More research is required to accurately assess this potential threat to the LPC, and ring-necked pheasant releases should be avoided in LPC range (Bidwell et al. 1995).

Tremendous progress has been made toward the use of environmentally friendly herbicides since the days of DDT applications. However many of the chemicals used today directly or indirectly affect LPCs as well as other wildlife species. Broad scale application of herbicides for brush control can eliminate woody cover including sandsage and shinnery oak; both utilized heavily by LPCs for food and cover. LPCs have been documented to avoid areas where large tracts of brush have been removed (Jackson and DeArment 1963). Seeds and vegetation provided by forbs and shinnery oak comprise a large portion of the seasonal diet of the LPC (Crawford and Bolen 1976, Davis et al. 1979, Riley et al. 1993). Therefore,

application of herbicides to control forbs directly eliminates an important food source in the form of vegetative material. Additionally, forb control indirectly reduces insect availability. Jones (1963a) reported that insects comprise the majority of food items consumed by LPCs during the summer months.

Bowen et al. (1976) suggested that researcher activities resulted in an inflated rate of nest failure. While one of the primary considerations of all research projects should be to minimize the impact to the species being studied, researcher influence is sometimes unavoidable.

Conclusion

Although much is known about the life history and habitat requirements of the LPC, many questions vital to its continued survival remain unanswered. The use of CRP habitats by LPC's needs to be quantified in order to assess its impacts upon LPC populations. There is also a need to investigate the potential impacts of oil and gas developments upon breeding populations of LPC's. Documentation of ring-necked pheasant and LPC interactions has become increasingly evident in recent years and should be studied. Additional research of these topics will help enable wildlife managers provide better management recommendations on both private and public lands within the range of the LPC.

Given the fact that most currently occupied LPC habitat is found on private lands, cooperation with private landowners is crucial if the LPC is to be conserved. Such cooperation includes the effective use of federal or state cost-share programs, education concerning the habitat requirements of the LPC, and the use of incentives (monetary or otherwise) to encourage good land stewardship. Much of the future of the LPC rests in the hands of private landowners. Future conservation efforts must focus on developing effective means of implementing management practices beneficial to this species on private lands while preserving landowner ability to derive an income from that land.

IV. SOCIAL / ECONOMIC CONSIDERATIONS

Potential and existing social/economic considerations related to the viability of LPC populations have been expressed by members of the LPCIWG and by respondents to a survey of over 25,000 individuals within the LPC range. These opinions of wildlife professionals, private landowners, and other

interested organizations and individuals are summarized below. Many issues developed in this section are addressed in the Conservation Strategy.

Commercial Value

Money spent on hunting and other wildlife-related activities is often realized as income, in local communities. Dollars spent on trespass fees, hunting leases, equipment, fuel, food, and lodging in local communities are often respent one or more times within those communities. Thus, the local commercial impact of moneys spent in pursuing wildlife is usually 2-3 times the amount of money spent by hunters and other wildlife enthusiasts.

In 1996, an estimated 8.7 million state residents participated in wildlife-associated recreation in the 5 states of Colorado, Kansas, New Mexico, Oklahoma, and Texas. They spent about \$1.2 billion on hunting and non-consumptive wildlife activities (excluding fishing, U. S. Department of Interior and U. S. Department of Commerce 1997).

The potential commercial value of LPC hunting and LPC viewing has seldom been measured and may not be large, especially with today's limited numbers of birds. However, enhanced populations of LPCs and marketing of opportunities could provide important income to local businesses that cater to hunters, and to bird watchers who seek the experience of lek-watching each spring.

Kansas estimates that the total annual economic impact of bird watching, including LPC, on the Cimarron National Grassland, the Finney Refuge, and the Pratt Sandhills is \$629,300. In addition, the impact of LPC hunting has been \$182,250 annually.

Recreational Value

In the 5-state area including LPCs, between 33% (Texas) and 41% (Kansas) of state residents participated in wildlife-associated recreation in 1996 (U. S. Department of Interior and U. S. Department of Commerce 1997). The dollars spent by those who seek the LPC are a measure of their willingness to pay for their outdoor experiences. Those dollars represent the enjoyment, challenge, camaraderie, adventure and enhanced physical and mental health achieved through hunting or watching LPCs. Due to the decline in

LPC numbers, the recreational value of hunting LPCs has been curtailed in 3 of the 5 states within the bird's range.

Biotic Value

LPCs are but one component of the complex Great Plains ecosystem. This ecosystem of interacting plants, animals and their physical environment has produced the soil that sustains today's agriculture. The remaining native prairie ecosystem maintains a livestock industry and protects the soil from erosion. The prairie has value that exceeds the sum of the values of its individual species. By living, eating, excreting, moving about and dying, LPCs contribute to their prairie ecosystem through seed dispersal, recycling, transport and concentration of nutrients, and providing a food source to predators and scavengers. If the prairie ecosystem has value, its value must be diminished whenever ecosystem components are lost through extirpation or extinction. To paraphrase Aldo Leopold: "The first rule of intelligent tinkering with productive ecosystems is to save all the parts" (Leopold 1949). Wise conservation of the landscape includes both use and maintenance of our resources.

As with all wildlife species, the LPC is an indicator of ecosystem health. The observed drastic population declines of LPCs indicate a significant alteration of habitat components, and suggest that other; unmeasured species are also being affected. Maintenance of viable populations of LPCs would indicate that the southern Great Plains ecosystem, including its many species and their interactions, is being maintained.

Scientific Value

Science, through enhanced understanding of how the world works, has produced immeasurable benefits for mankind. Every component of the world, including populations of wild animals, has value as an object for scientific study. Should LPCs become extinct, we will have lost the opportunity to study and learn from this unique member of the grouse subfamily. In particular, much of the research on this species has provided insights into concepts of mate selection that apply to many species of wildlife.

Aesthetic Value

Aesthetic values are the most personal and variously conceived of wildlife values. The LPC is enjoyed as an object of beauty and of historical significance. It is the unique grouse of the southern prairies; it shares the interesting and fascinating lek-behavior of the grouse subfamily. Vocalizations of LPC males announce the arrival of another springtime morning. LPC habitat provides a panorama of the plains that welcomed our ancestors who first settled the region, and of nomadic tribes who once called it home.

Legal Obligations and Ethical Responsibilities

Wildlife professionals, landowners, and others have expressed concern over the potential social and economic impacts of declining LPCs and of possible new federal or state listings as threatened or endangered. Certainly, declining populations have already diminished the values noted above. There is concern that listing the LPC by the U. S. Fish and Wildlife Service (USFWS), or by state agencies, would result in additional legal obligations that would restrict economic activity on both public and private lands. Activities most likely to be affected are grazing of rangeland, brush control to enhance livestock carrying capacity, conversion of native rangeland, and oil and gas developments.

Currently, there are legal obligations to consider the needs of the LPC on the limited public lands within the LPC range. The U.S. Forest Service (USFS) and the Bureau of Land Management (BLM) have obligations to manage these lands for multiple uses, including the maintenance of biodiversity. These obligations exist in the National Forest Management Act of 1976 (16 U.S.C. 1600) and in the Federal Land Policy and Management Act of 1976 (90 Stat. 2743).

The USDA Forest Service (USFS) administers the National Grasslands. Portions of the Comanche and Cimarron National Grasslands are occupied by LPC's. In such areas, the USFS focuses its management efforts on maintaining habitat structure, particularly nesting cover. Grazing rotations emphasize leaving residual cover, and increasing or maintaining bunchgrasses such as big bluestem. Several grazing rotations have been, or are being, established that incorporate both private and public pastures. This allows more refined grazing management to be applied over a wider area. Nesting habitat quality is assessed by both pre- and post- grazing season monitoring, using a Robel pole. In addition to these efforts, seasonal

restrictions are placed on surface-disturbing activities, to lessen disruption of nesting. A detailed habitat assessment is currently underway on the Comanche and Cimarron National Grasslands to further define suitable habitat.

Low numbers of LPCs have caused the bird to be considered an "emphasis species" by the BLM in New Mexico. This has resulted in local and seasonal restrictions upon oil and gas developments on BLM lands. No applications to drill have been denied under existing permits. However, BLM is not currently offering to lease lands within the main LPC habitat for oil and gas development. The Bureau of Land Management has regulatory authority to move facilities such as drill pads, ROW's, and range improvements 200 meters away from known booming grounds. During the NEPA process, if it is determined that the 200-meter offset is not sufficient to minimize impacts, then BLM has the authority to extend the off-set distance to an acceptable distance. The BLM implements a seasonal oil and gas timing restriction during the booming season. While drilling for oil and gas, 3-D geophysical operations would not be allowed within LPC habitat during the period of March 15 through June 15, each year. Normal operations such as Maintenance, pipelines, roads, and well pad construction would not be allowed between the times of 3:00 a.m. and 9:00 a.m. The 3-9 a.m. restrictions would not apply to normal around the clock operations such as venting, flaring, or pumping, which do not require a human presence during that period. Partly in deference to LPCs, brush control actions are prohibited in areas having less than 40% cover of shinnery oak. Grazing standards and guidelines are yet to be developed, but will have to consider the needs of the LPC. In addition, the USFS also has seasonal restrictions on oil and gas development on the Comanche and Cimarron National Grasslands.

If the LPC were federally listed, federal agencies would have to consult with the USFWS regarding any actions in which the use of federal resources, such as land, permits, or funding, might negatively impact the bird. The Endangered Species Act (ESA) requires that detrimental impacts of federal programs upon endangered species be eliminated, minimized, or mitigated. The ESA also authorizes the Fish and Wildlife Service to prohibit private activities that harm endangered species on private lands. The Service has seldom used this authority. A 1994 report by the General Accounting Office shows that from FY '88 through FY '93, the Service obtained injunctive relief only four times to stop or delay activities harming endangered species on nonfederal land nationwide. In the past, almost all restrictions of economic

activity by the Service have occurred when federal resources have been involved. Despite this record, many landowners foresee restrictions of activities on their lands, should the LPC be federally listed.

Currently, New Mexico Department of Game and Fish is considering listing the LPC as state threatened or endangered under the authority of the state's Wildlife Conservation Act. However, as with most other states, this act does not authorize the New Mexico Department of Game and Fish to prohibit any land-use activities on any lands, public or private. The Department may only provide recommendations for maintaining LPCs and regulating harvest.

Most of the existing and historical range of the LPC is private land. The bird has disappeared from much of its former range. Persistence of viable populations on most of the remaining range will depend upon improving or maintaining LPC habitat by private landowners. Landowners may assume an ethical responsibility for maintaining a component of natural biodiversity, including the LPC, on their properties. Widespread acceptance of this responsibility would enhance the status of the LPC and might delay or eliminate any need to list the bird. If the LPC is listed as threatened or endangered under the ESA, or by an individual state, voluntary landowner participation in recovery of the bird would hasten delisting, and would reduce or eliminate any need for imposing federal legal obligations upon private activities that could negatively impact the LPC.

History has shown that as the population of the United States has grown, and our use of the landscape has intensified, the acceptance of ethical responsibilities by our fellow citizens has gradually become insufficient to mitigate for cumulative impacts upon our mutual quality of life, and upon future generations. As a result, our governments have adopted laws, and ethical responsibilities have increasingly become legal obligations. The future of the LPC will depend upon some combination of accepting ethical responsibilities and enduring legal obligations.

Conservation Strategy

I. INTRODUCTION

The following conservation strategy describes the goal, objectives, strategies, and actions believed to be necessary to maintain and enhance LPC populations throughout their five-state range. This strategy was developed through the cooperative effort of the participants in the LPCIWG as well as the input received through private landowner surveys. A tremendous effort has been made to incorporate the comments and concerns of all stakeholders and to derive extensive review from a diverse group of interested parties. This strategy is intended to address LPC conservation at a regional level. Implementation of the activities described within will be coordinated through the LPCIWG and will require the cooperation of many state, federal, and private entities. The objectives, strategies, and activities outlined below have been developed to specifically address those potential threats identified in the Risk Assessment section of this document.

Each of the strategies have been placed into one of four categories, Top, High, Medium, or Low according to their importance. Strategies categorized as Top will be given first priority for initiation/completion. Each of the strategies were categorized by the group as follows:

Top: 1.1, 2.1, 2.2, and 2.5
High: 3.1, 3.2, 3.4, and 5.1
Medium: 2.3, 3.3, and 4.1
Low: 2.4, 4.2

Items preceded by an asterisk (*) denotes areas already accomplished or for which some progress towards completion has been made.

II. GOAL

The goal of this conservation Strategy is to enhance the current population and distribution of LPCs range-wide based upon population and distribution parameters outlined in section 2.3.1 of the Conservation Strategy.

III. OBJECTIVES, STRATEGIES, AND ACTIONS

*1. Establish a Lesser Prairie-chicken Interstate Working Group (LPCIWG) to help identify threats to the LPC and to develop/implement regional conservation actions that will enhance habitat and populations rangewide.

1.1 The LPCIWG is led by a Core Committee comprised of 1 representative from each of the 5 state wildlife agencies. Membership of the working group (APPENDIX B) will be comprised of state, federal, and private entities that bring to the table the resources, willingness, authority, and ability to implement the goals, objectives, and strategies outlined in this document. LPCIWG Partners may be comprised of any and all individuals interested in LPC conservation and who support the efforts of the LPCIWG.

1.1.1 Responsibilities of the LPCIWG are to coordinate LPC conservation efforts across the range by: (1) setting priorities and deadlines for conservation strategy activities; (2) establishing working group subcommittees to address specific conservation objectives; (3) developing habitat and species management guidelines; (4) providing management guidelines to all land managers within LPC range; (5) promoting public education concerning conservation; (6) serving as a forum where information transfer and problem solving can occur; (7) providing new information to the Service as needed; and (8) seeking the resources necessary to achieve the goal of the Conservation Plan.

1.1.2 The LPCIWG will prepare and submit an annual progress report to the USFWS detailing the progress made toward completing each of the strategies. A brief summary of activities completed by all land management agencies in each of the five states, including the most current population survey information. The report shall be prepared and submitted to the Service each year prior to their annual status review.

2. Determine status and monitor trends of LPC populations and habitat.

2.1 Determine the current population status of the LPC.

* 2.1.1 Conduct annual surveys to determine lek and population density estimates.

- 2.1.2 Expand survey efforts to include areas of known occupied habitat and potentially occupied habitat. Beginning with the spring of 1999 LPC population monitoring, efforts to determine all known occupied range will commence. Any area classified as known occupied range shall be re-visited to verify the presence of LPC's at least once every five years. All areas determined to be known occupied range would be delineated by the year 2004.
- * 2.1.3 Standardize data collection and reporting methods across the range. A standardized reporting form and suggested monitoring protocol will be prepared and made available by 01 January 1999. Reporting will at a minimum include a measure of the number of active leks per unit area, and the number of birds flushed from each active lek located. Each core committee member will be responsible for ensuring completion of the standardized form in his/her respective state.
- * 2.2 Identify and evaluate the historical and current status of habitat occupied by LPCs.
 - 2.2.1 Map current and historical LPC habitat and input into GIS format.
 - 2.2.2 Develop GIS overlays that categorize LPC habitat by different variables (ex. Range quality, precipitation, land ownership, land use, etc.).
 - 2.2.3 Update overlays as necessary to reflect significant changes in information.
- 2.3 Utilize baseline population information as one method to measure success of conservation efforts.
 - * 2.3.1 Establish baseline population and distribution levels from information contained in APPENDIX C.
- 2.4 Utilize new standardized survey information that can be statistically analyzed for the purpose of detecting significant changes in LPC population indices in each state for the next 10 years beginning in 1998.
- 2.5 Maintain or increase the current LPC population distribution.
 - 2.5.1 Each state will develop and implement a method to monitor changes in distribution.
- 3. Develop and implement management guidelines for LPC population and habitat conservation.
 - * 3.1 Identify management practices that conserve LPC habitat.

* 3.1.1 Conduct a literature review to compile a list of known management recommendations. Core committee representatives will be responsible for conducting a thorough review of information, particularly literature specific to their respective states by universities and governmental publications. A list of management recommendations and source documentation should be complete by 01 September 1999. The Information Gathering Committee chair will be responsible for compiling the comprehensive list of management recommendations.

* 3.1.2 Establish management guidelines in cooperation with private landowners, state and federal agencies, and other interested parties. This activity will begin upon completion of action 3.1.1.

3.1.3 Compile, distribute, and make available these management guidelines to all interested parties.

3.2 Implement management practices that conserve LPC habitat and are compatible with modern sustainable land use practices.

* 3.2.1 Utilize Farm Bill programs such as CRP and WHIP to provide incentives for habitat improvements on private land. This includes coordinating with state and federal agencies during planning phases to ensure that such programs are implemented in the most beneficial manner.

3.2.2 Promote and implement Safe Harbor and Candidate Conservation Agreements for LPC conservation where appropriate.

3.2.3 Identify areas to be targeted for conservation efforts.

* 3.2.4 establish at least one adaptive management or demonstration area in each state within the range to further study and refine management practices.

3.3 Implement population management practices.

3.3.1 Initiate research, and if feasible, test techniques for using wild birds to repopulate areas of suitable but unoccupied habitat.

- * 3.3.2 Where hunted, implement program to monitor harvest and utilize this information in conjunction with population surveys to set hunting season dates, length, and bag limits.
- * 3.4 Cooperate with BLM, USFS, USFWS, and state wildlife agencies to identify and delineate public lands in occupied/suitable habitat and coordinate with the proper agency to implement the appropriate conservation practices.
 - 3.4.1 Develop and implement MOUs, Policy and management plan changes, etc. where appropriate to help improve conservation on public lands.
- 4. Provide information, education, and technical assistance on LPC conservation.
 - 4.1 Develop, distribute, and implement educational materials and projects that will help improve LPC conservation.
 - 4.1.1 Develop informational brochures that target the general public and land managers. These brochures will emphasize the need for LPC conservation, and contain a description of the bird and a list of beneficial and detrimental management practices.
 - 4.1.2 Implement demonstration areas to be used to educate land managers on what good LPC habitat is comprised of and how to accomplish it.
 - * 4.1.3 Develop a LPC Update to be distributed to land managers within the LPC range. This update would keep land managers informed of conservation issues and new technology being developed for LPC conservation. It would also serve as an avenue for the working group to receive valuable input from private landowners.
 - 4.1.4 Develop educational materials that could be incorporated into existing school curricula.
 - 4.1.5 Establish a database that contains a bibliography of historical and current information on LPCs.
 - * 4.1.6 Establish a WEB page on the Internet that can be accessed to provide available LPC information. Members of the LPCIWG will provide information to update the database and WEB page.
 - 4.2 Identify the recreational, educational, scientific, and economic benefits associated with LPCs.

- *
 - 4.2.1 Conduct a formal survey of the public to identify their concerns/issues/needs to be addressed by conservation strategies.
 - 4.2.2 Utilize this information when developing conservation guidelines.
 - 4.2.3 Implement/promote projects that enhance benefit to the public and improve LPC conservation (ex. viewing areas, ecotourism, local festivals, etc.)
- 5. Increase current knowledge regarding biology and management of the LPC through research.
 - 5.1 Prioritize, coordinate, and plan research projects that address the needs identified by the research committee.
 - *
 - 5.1.1 Establish a research committee that will evaluate and coordinate research activities.
The research committee will be responsible for identifying gaps in current LPC information, prioritizing informational needs so that limited resources are used to answer the most immediately critical questions, and to help increase information transfer between researchers throughout the LPC range.
 - 5.1.2 Use information gained from research to improve LPC conservation efforts and to revise The Conservation Plan as needed.
 - 5.1.3 Distribute research findings to appropriate land management agencies.

IV. HABITAT MANAGEMENT RECOMMENDATIONS

General Management Recommendations

Conservation of the Lesser Prairie-chicken should be concentrated on remaining areas of suitable habitat (Litton et al. 1994). Management for late seral stage residual vegetation to provide adequate nesting cover should be a primary goal of lesser prairie-chicken managers. Such vegetation can be maintained throughout the range of the LPC by utilizing no more than 25%-35% of the annual growth of desired species (Holechek et al. 1989 in Riley et al. 1992) in either continuous, deferred-rotation, or rest-rotation grazing systems (Holechek et al. 1989). High quality nesting cover should occur in relatively large tracts, be located in close proximity (~1-3 km) (Riley 1978, Davis et al. 1979, Giesen 1994) to a lek site(s), and be adjacent to or interspersed with brood rearing cover.

Brush control programs aimed at increasing forage production for domestic livestock production should be designed in a manner that are not detrimental to LPC populations. Since LPCs respond to changes in sand sagebrush and shinnery oak cover differently, management practices should be tailored to specific range sites (Cannon and Knopf 1981). Areas having greater than 50% shinnery oak basal cover may require limited brush removal (Haukos and Smith 1989) due to avoidance of such stands by LPCs (Cannon and Knopf 1981). Applying the herbicide Tebuthiuron at a rate of 0.5 lb./ac can control shinnery oak. Controlling shinnery oak in this manner increases canopy coverage of warm-season bunchgrasses without negatively impacting insect populations (Doerr 1980). Control should not occur on deep sands or other areas prone to wind erosion, and shinnery motts should be left untreated (Litton et al. 1994).

Given the LPCs' reliance on sand sagebrush as nesting cover (Hoffman 1963, Giesen 1994b), managers should strive to maintain areas of sand sagebrush with intermediate amounts of residual grass cover for nesting (Cannon and Knopf 1981). The herbicide 2,4-D is most commonly used to control sand sagebrush, but is also effective against Chickasaw plum and fragrant sumac (Jackson and DeArment 1963). Control operations should not include Chickasaw plum or fragrant sumac, because these species function as food and cover for northern bobwhites (*Colinus virginianus*) as well as LPCs (Jackson and DeArment 1963). Herbicidal control of large blocks of sand sagebrush should be avoided because it results in the

abandonment of these areas by LPCs (Jackson and DeArment 1963). Control of sand sagebrush should be restricted to spot treatments in areas where canopy coverage exceeds 30%.

Prescribed fire is a tool not commonly used by land managers within the range of the LPC, but it can be very beneficial if used properly. Late winter or early spring burns may be used to increase green forage and insect availability during the spring and summer, while summer or fall burns may be used to increase native annual forbs and insects (Bidwell et al. 1995). Care should be taken not to burn areas of deep sandy soils to avoid wind erosion problems (Litton et al. 1994). Managers should burn only 20%-33% of their rangeland each year in order to preserve residual nesting cover (Bidwell et al. 1995). Burning should also be avoided in areas having shinnery oak coverage greater than 50%, as fire tends to increase shinnery density at the expense of grasses and forbs (Bidwell et al. 1995). Land managers wishing to conduct prescribed burns on their property should contact state wildlife agency and/or NRCS personnel for assistance.

Specific Habitat Recommendations

The area under evaluation as lesser prairie-chicken habitat should be within or adjacent to currently occupied lesser prairie-chicken range. The area should also be part of a contiguous block of 20 mi² of rangeland habitat. Visual obstruction readings (VOR, Robel et al. 1970) should be taken during late March to early May, but step-point transects may be conducted during any time of the year. Land managers not familiar with the techniques described below is encouraged to contact their local NRCS, state wildlife agency, or extension service personnel for assistance.

I. Sand sagebrush/midgrass habitat parameters:

Mean sand sagebrush density - 1,200 - 1,600 plants/acre

Vegetative structure characteristics (shrubs, grasses, and forbs considered together)- 10% of total area having VOR \geq 3.0 decimeters (dm), average VOR = 1.0 dm.

A minimum of 60 visual obstruction readings (Robel et al. 1970) should be taken at random locations for each section (640 acres) of habitat to determine vegetative height-density.

Sand sagebrush density may be obtained using any method that provides vegetative density estimates (quadrats, belt transects, etc.). Plant numbers within a 4-meter radius of the Robel pole (the area described by the string of specified length) may be used to derive this estimate.

II. Shinnery oak/midgrass habitat parameters:

Shrub coverage (all species present) - 25 to 30% of entire vegetative community

Forb coverage - 15% of entire vegetative community

Grass coverage - 60% of entire vegetative community; 10% with VOR \geq 3.0 dm, average

VOR = 1.0 dm. Readings should be taken in grassland (not shinnery oak) areas only.

Step point transects (Evans and Love 1957) should be used to determine % shrub, % forb, and % grass composition for the area to be evaluated.

A minimum of 60 visual obstruction readings (Robel et al. 1970) should be taken at random locations for each section (640 acres) of habitat to determine vegetative height-density.

Literature Cited

- Ahlborn, G. G. 1980. Brood-rearing habitat and fall-winter movements of Lesser Prairie Chickens in eastern New Mexico. M.Sc. Thesis. New Mexico State Univ., Las Cruces.
- Aldrich, J. W. 1963. Geographic orientation of American Tetraonidae. *J. Wildl. Manage.* 27: 529-545.
- Bailey, F. M. 1928. *Birds of New Mexico*. Judd and Detweiler, Inc., Washington, DC.
- Baker, M. F. 1953. Prairie chickens of Kansas. *Univ. Kansas Mus. Nat. Hist. and Biol. Surv. Kansas. Misc. Publ. 5.*, Lawrence.
- Bent, A. C. 1932. Life histories of North American gallinaceous birds. *U.S. Nat. Mus. Bull.* 162.
- Best, L. B. 1972. First-year effects of sagebrush control on two sparrows. *J. Wildl. Manage.* 36:534-544.
- Bidwell, T.G., C.B. Green, A.D. Peoples, and R.E. Masters. 1995. Prairie chicken management in Oklahoma. Oklahoma Cooperative Extension Service Circular E-945. 10pp.
- Bowen, D.E., R.J. Robel, and P.G. Watt. 1976. Habitat and investigators influence artificial ground nest losses: Kansas. *Kansas Acad. Sci.* 79:141-147.
- Braun, C.E., K.W. Harmon, J.A. Jackson, and C.D. Littlefield. 1978. Management of National Wildlife Refuges in the United States: its impacts on birds. *Wilson Bull.* 90:309-321.
- Campbell, H. 1972. A population study of Lesser Prairie Chickens in New Mexico. *J. Wildl. Manage.* 36: 689-699.
- Candelaria, M. A. 1979. Movements and habitat-use by Lesser Prairie Chickens in eastern New Mexico. M.Sc. Thesis, New Mexico State Univ., Las Cruces.
- Cannon, R. W. 1980. Current status and approaches to monitoring populations and status of Lesser Prairie Chickens in Oklahoma. M.Sc. Thesis, Oklahoma State Univ., Stillwater.
- Cannon, R. W., and F. L. Knopf. 1979. Lesser Prairie-Chicken responses to range fires at the booming ground. *Wildl. Soc. Bull.* 7: 44-46.
- Cannon, R. W., and F. L. Knopf. 1981. Lesser prairie chicken densities on shinnery oak and sand sagebrush rangelands in Oklahoma. *J. Wildl. Manage.* 45: 521-524.
- Coats, J. 1955. Raising Lesser Prairie Chickens in captivity. *Kansas Fish and Game* 13(2): 16-20.
- Copelin, F. F. 1963. The Lesser Prairie Chicken in Oklahoma. *Okla. Wildl. Conserv. Dep. Tech. Bull.* 6.
- Crawford, J. A. 1980. Status, problems, and research needs of the Lesser Prairie chicken, pp. 1-7 in Proceedings Prairie Grouse symposium, (P. A. Vohs and F. L. Knopf, eds.), Oklahoma State University, Stillwater.
- Crawford, J. A., and E. G. Bolen. 1975. Spring lek activity of the Lesser Prairie Chicken in west Texas. *Auk* 92: 808-810.
- Crawford, J. A., and E. G. Bolen. 1976a. Effects of land use on Lesser Prairie Chickens in Texas. *J. Wildl. Manage.* 40: 96-104.

- Crawford, J. A., and E. G. Bolen. 1976b. Fall diet of Lesser Prairie Chickens in west Texas. *Condor* 78: 142-144.
- Crawford, J. A., and E. G. Bolen. 1976c. Effects of lek disturbances on Lesser Prairie Chickens. *Southwest. Nat.* 21: 238-240.
- Davis, C. A., T. Z. Riley, R. A. Smith, H. R. Suminski, and D. M. Wisdom. 1979. Habitat evaluation of Lesser Prairie Chickens in eastern Chaves County, New Mexico. *New Mexico Agric. Experi. Sta., Las Cruces.*
- Davison, V. E. 1940. An 8-year census of Lesser Prairie Chickens. *J. Wildl. Manage.* 4: 55-62.
- Donaldson, D. D. 1969. Effect on Lesser Prairie Chickens of brush control in western Oklahoma. Ph.D. diss., Oklahoma State Univ., Stillwater.
- Doerr, T.B. 1980. Effects of tebuthiuron on lesser prairie chicken habitat and food supplies. M.S. Thesis, Texas Tech Univ., Lubbock. 55pp.
- Doerr, T. B., and F. S. Guthery. 1980. Effects of shinnery oak control on Lesser Prairie Chicken habitat. Pp. 59-63 *in* Proceedings Prairie Grouse Symposium (P. A. Vohs, Jr., and F. L. Knopf, eds.), Stillwater, OK.
- Evans, R. A., and R. M. Love. 1957. The step point method of sampling - a practical tool in range research. *J. Range Manage.* 10:208-212.
- Giesen, K. M. 1991. Population inventory and habitat use by Lesser Prairie-Chickens in southeast Colorado. *Fed. Aid in Wildl. Restor. Rep. W-152-R, Colo. Div. Wildl.*
- Giesen, K. M. 1994a. Breeding range and population status of Lesser Prairie-Chickens in Colorado. *Prairie Nat.* 26: 175-182.
- Giesen, K. M. 1994b. Movements and nesting habitat of Lesser Prairie-Chicken hens in Colorado. *Southwest. Nat.* 39: 96-98.
- Giesen, K. M. 1998. The Lesser Prairie-chicken. *in* *Birds of North America.* (A. Poole and G. Gill, Eds.) Philadelphia: The Academy of Natural Sciences; Washington, D. C.: The American Ornithologists' Union..
- Grange, W. B. 1940. A comparison of the displays and vocal performance of the Greater Prairie Chicken, Lesser Prairie Chicken, Sharp-Tailed Grouse, and Sooty Grouse. *Passenger Pigeon* 2: 127-133.
- Haukos, D. A. 1988. Reproductive ecology of Lesser Prairie-Chickens. M.Sc. Thesis, Texas Tech. Univ., Lubbock.
- Haukos, D.A. and G.S. Broda. 1989. Northern Harrier (*Circus cyaneus*) predation of Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*). *J. Raptor Res.* 23(4):182-183.
- Haukos, D. A., and L. M. Smith. 1989. Lesser Prairie-Chicken nest site selection and vegetation characteristics in tebuthiuron-treated and untreated sand shinnery oak in Texas. *Great Basin Nat.* 49: 624-626.
- Hjorth, I. 1970. Reproductive behavior in the Tetraonidae, with special reference to males. *Viltrevy* 7(4): 184-596.
- Hoffman, D. M. 1963. The Lesser Prairie Chicken in Colorado. *J. Wildl. Manage.* 27: 726-732.

555-565.

- Potts, G. R. 1984. Monitoring changes in the cereal ecosystem. Pages 128-134 in *Agriculture and the environment*, D. Jenkins, editor. Institute of Terrestrial Ecology, Natural Environment Research Council, United Kingdom.
- Reijnen, R., R. Foppen, C.T. Braak, and J. Thissen. 1995. The effects of car traffic on breeding bird populations in woodland. III. Reduction of density in relation to the proximity of main roads. *J. Appl. Ecol.* 32:187-202.
- Riley, T. Z. 1978. Nesting and brood rearing habitat of Lesser Prairie Chickens. M.Sc. Thesis, New Mexico State Univ., Las Cruces.
- Riley, T. Z., C. A. Davis, and R. A. Smith. 1993. Autumn and winter foods of the Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*) (Galliformes: Tetraonidae). *Great Basin Nat.* 53: 186-189.
- Riley, T. Z., C. A. Davis, M. Ortiz, and M. J. Wisdom. 1992. Vegetative characteristics of successful and unsuccessful nests of Lesser Prairie Chickens. *J. Wildl. Manage.* 56: 383-387.
- Robel, R.J., J.N. Briggs, J.J. Cebula, A.D. Dayton, and L.C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. *J. Range Manage.* 23:295-297.
- Rodgers, R. D., and M. L. Sexson. 1990. Impacts of extensive chemical control of sand sagebrush on breeding birds. *J. Soil and Water Conserv.* 45: 494-497.
- Sell, D. L. 1979. Spring and summer movements and habitat use by Lesser Prairie Chicken females in Yoakum County, Texas. M.Sc. Thesis, Texas Tech. Univ., Lubbock.
- Sharpe, R. S. 1968. The evolutionary relationships and comparative behavior of prairie chickens. Ph.D. diss. Univ. Nebraska, Lincoln.
- Short, L. L. 1967. A review of the genera of grouse (Aves, Tetraoninae). *Am. Mus. Novit.* 2289: 1-39.
- Snyder, W. A. 1967. Lesser Prairie Chicken. pp. 121-128 in *New Mexico Wildlife Management*. New Mexico Dept. Game and Fish, Sante Fe.
- Stabler, R.M. 1978. Plasmodium (*Giovannolaia*) *pedioecetii* from the lesser prairie chicken, *Tympanuchus pallidicinctus*. *J. Parasitol.* 64:1126-1135.
- Suminski, H. R. 1977. Habitat evaluation for Lesser Prairie Chickens in eastern Chaves County, New Mexico. M.Sc. Thesis, New Mexico State Univ., Las Cruces.
- Sutton, G. M. 1967. *Oklahoma birds*. Univ. Oklahoma Press, Norman.
- Sutton, G. M. 1968. The natal plumage of the Lesser Prairie Chicken. *Auk* 85: 679.
- Sutton, G. M. 1977. The Lesser Prairie Chicken's inflatable neck sacs. *Wilson Bull.* 89: 521-522.
- Taylor, M. A. 1979. Lesser Prairie Chicken use of man-made leks. *Southwest. Nat.* 24: 683-714.
- Taylor, M. A., and F. S. Guthery. 1980. Status, ecology, and management of the Lesser Prairie Chicken. U.S. Dep. Agric. Forest Service Gen. Tech. Rep. RM-77, Rocky Mountain Forest and Range Exper. Sta., Fort Collins, CO.

- Thompson, M. C., and C. Ely. 1989. Birds in Kansas. Vol. 1. Univ. Kansas Mus. Nat. Hist. Public Educ. Ser. No. 11.
- Vance, D.R., and R.L. Westemeier. 1979. Interactions of pheasants and greater prairie chickens in Illinois. Wildl. Soc. Bull. 7:221-225.
- U. S. Department of Interior, and U. S. Department of Commerce. 1997. 1996 national survey of fishing, hunting, and wildlife associated recreation. U. S. Government Printing Office, Washington, D. C.
- Wisdom, M. J. 1980. Nesting habitat of Lesser Prairie Chickens in eastern New Mexico. M.Sc. Thesis, Univ. New Mexico, Las Cruces.
- Wood, D. S., and G. D. Schnell. 1984. Distribution of Oklahoma birds. Univ. Oklahoma Press, Norman.

APPENDIX A
LETTER OF COMMITMENT FROM
THE FIVE STATE WILDLIFE AGENCIES



TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road • Austin, Texas 78744 • 512-389-4800

ANDREW SANSON
Executive Director

COMMISSIONERS

LEE M. BASS
Chairman, Ft. Worth

NOLAN RYAN
Vice-Chairman
Alvin

MICKEY BURLESON
Temple

RAY CLYMER
Wichita Falls

YGNACIO D. GARZA
Brownsville

RICHARD (DICK) HEATH
Dallas

TERESE TARLTON HERSHEY
Houston

SUSAN HOWARD-CHRANE
Boerne

WALTER UMPHREY
Beaumont

PERRY R. BASS
Chairman-Emeritus
Ft. Worth

October 10, 1996

Jerry Brabander
Ecological Services Field Office
U.S. Fish and Wildlife Service
222 S. Houston, Suite A
Tulsa, Oklahoma 74127

Dear Mr. Brabander:

The service received a petition to list the lesser prairie chicken (LPC) as threatened on October 6, 1995. In response to this petition, state conservation agency biologists within the historic range (CO, KS, NM, OK, and TX) as well as representatives from BLM, USFS, USFWS, Wildlife Management Institute, and university researchers met to outline a process to reverse the reported decline of the lesser prairie chicken. As a result of this meeting, a Lesser Prairie Chicken Interstate Conservation Group (LPCICG) was established, and four committees were formed. Each of the four committees will be responsible for specific tasks the group believes to be relevant to LPC conservation. The specific tasks outlined for each committee are as follows:

1. Habitat Status/Quality - Determine existing habitat status and quality and identify management needs and strategies for habitat improvement.
2. Information Acquisition - Improve and standardize survey methods and consolidate existing information to facilitate better cooperation between states and the Service.
3. Implementation/Outreach/Education - Develop outreach and educational materials that identify landowner incentive opportunities, describe management strategies, and incorporate these strategies with wildlife management practices for other species.
4. Research/Life History - Identify, prioritize, and facilitate research on a regional level.

Mr. Jerry Brabander

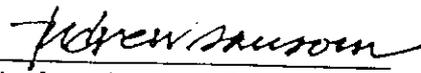
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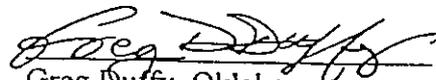
The goals of this working group are to produce a regional conservation strategy that will outline potential threats, develop management practices, determine research needs, and enhance public awareness of the lesser prairie chicken through outreach and educational materials.

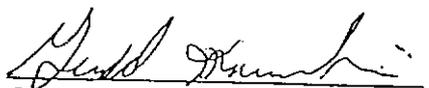
Concern about declines in prairie chicken populations on behalf of the states began prior to the date of the petition. In February of 1995 biologists from each of the states within the range met to discuss current status, research needs, and to develop an information exchange network. Since that time, Kansas, Oklahoma, New Mexico, and Texas have initiated proposals for research. The USFS (Comanche and Cimarron National Grasslands) is currently operating under management plans that contain provisions for lesser prairie chicken habitat enhancement. New Mexico has closed its hunting season, Kansas and Oklahoma have reduced season length and bag limit, and Texas has proposed reinstating a permit system to more closely monitor harvest. The lesser prairie chicken has been on the state threatened list in Colorado since 1973 and a state recovery plan was implemented in 1992.

Due to the fact that the majority of lesser prairie chicken habitat falls under private ownership in four of the five states and in light of current private landowner concern about the Endangered Species Act (ESA), we believe that cooperation between the states, the Service, and private landowners in a proactive approach is crucial. We strongly believe that the LPCICG will provide a more effective means of conserving the lesser prairie chicken than would be offered by the ESA alone. Therefore, we are submitting this charter letter to document the states' commitment to work in a cooperative fashion to ensure the conservation of this species.

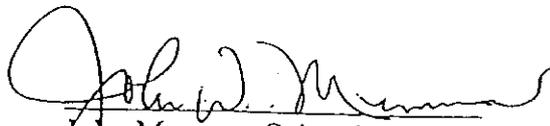
Sincerely,


Andrew Sansom, Texas


Greg Duffy, Oklahoma


Gerald Maracchini, New Mexico


Steve Williams, Kansas


John Mumma, Colorado
AS:km

APPENDIX B
LPCIWG MEMBERSHIP LIST

Kevin Mote (Chair)
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Rand French
Bureau of Land Management
2909 W. 2nd
Roswell, NM 88201

Wendell Gilgert
NRCS
2030 Amber
Ft. Collins, CO 80525

APPENDIX C

BASELINE POPULATION AND DISTRIBUTION INFORMATION

Information in this appendix will be used as the baseline by which progress is being made toward accomplishing our goal. For each of the five states, a ten-year period of population data was selected. The average of these 10 years will be used as the baseline by which future population information will be compared. Because each state has historically collected data by different methods, this information will only be used for intrastate comparisons. Only after a sufficient data set has been collected using the standardized protocol can comparisons be made rangewide. Population distribution maps are provided to serve as a baseline by which to measure future distribution changes.

Colorado baseline population data.

Year	# Leks	# Males	Average
1981	25	303	12.1
1982	23	257	11.2
1983	27	310	11.5
1984	29	349	12
1985	36	285	7.9
1986	37	282	7.6
1987	43	346	8
1988	37	365	9.9
1989	35	380	10.9
1990	31	210	6.8
10 Year Average	32.3	308.7	9.6

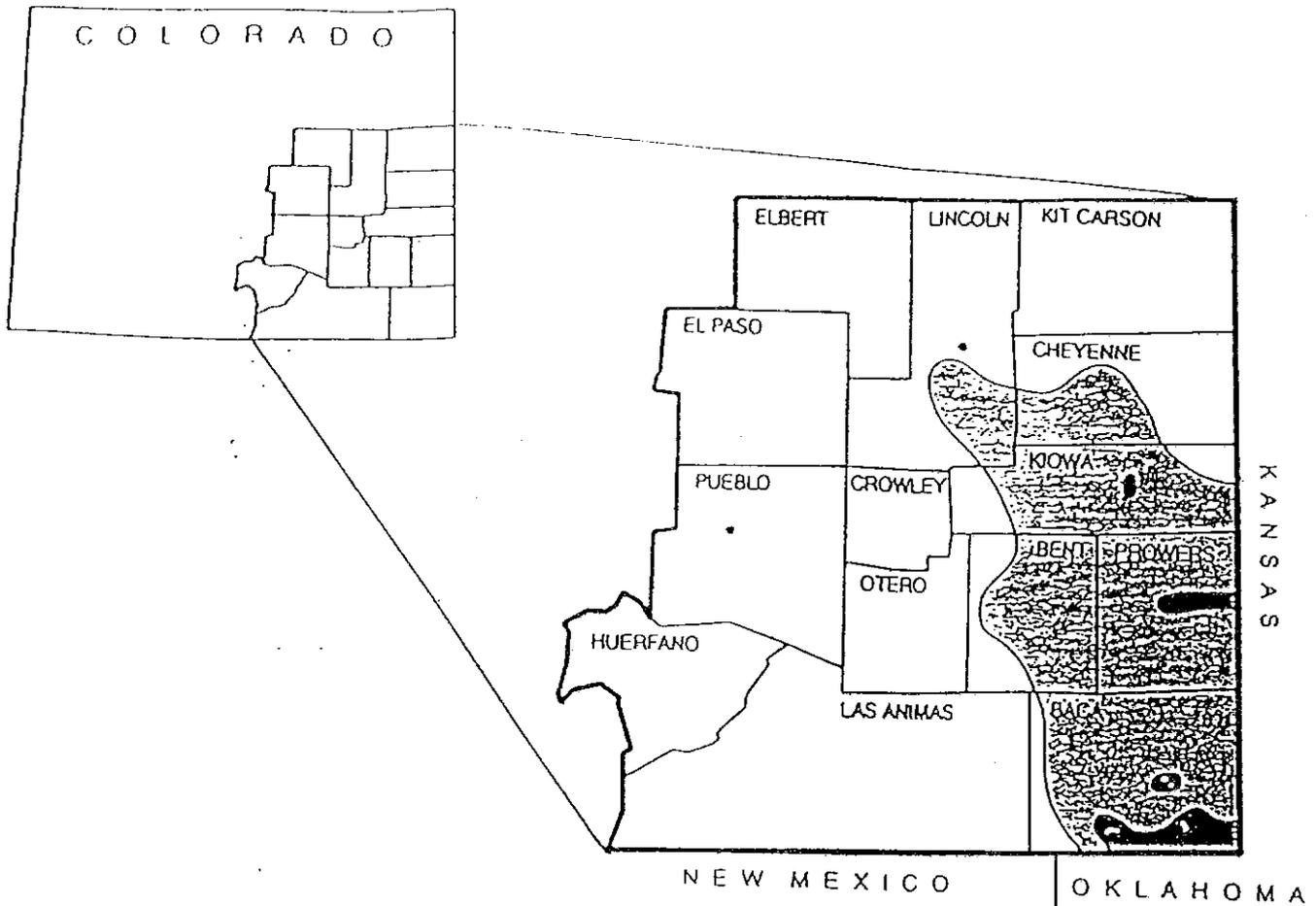


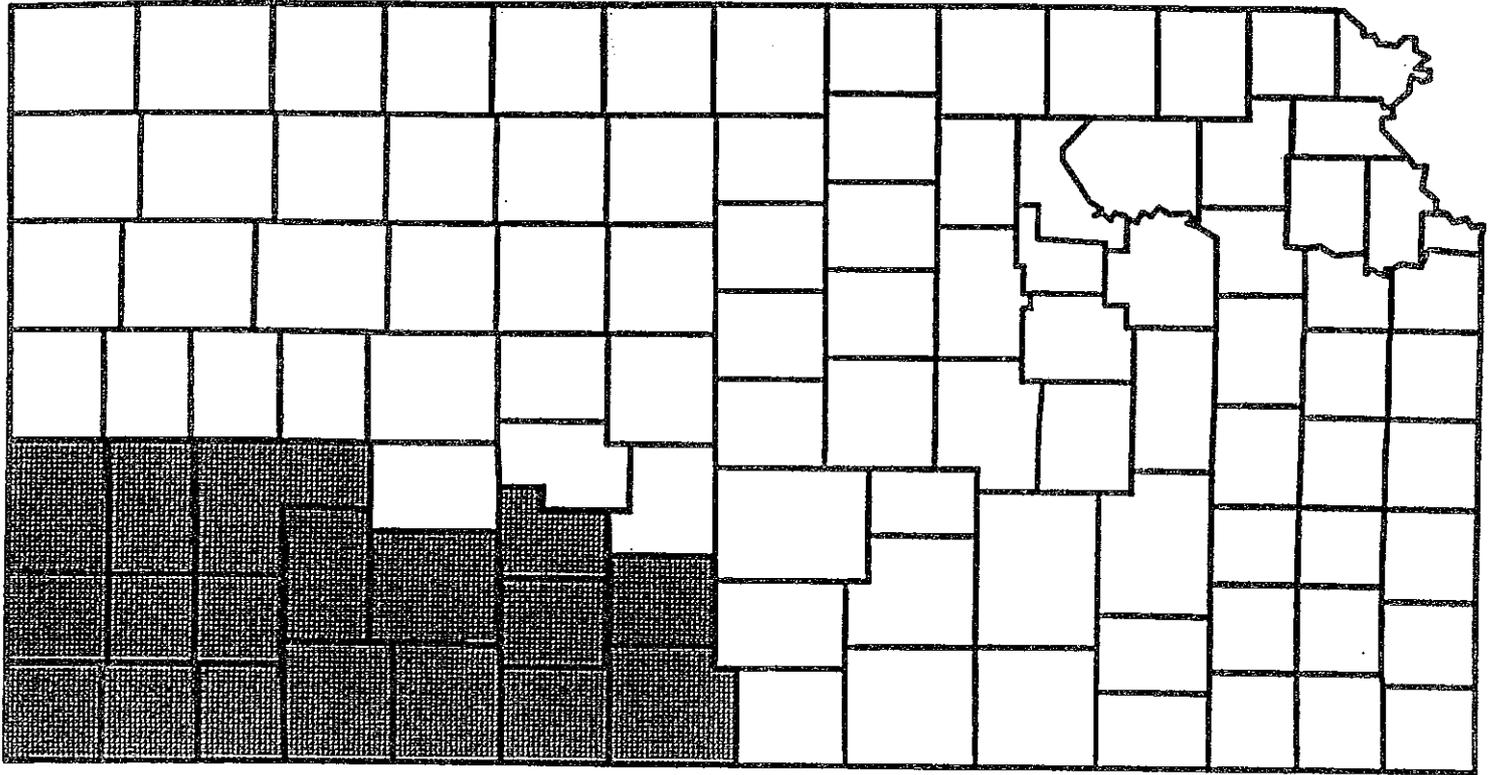
Figure 1. Presumed maximum historic (light shading) and current distribution (dark shading) of lesser prairie-chickens in Colorado. Locations of transplants since 1960 are indicated by closed circles. From Gieser (1994a).

Kansas Baseline Population Data

Year	Bison Refuge birds/sq mi	Cimarron NG birds/sq mi	Clark Co. birds/sq mi	Comanche Co. birds/sq mi	Finney Co. birds/sq mi	Ford Co. birds/sq mi	Hamilton Co. birds/sq mi	Kearney Co. birds/sq mi	Meade Co. birds/sq mi	Pratt Sandhills birds/sq mi	Rangewide birds/sq mi
1970	.	9.20	2.10	.	36.60	.	.	.	7.20	.	13.80
1971	.	15.90	3.90	.	28.00	.	.	.	5.60	.	13.40
1972	.	12.70	.	.	23.60	.	.	.	5.40	.	13.90
1973	.	12.30	7.70	.	10.10	10.00
1974	.	10.50	7.30	.	36.20	.	.	.	4.50	.	14.60
1975	.	8.50	8.10	.	36.50	.	.	.	7.60	.	17.50
1976	.	6.70	.	.	16.90	.	.	.	11.80	.	11.80
1977	8.90	7.30	8.90	.	20.00	.	.	4.70	7.90	.	10.00
1978	11.00	7.40	6.00	.	10.40	.	.	6.90	.	.	8.30
1979	44.40	7.70	6.20	.	6.70	.	10.60	14.10	7.1	.	15.80
Mean (SD)	21.4(19.9)	9.8(2.9)	6.3(2.3)	.	22.5(11.6)	.	10.6	8.6(4.9)	7.1(2.4)	.	12.9(2.9)

Route not established during this period.

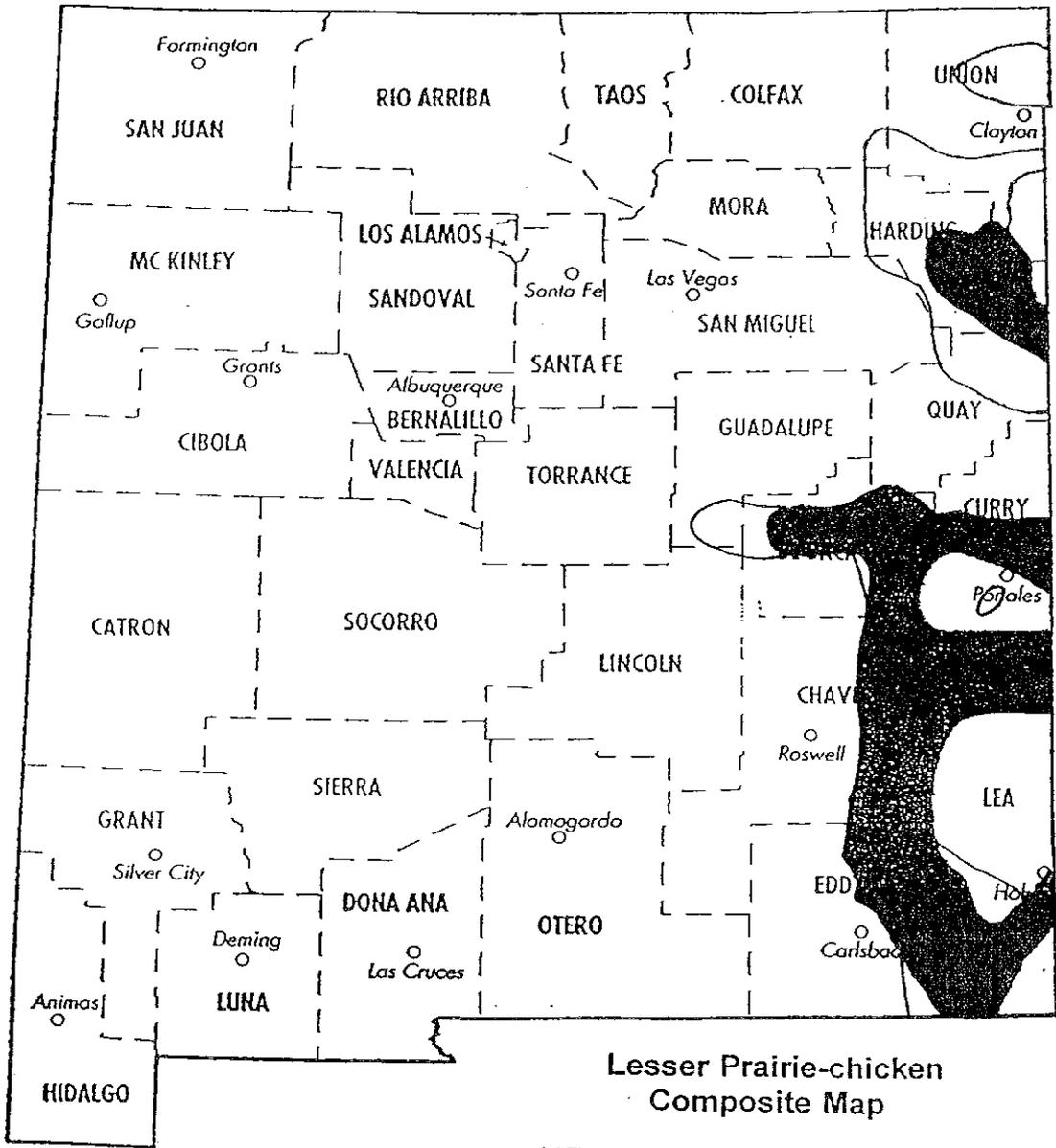
Kansas Baseline Distribution map



New Mexico Baseline Population Data

New Mexico has had no rangewide surveys of lek densities, percent of known lek sites active, or birds observed per lek. The only long series of data on Lesser Prairie-chickens (LPC) in New Mexico has been obtained since 1971 by the Bureau of Land Management (BLM) for the Caprock Wildlife Habitat Area (CWhA) in Eastern Chaves County. Extrapolation of these results from mostly BLM land to large portions of the New Mexico LPC range that are dominated by private land requires caution.

LPC data from the CWhA indicate a modest increase in birds during a relatively moist period of 1982-88, followed by an abrupt and persistent decline beginning in 1989. These data indicate that populations in the 1970's were of sufficient viability to be able to respond positively to the more moist conditions of the 1980's. Therefore population indices for 1971-1981 (10 years, with no data in 1973) will be used as a baseline for evaluating the success of current management. During 1971-1981 on the CWhA, an average of 70% of known lek sites were active ($S=17\%$), and an average of 7.4 birds were observed per active lek site ($S=2.2$).



Lesser Prairie-chicken
Composite Map

Lesser Prairie Chicken Booming Ground Density in Oklahoma, 1982 -1990

Year	1982	1985	1990	Mean
Beaver				
Ellis	0.5	0.1	0.4	0.26875
Harper		0.35	0.6	0.461111
R. Mills		0.1	0.2	0.21875
Texas		0.25	0.4	0.05
Woodward		0.2	0.25	0.183333
Average	0.5	0.2	0.32	0.216667
	0.166667	0.26	0.39	0.268333
Maximum	0.65	0.25	0.15	
Minimum	0.05	0.2	0.15	
SD	0.154708	0.25	0.25	
Mean	0.276316	0.2	0.35	
Median	0.25	0.25	0.35	

Average Number of Booming Male Lesser Prairie Chickens in Oklahoma, 1980 - 1990

Year	80		85		90						
BEAVER 1	9	13	16	15	9	12	0	10	4	7	6
BEAVER 2	10	17	12	19	11	14	14	12	12	10	11
AVERAGE	9.5	15	14	17	10	13	7	11	8	8.5	8.5
ELLIS 1	14	16	18	11	12	17	18	16	19	15	8
ELLIS 2	10	8	7	7	7	9	4	3	0	3	0
AVERAGE	12	12	12.5	9	9.5	13	11	9.5	9.5	9	4
HARPER 1	9	11	8	10	8	13	7	9	16	9	0
HARPER 2	5	13	6	7	8	11	0	7	12	10	10
AVERAGE	7	12	7	8.5	8	12	3.5	8	14	9.5	5
R. MILLS 1	0	0	15	8	6	0	5	*	0	0	0
R. MILLS 2	0	0	0	0	0	0	0	*	0	0	0
AVERAGE	0	0	7.5	4	3	0	2.5	0	0	0	0
TEXAS 1										28	27
TEXAS 2											
AVERAGE							0	0	0	14	13.5
WOODWARD 1	13	*	12	5	5	12	16	15	19	12	16
WOODWARD 2	0	.	0	0	0	0	0	0	0	0	0
WOODWARD 3							7		17	17	17
AVERAGE	6.5	0	6	2.5	2.5	6	7.6667	7.5	12	9.67	11.00
AVERAGE	7.00	7.80	9.40	8.20	6.60	8.80	5.92	6.00	8.25	8.54	7.31
Maximum	19										
Minimum	0										
Mean	7.3909										
SD	6.0844										
Median	8										

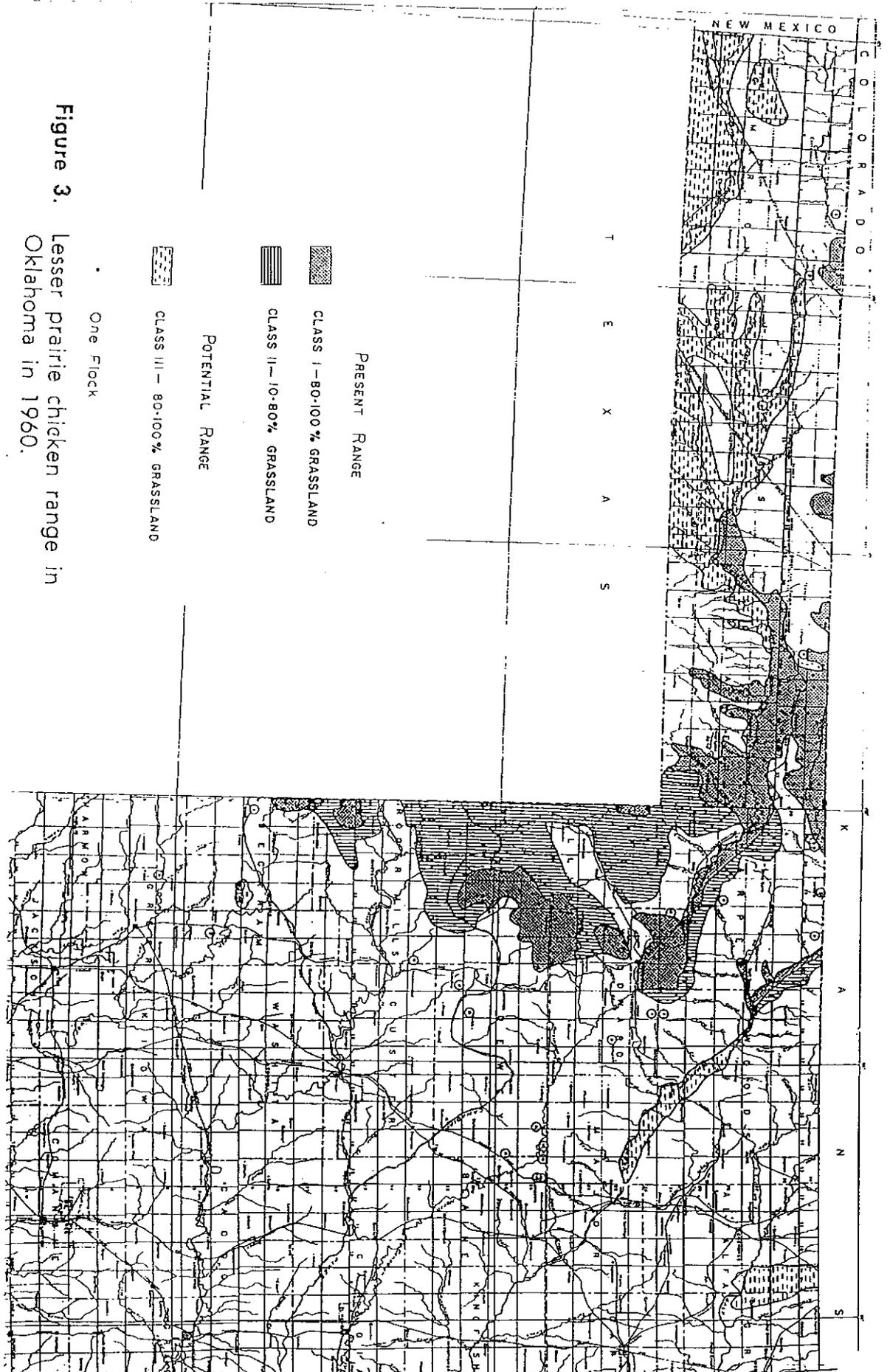


Figure 3. Lesser prairie chicken range in Oklahoma in 1960.

Texas Baseline Population and Distribution Information

Two metapopulations are recognized in Texas. One is located in the northeast portion of the Panhandle and is represented in the survey data by Hemphill and Wheeler Counties. The other metapopulation is referred to as the Permian Basin Population which consists of several Counties southwest of Lubbock. The period including the years of 1985-1994 will be used as the baseline for the Permian and the period including 1976-1985 will be used for the Panhandle in order to utilize both birds/lek and lek density estimates. The baseline distribution is represented by the 1989 map which has been digitized and total occupied area estimated. For reference, a map depicting the 1940 distribution is provided. This is the first systematic effort to be conducted to describe the distribution of LPCs in Texas.

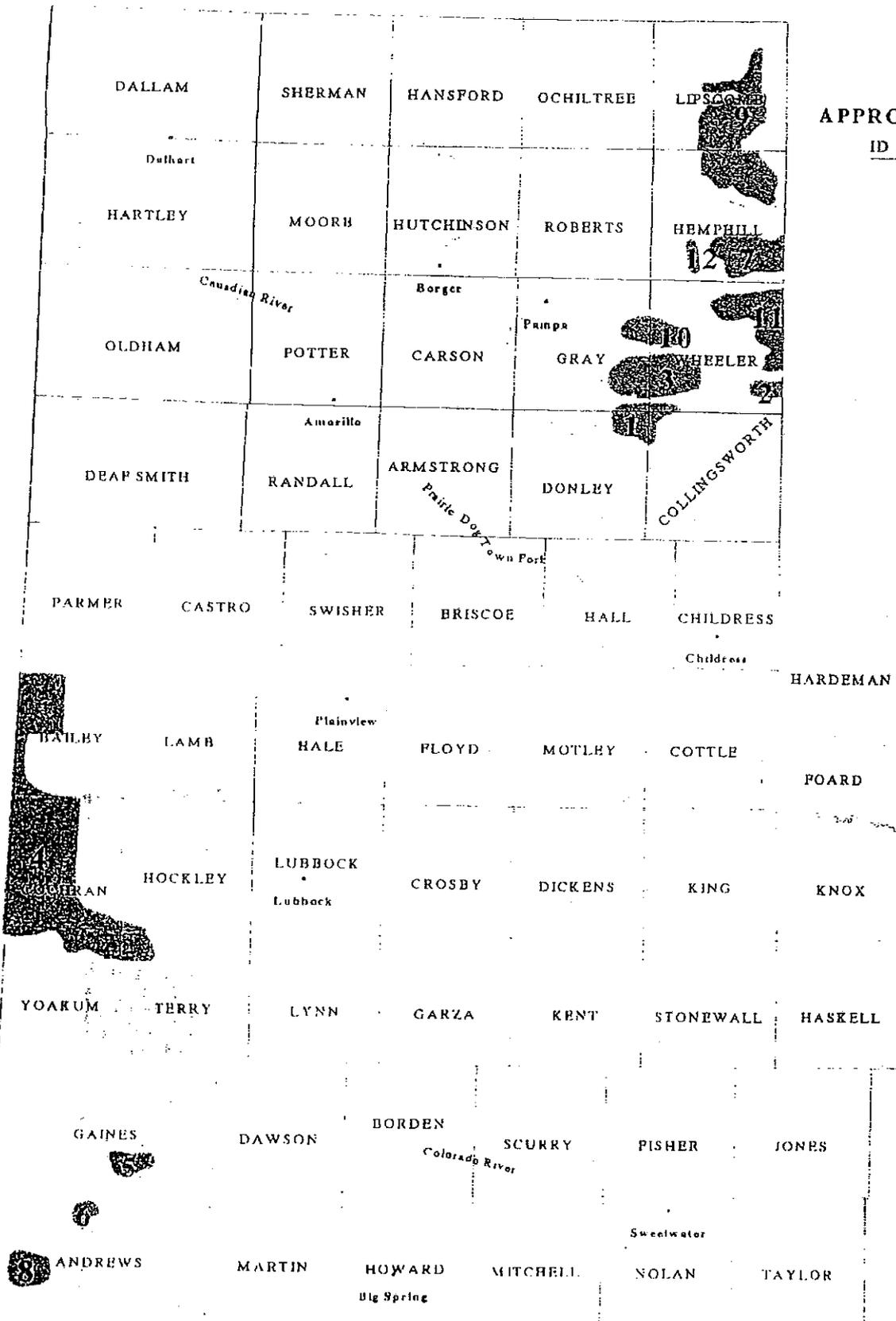
Panhandle LPC Population Data - Number of leks per 100 hectares		
Year	Hemphill County	Wheeler County
1976	0.119	0.727
1977	0.111	0.545
1978	0.089	0.681
1979		0.636
1980	0.109	0.727
1981	0.079	0.5
1982	0.086	0.636
1983	0.099	0.59
1984	0.101	0.5
1985	0.089	0.5

Number of Males/Lek for the Panhandle and Permian Basin Metapopulations.

Year	Panhandle			Permian		
	# of leks	# of males	males/lek	# of leks	# of males	males/lek
1976	64	938	14.66	35	536	15.31
1977	57	619	10.86	34	399	11.74
1978	51	540	10.59	28	227	8.11
1979	44	498	11.32	34	285	8.38
1980	50	665	13.30	24	289	12.04
1981	49	495	10.10	25	271	10.84
1982	50	567	11.34			
1983	53	630	11.89			
1984	52	665	12.79			
1985	47	599	12.74			
1986	31	432	13.94	27	368	13.63
1987	24	431	17.96	27	350	12.96
1988	23	404	17.57	31	361	11.74
1989	17	294	17.29	13	209	16.08
1990	18	233	12.94	27	328	12.15
1991	21	278	13.24	26	243	9.35
1992	18	242	13.44	57	134	2.35
1993	18	191	10.61	16	30	1.88
1994	15	152	10.13	29	133	4.59
1994				26	188	7.23
10 yr. Total	481	5866	120.25	279	2447	95.96
10 yr. Avg.	48.1	586.6	12.03	27.9	244.7	9.60

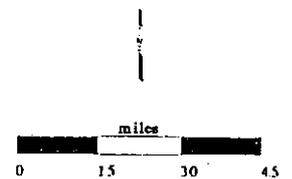
Shaded areas represent the 10 year period used for baseline.

1989 Distribution of Lesser Prairie Chicken in Texas



APPROXIMATE HABITAT ARE

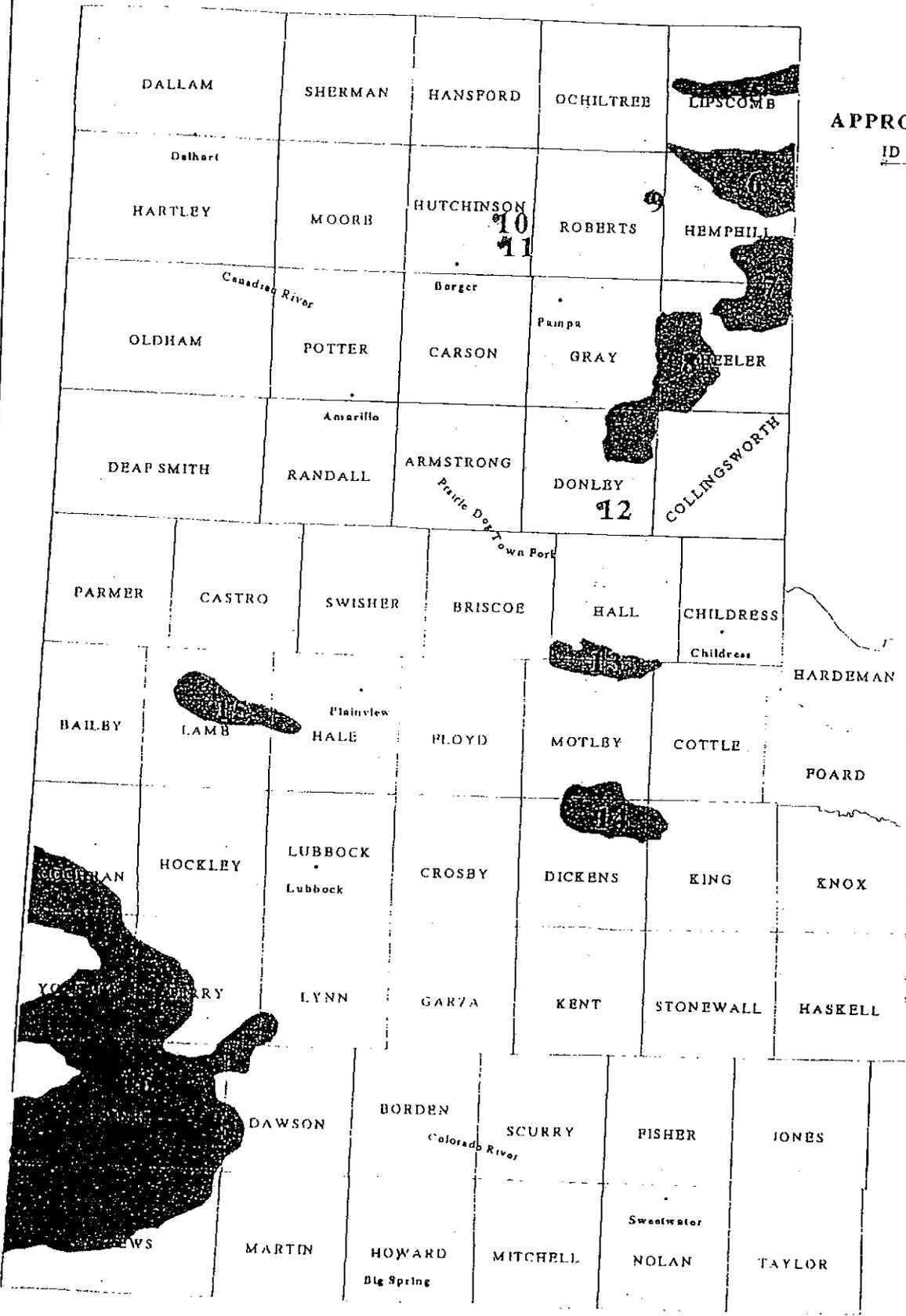
ID NUMBER	HECTARES
1	26,252
2	7,746
3	49,626
4	238,809
5	13,715
6	8,048
7	36,165
8	18,859
9	102,495
10	21,522
11	44,155
12	5,838



Source: FedAide Proj. W-108-R-13
 Establish Harvest Regulations
 William C. Browlee,
 October 10, 1989

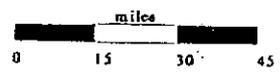
Produced by the TPWD GIS Lab,
 December 19, 1996. No claims are
 made to the accuracy of the data
 or the suitability of the data to
 a particular use

1940 Distribution of Lesser Prairie Chicken in Texas



APPROXIMATE HABITAT AREA

ID NUMBER	HECTARES
5	37,260
6	86,775
7	79,717
8	123,565
9	3,506
10	1,025
11	1,962
12	800
13	42,914
14	66,815
15	56,016
16	866,123



Source: Henke, P.S. (1940) Present Status and Future Management of the Prairie Chicken in Region 5. Special Report: Texas Game Fish and Oyster Commission, Division of Wildlife Recreation.

Produced by the TPWD GIS Lab, December 19, 1996. No claims are made to the accuracy of the data or the suitability of the data to a particular use.