Status, Ecology, and Management of the Lesser Prairie Chicken

Maple A. Taylor and Fred S. Guthery

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Abstract

This report assesses past and recent distribution of the lesser prairie chicken; summarizes knowledge of its life history, ecology, and management; and identifies research needs.

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MANAGEMENT IMPLICATIONS

The occupied range of lesser prairie chickens (*Tympanuchus pallidicinctus*) has decreased 92% since the 1800's, and the sandy prairies upon which these birds depend continue to be converted to cropland. Therefore, management should be directed at acquisition, preservation, and improvement of habitat.

Optimum habitat for lesser prairie chickens consists of mid to tall grass prairies for nesting and wintering cover interspersed with lower seral stages for feeding and brooding cover. Grazing systems that perpetuate higher successional grasses and leave adequate residual cover are essential for these birds. On those portions of lesser prairie chicken range that are infested with Havard oak (*Quercus havardii*), application of herbicides may improve habitat by increasing grass production.

Research is indicated to maintain or increase lesser prairie chicken populations and to improve their management. The response of these birds to weather, stocking rates, grazing systems, brush control, and various land management practices needs to be quantified so that sound advice can be given to land managers. Methods of censusing lesser prairie chickens need to be evaluated and improved. Lastly, successful transplanting techniques need to be developed because currently unoccupied habitat likely is available for re-introductions.

INTRODUCTION

The range of the lesser prairie chicken has shrunk dramatically since 1900, and in 1979 was restricted to isolated areas in New Mexico, Colorado, Kansas, Oklahoma, and Texas. Research on this species has been diverse, including basic life history, seasonal habitat requirements, food habits, and behavior. However, much more needs to be known about the ecology and habitat use of the lesser prairie chicken if its welfare is to be insured. To aid in orienting future research and management, we have synthesized available information on the status, ecology, and management of the lesser prairie chicken and have identified research needs.

TAXONOMY

Ridgway (1873) first described the lesser prairie chicken as a variety of the greater prairie chicken, designated *Cupidonia cupido* var. *pallidicincta*. He later (1885) re-evaluated the lesser prairie chicken to specific rank.

Short (1967) regarded the lesser prairie chicken as only racially distinct from *T. cupido*, a position supported by Johnsgard (1973). Based on detailed studies of morphology and behavior, Sharpe (1968) considered the lesser an allospecies. Conversely, Jones (1964a) supported specific distinction between the two based on differences in behavior, vocalization, morphology, and habitat use. Likewise, the American Ornithologists' Union (1957) recognizes the lesser prairie chicken as a distinct species.

DISTRIBUTION AND STATUS

Historical

Accurately determining the historical distribution of the lesser prairie chicken is difficult because early observers confused them with greater prairie chickens and, perhaps, because of their late recognition as a distinct species (Sharpe 1968). Nonetheless, early researchers agree that lesser prairie chickens inhabited the eastern portion of the Great Plains from southwestern Kansas and southeastern Colorado south through western Oklahoma and eastern New Mexico to west-central Texas. There may have been small populations in the sandy lands of northeastern Colorado and northwestern Nebraska. The area originally occupied by lesser prairie chickens, based on Aldrich's (1963, p. 537) map, was about 358,000 km^2.

Records summarized by Sharpe (1968) suggest that lesser prairie chickens migrated from breeding to wintering areas in the 1800's. Bent (1932) considered roughly the northern half of their original distribution as breeding range and the southern half as wintering range. Whether migrations to wintering areas were normal or only periodic responses to overpopulation, extreme food shortagres, or other phenomena is unknown.

It is difficult to envision gallinaceous birds making regular, long-distance migrations of the magnitude indicated by Bent (1932). Willow ptarmigan (*Lagopus lagopus*), rock ptarmigan (*L. mutus*), and blue grouse (*Dendragapus obscurus*)—the most mobile grouse—seldom migrate farther than 32 km (Weeden 1964, Zwickel et al. 1968). We suspect birds seen in the southernmost portions of their historical range were residents rather than migrants, because plant communities currently occupied by the birds were present in those areas.

Recent

By 1969, the range of the lesser prairie chicken had shrunk to 125,000 km², based on our measurement of Aldrich's (1963, p. 537) map, a 65% decrease from the 1800's. Although patchwork agriculture may have increased lesser prairie chicken numbers during 1900 to 1930 (Jackson and DeArment 1963), the species seems unable to tolerate areas with greater than 37% cultivation (Crawford and Bolen 1976a). Thus, wide-scale conversion of prairies to farmland has been primarily responsible for the decline in distribution and numbers of lesser prairie chickens.

Because the bird depends on medium and tall grasses preferred by cattle in regions of low rainfall, its habitat is easily overgrazed (Hamerstrom and Hamerstrom 1961). Overgrazing of rangeland was probably another cause of the population decline (Bent 1932, Lee 1950). The birds have disappeared from extensive blocks of Havard oak rangeland in some areas (e.g., Dickens County, Texas), where overgrazing is the most likely explanation for their demise. However, stable (but perhaps low) populations in heavily grazed Havard oak sandhills in west Texas indicate they can tolerate long-term grazing of high intensity.

Other factors implicated in the decline of lesser prairie chicken populations include overharvest during droughts of the 1930's and 1950's (when continental populations reached an all-time low) and extensive brush control (Jackson and DeArment 1963).

Colorado

By the late 1950's, the lesser prairie chicken was rare in Colorado and was found only in Kiowa, Prowers, and Baca counties (Hoffman 1963). The species is presently classified as threatened in this state (Torres et al. n.d.). There are two populations with a total of 400 to 500 birds.[2] One is small (2 gobbling grounds) and is southeast of Holly in Prowers County; the other is larger (20 gobbling grounds) and is near Campo in Baca County[3] (fig. 1). The latter population is primarily on the Comanche National Grassland, administered by the USDA Forest Service, although some birds can be found on private land south of the Cimarron River.[4] Lesser prairie chickens currently occupy about 1,634 km² in Colorado.

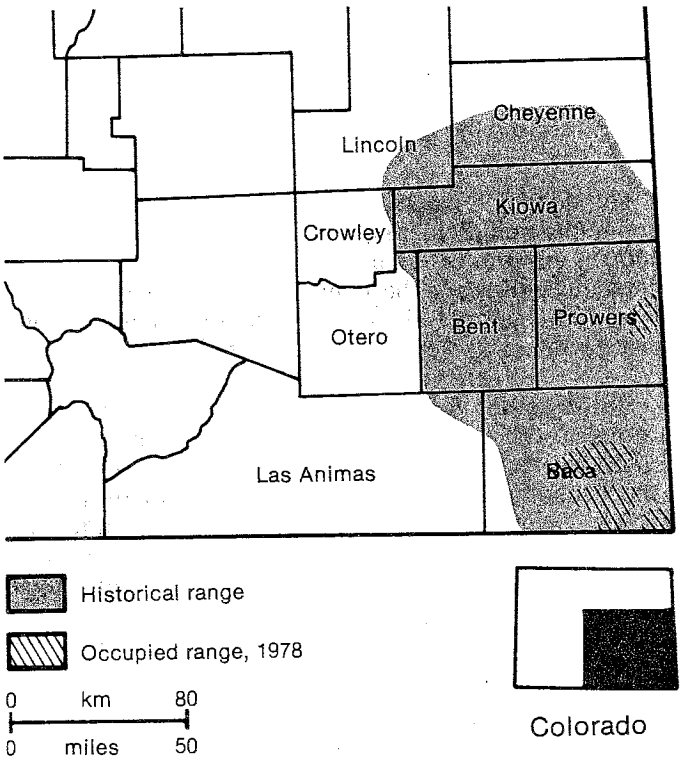

Figure 1.—Past and recent distribution of the lesser prairie chicken in Colorado.

Kansas

White[5] assessed the distribution of lesser prairie chickens in Kansas, finding only minor changes in occupied range since 1950. He reported the species was primarily restricted to areas near the Cimarron and Arkansas Rivers. The birds inhabited Hamilton, Stanton, and Morton counties eastward to Reno, Kingman, and Harper counties northward to Ness County (Waddell 1977). Gobbling grounds were found on 213 sections in 1976. Observations or reliable reports of sightings were noted for an additional 91 sections. Thus, occupied range included at least 778 km² (fig. 2), but most of Meade, Seward, Finney, Hamilton, Hodgeman, Clark, Comanche, Barber, Pratt, Stafford, and Kiowa counties needed further evaluation. Based on 1974 data and habitat conditions, there were about 17,000 lesser prairie chickens in Kansas (Waddell 1977).

[2]*Personal communication, Ed Prenzlow, Division of Wildlife, Colorado Springs, Colo.*

[3]*Personal communication, Walter Graul, Division of Wildlife, Denver, Colo.*

[4]*Personal communication, Morris Snider, USDA Forest Service, Springfield, Colo.*

[5]*Unpublished manuscript, C. White, Kansas Forestry, Fish, and Game Commission, Pratt.*

Oklahoma

In Oklahoma, the range of the lesser prairie chicken changed little from 1940 to 1957 (Copelin 1963). The birds were common in Beaver, Harper, Woodward, Ellis, and Roger Mills counties; occupied limited areas in Beckham, Cimarron, and Texas counties; and were rare in Blaine, Dewey, and Green counties. From 1957 to 1960 they extended their range in Wood, Dewey, and Harper counties. The current range of the lesser prairie chicken has many spatially separated populations and some isolated flocks (Cannon and Knopf 1978) (fig. 3). These data are tentative as distribution studies are still in progress,[6] but the birds occupy at least 1,355 km².

[6]*Personal communication, Fritz Knopf, Oklahoma State University, Stillwater.*

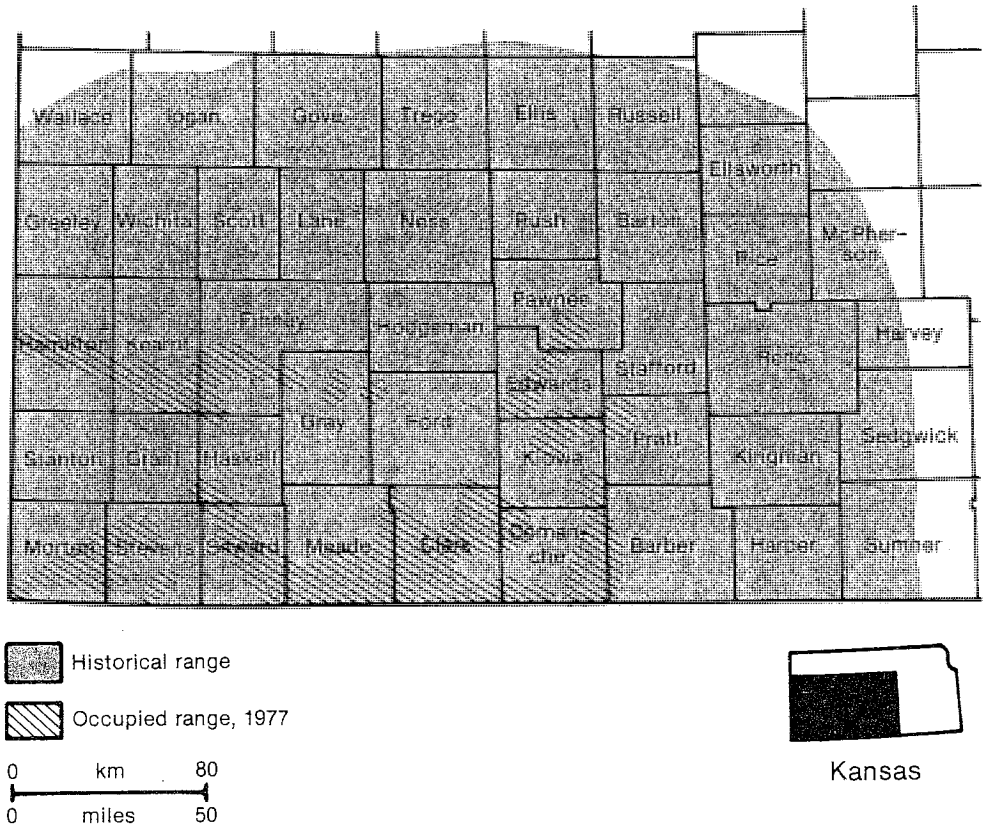

Figure 2.—Past and recent distribution of the lesser prairie chicken in Kansas (Waddell 1977).

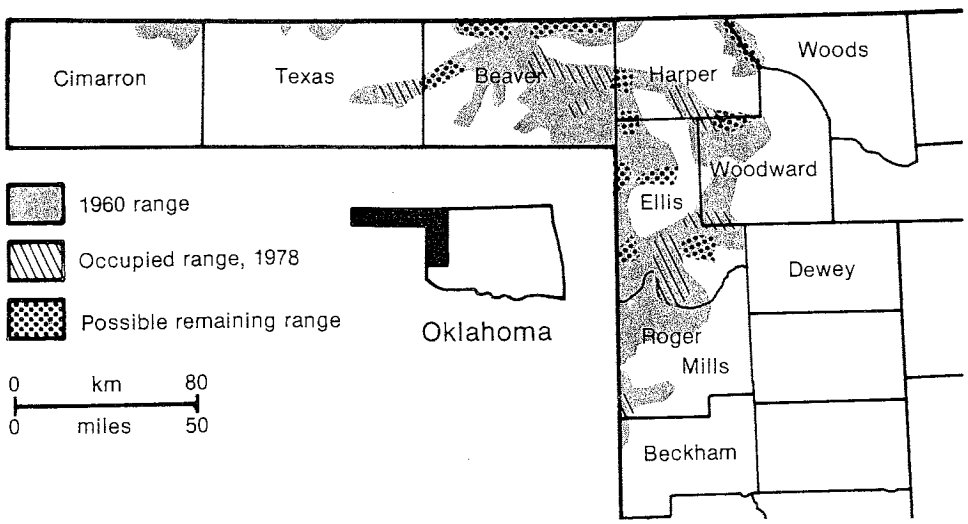

Figure 3.—Past and recent distribution of the lesser prairie chicken in Oklahoma (Cannon and Knopf 1978).

New Mexico

After the drought of the early 1950's, populations of lesser prairie chickens in New Mexico showed noticeable increases in 1956, peaked in 1959, and remained relatively stable through 1964 (Snyder 1967). During the peak, birds re-occupied much of their former range in southeastern New Mexico (fig. 4). Highest populations are found in Roosevelt and northern Lea counties. There are approximately 2,600 birds on U.S. Bureau of Land Management land in Chaves and Roosevelt counties.[7] Harvest data showed most birds were taken in Roosevelt, Lea, and Chaves counties, although there is also hunting in Eddy, Curry, and DeBaca counties (Sands 1978). Based on data presented by Campbell (1972), the average fall population of lesser prairie chickens in New Mexico is approximately 6,000-10,000 birds. Occupied range is about 18,898 km².

[7]*Personal communication, Lynn Metz, Bureau of Land Management, Roswell, N. Mex.*

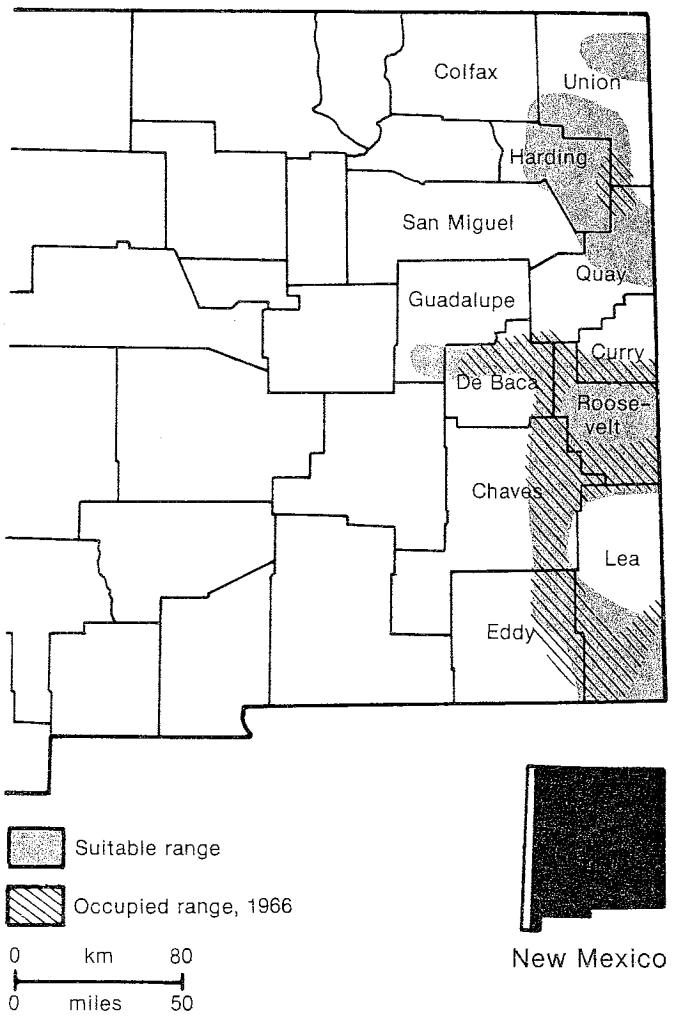

Figure 4.—Past and recent distribution of the lesser prairie chicken in New Mexico (Snyder 1967).

Texas

The range of lesser prairie chickens in Texas has decreased sharply since 1945 (fig. 5). Presently, two disjunct populations remain. The population in the northeastern portion of the panhandle occupies about 3,238 km² and sustains an annual harvest rate of 2%-3% (Litton 1978). The southwestern population occupies 1,388 km² and sustains an annual harvest rate of 10%-21%. Litton (1978) estimated the statewide population at 18,000 birds.

Overall

Lesser prairie chickens currently occupy a total of 27,300 km² in five states. This represents a 78% decrease in range since 1963 and a 92% decrease since the 1800's. To obtain a crude estimate of the current continental population, we multiplied lesser prairie chicken density in Texas (3.9/km²) by the minimum area occupied in Oklahoma (1,355 km²) to obtain a population estimate of 5,300 birds for the latter state. This figure was added to the range of values reported for other states to obtain an overall estimate of 46,700-55,330 birds.

Future

Conversion of sandy rangeland into farmland will continue to decrease the range and numbers of lesser prairie chickens. In Kansas, center-pivot sprinkler systems are permitting irrigation of lands formerly impractical, uneconomical, or technically impossible to farm (Waddell 1977). Sand prairies south of the Arkansas River, the heart of lesser prairie chicken range in Kansas, are disappearing at an average rate of 5% per year (Waddell and Hanzlick 1978). Habitat loss through conversion of rangeland to cropland in Finney, Grant, Gray, Haskell, and Kearney counties is expected to reduce the Kansas population to 9,500 birds (a loss of 7,500) by 1983 (Waddell 1977). In Colorado, center-pivot irrigation may soon eliminate the remnant prairie chicken population near Holly.[8] Texas has also seen development of center-pivot systems in the range of its lesser prairie chicken populations (fig. 5), but the extent of the development is unknown. Conversion of sandy rangeland to cropland may increase in Texas because water tables are relatively high in these areas and dropping in other portions of the High Plains.

Although conversion of sandy prairies into cropland will continue to decrease the range and numbers of lesser prairie chickens, some areas appear immune to such developments. Besides occupied range on state and federal land, some rangeland will not be converted because it cannot be farmed or because it is on large ranches whose owners are unlikely to begin farming. Limited areas of Havard oak rangeland in west Texas will not be cultivated because the City of Lubbock owns the water rights. Thus, it appears that enough habitat is available to maintain populations of lesser prairie

[8]*Personal communication, Ed Prenzlow, Division of Wildlife, Colorado Springs, Colo.*

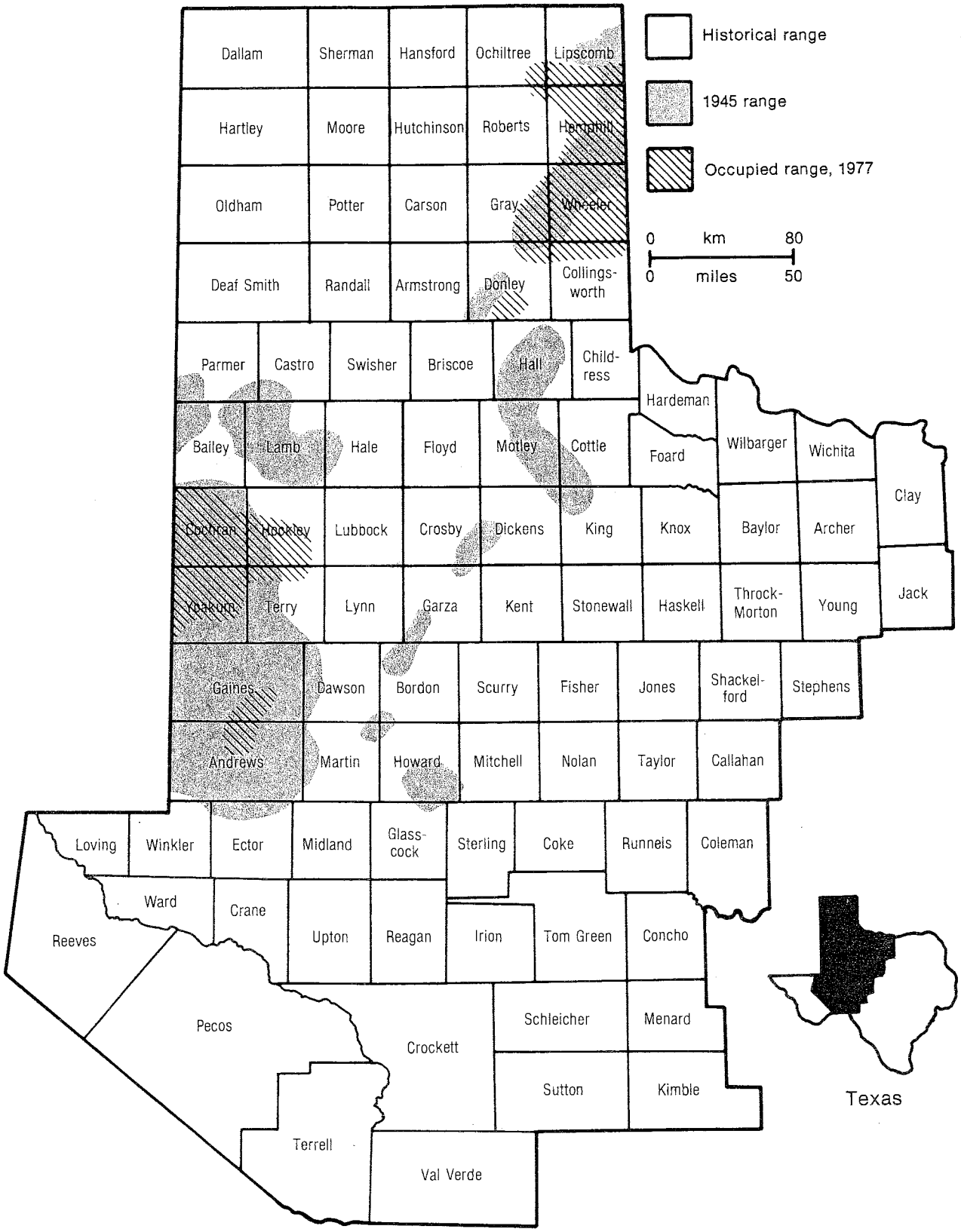

Figure 5.—Past and recent distribution of the lesser prairie chicken in Texas (Litton 1978).

chickens, perhaps indefinitely. Areas (km²) of public land occupied by lesser prairie chickens in 1979 are shown below:

State	Federal	State	Total
Kansas	142.6	33.8	176.4
Colorado	153.6	0	153.6
New Mexico	1,005.1	79.9	1,085.0
Oklahoma	0	37.6	37.6
Texas	0	20.0	20.0
	1,301.3	171.3	1,472.6

There are lesser prairie chickens on the Black Kettle National Grassland in Oklahoma, but this area consists of small tracts interspersed in private land.[9]

HABITAT

General Cover Requirements

Although the original habitat requirements of the lesser prairie chicken are poorly documented, these birds currently depend on mixed grass-dwarf shrub vegetation found on sandier soils (Jones 1963a). Two general habitat types, sometimes interspersed with shortgrass prairie on loamy to clayey soils, are suitable: (1) sand sagebrush (*Artemisia filifolia*)-bluestem (*Andropogon* spp.), and (2) Havard oak-bluestem (Jones 1963b). The sand sagebrush type is predominantly in Colorado, Kansas, and Oklahoma, with some areas in New Mexico and Texas; the Havard oak type is in Oklahoma, Texas, and New Mexico. The distribution of these vegetation types (Kuchler 1964) conforms well with the distribution of lesser prairie chickens in the 1800's (Sharpe 1968).

The sand sagebrush-grassland community occupied by lesser prairie chickens in Colorado is dominated by sand sagebrush, little bluestem (*A. scorparium*), switchgrass (*Panicum virgatum*), sideoats grama (*Bouteloua curtipendula*), and red threeawn (*Aristida longiseta*).[10]

In Kansas, the highest densities of lesser prairie chickens are south of the Arkansas River in sand sagebrush prairies similar to those in southeastern Colorado (Sexson and Horak 1978). A few flocks remain, however, on sand prairies dominated by mid to short grasses.

Copelin (1963) found lesser prairie chickens in western Oklahoma using three vegetation types. The Havard oak type was composed of mid and tall grasses (sand bluestem (*A. hallii*), little bluestem, sand dropseed (*Sporobolus cryptandrus*), and sideoats grama), a variety of forbs, and Havard oak. The sand sagebrush type had mixed grasses, especially buffalograss (*Buchloe dactyloides*), hairy grama (*B. hirsuta*), and blue grama (*B. gracilis*), and dense sand sagebrush. The mixed-grass prairie type was composed of tall, mid, and short grasses, some forbs, and sand sagebrush. Copelin (1963) found that birds used areas of 80%-100% rangeland more than areas with 10%-80% rangeland.

Although there are lesser prairie chickens in a variety of habitat types in New Mexico, they are most abundant in Havard oak and sand sagebrush rangelands (Frary 1956). The Havard oak type dominates southern portions of lesser prairie chicken range in New Mexico; sand sagebrush prevails to the north. Mid and tall grasses, including sand bluestem, big bluestem (*A. gerardi*), little bluestem, yellow Indiangrass (*Sorghastrum nutans*), prairie sandreed (*Calamovilfa longifolia*), and grama grasses, probably dominated the climax vegetation of these areas, with lesser amounts of yucca (*Yucca* spp.), Havard oak, sand sagebrush, mesquite (*Prosopis* spp.), and fragrant sumac (*Rhus aromatica*).

In Texas, the lesser prairie chicken inhabits sand sagebrush and Havard oak grasslands north of the Canadian River and Havard oak to the south and west (Jackson and DeArment 1963). The sagebrush-grassland type is characterized by sand sagebrush, sand chickasaw plum (*Prunus angustifolia watsoni*), and fragrant sumac. Havard oak dominates in the Havard oak association; sand sagebrush and fragrant sumac occur in lesser amounts. The two types have the same grasses: sand bluestem, little bluestem, sand dropseed, and switchgrass. Crawford and Bolen (1976a), working in the Havard oak sandhills of west Texas, considered 23-km² areas with 63%-95% native rangeland and the balance in grain farming better habitat than areas with 100% native rangeland. Areas with less than 63% rangeland appeared incapable of sustaining populations. Crawford and Bolen (1976a) also found that density of lesser prairie chickens was positively correlated with the proportion of an area occupied by deep sand range sites.

Seasonal Variation in Habitat Use

Lesser prairie chickens are associated with various components of their overall habitat depending on phenological changes in the availability of foods and coverts (Jones 1963a) and seasonal weather. Researchers in Oklahoma have analyzed seasonal changes in habitat use with life-form criteria. The single-most important vegetation life form, by covert function and season, as determined for lesser prairie chickens in Oklahoma, is shown below. (Short or dwarf is less than 25 cm tall; mid is 25 to 80 cm tall; tall is more than 80 cm tall. A shrub is a stem branched from the base, more than 80 cm tall; a half-shrub has lower parts lignified, upper parts herbaceous; a tree has a distinct main trunk remaining unbranched in lower parts. Short life forms surrounded by taller life forms were used throughout the year.)

[9]*Personal communication, Bill McCaslan, Oklahoma Department of Wildlife Conservation, Shattuck.*

[10]*Personal communication, Walter Graul, Division of Wildlife, Denver, Colo.*

Function and season	Author	
	Jones (1964a)	Donaldson (1969)
Feeding		
Winter	Tall grass	Short grass
Spring	Dwarf half-shrub	—
Summer	Mid forbs	Short grass
Fall	Mid grass	Short grass
Resting		
Winter	Dwarf half-shrub	Mid grass
Spring	Dwarf half-shrub	Short grass
Summer	Dwarf half-shrub	Dwarf shrub
Fall	Dwarf half-shrub	Mid grass
Roosting		
Winter	Short life forms	Mid grass
Spring	Short life forms	—
Summer	Short life forms	Mid grass, dwarf shrub
Fall	Short life forms	Mid grass
Escape		
Winter	—	Mid grass
Spring	—	—
Summer	—	Tree
Fall	—	—

The differences reported by these authors probably reflect the fact that Jones (1963) was working in a sand sagebrush prairie, whereas Donaldson (1969) combined data from treated (sprayed) and untreated sand sagebrush and Havard oak associations. The data are oversimplified because lesser prairie chickens are associated with several life forms for various activities during all seasons, particularly spring. These birds require a diversity of life forms within their home range.

On a plant community basis in New Mexico, Davis et al. (1979) found that Havard oak-sand bluestem areas with the highest percentage of sand bluestem generally were preferred throughout the year over areas with decreasing percentages of sand bluestem and increasing percentages of Havard oak. However, fall-winter feeding sites were in areas with more Havard oak, probably because of the availability of acorns. Mesquite-shortgrass communities were least preferred throughout the year.

Taylor (1978) and Sell (1979) studied habitat use of lesser prairie chickens on a heavily overgrazed site in the Havard oak sandhills of west Texas. During summer, females were found most often in areas with the highest Havard oak coverage and height and areas with the greatest diversity of forbs and grasses. Although the birds apparently foraged in sandhills with high densities of Havard oak during morning and evening in fall and winter, they preferred Havard oak-sand sagebrush flats and shinnery oak-bluestem communities. Birds avoided mesquite-Havard oak, mesquite-blue grama, and reverted cropland communities or used them incidentally to foraging in a sunflower field.

Taller trees and shrubs, if available, are used for shade during the summer when temperatures approach or exceed 23.6° C (Copelin 1963). Plants used include Havard oak, sand sagebrush, fragrant sumac, and sand chickasaw plum.

Many investigators have documented the use by and importance of crops to lesser prairie chickens during fall and winter. Jones (1964b) found that the birds ate sorghum when available, unless fragrant sumac was amply present. In west Texas, sorghum is an important component of the diet (Crawford and Bolen 1976b), as are sunflowers if available (Taylor and Guthery 1980b).

Foods

The diet of young lesser prairie chickens is 85% (Jones 1963a) to 99% (Davis et al. 1979) insects, mostly grasshoppers (Orthoptera) and beetles (Coleoptera). Broods spend considerable time foraging in plant communities with high percentages of forbs because there are more insects in these areas (Jones 1963a).

Studies conducted in the sand sagebrush grasslands in Oklahoma (Jones 1963a) and the Havard oak-tall grass community in New Mexico (Davis et al. 1979) suggest general similarities in the diet of adult lesser prairie chickens and differences representing adaption to available food supplies. For example, mast and seeds constituted the lowest percentage of the diet in both areas during spring, and animal matter (almost exclusively insects) was over 50% of the summer diet (fig. 6). Data from both studies reveal that dicotyledons contribute the vast majority of plant foods to the lesser prairie chicken diet.

However, foliage constituted about 80% of the spring diet in New Mexico, consisting largely of Havard oak catkins, annual eriogonum (*Eriogonum annuum*) leaves, and broom snakeweed (*Gutierrezia sarothrae*) leaves (Davis et al. 1979). Foliage, mainly of big-headed evax (*Evax prolifera*) and sixweeks fescue (*Festuca octoflora*), constituted only about 50% of the spring diet in Oklahoma (Jones 1963a). Insects were more important in Oklahoma than in New Mexico, although this finding may be an artifact of the two methodologies. Jones analyzed droppings, which yield an upward bias in the proportion of hard foods, such as insect fragments, passing intact through the digestive tract, whereas Davis et al. (1979) analyzed crop contents.

During fall and winter, mast from Havard oak was 39.2% and 69.3%, respectively, of the diet of birds in New Mexico (Davis et al. 1979). However, in Oklahoma, insects were the principal dietary item during fall (Jones 1963a). Foliage, principally leaf and flower buds of fragrant sumac, leaves of sand sagebrush, and leaves of broom snakeweed during snow cover, and annuals such as sixweeks fescue, annual eriogonum, Ivarian violet (*Viola kitaibeliana*), and big-headed evax (when available) were about 70% of the winter diet.

Crawford and Bolen (1976b) found that plant and animal matter comprised 81% and 19%, respectively, of the volume of foods in the fall diet of lesser prairie chickens in west Texas. Grain sorghum, Havard oak (leaves, acorns, and galls), and short-horned grasshoppers together were 70% of the volume.

Water

Lesser prairie chickens drink free water (from stock ponds) during spring (Crawford and Bolen 1973, Sell 1979), summer and fall (Copelin 1963, Jones 1963a, Sell 1979), and early winter (Taylor 1978). That the birds inhabited arid regions prior to development of water supplies indicates they do not require abundant free water (Snyder 1967, Crawford and Bolen 1973).

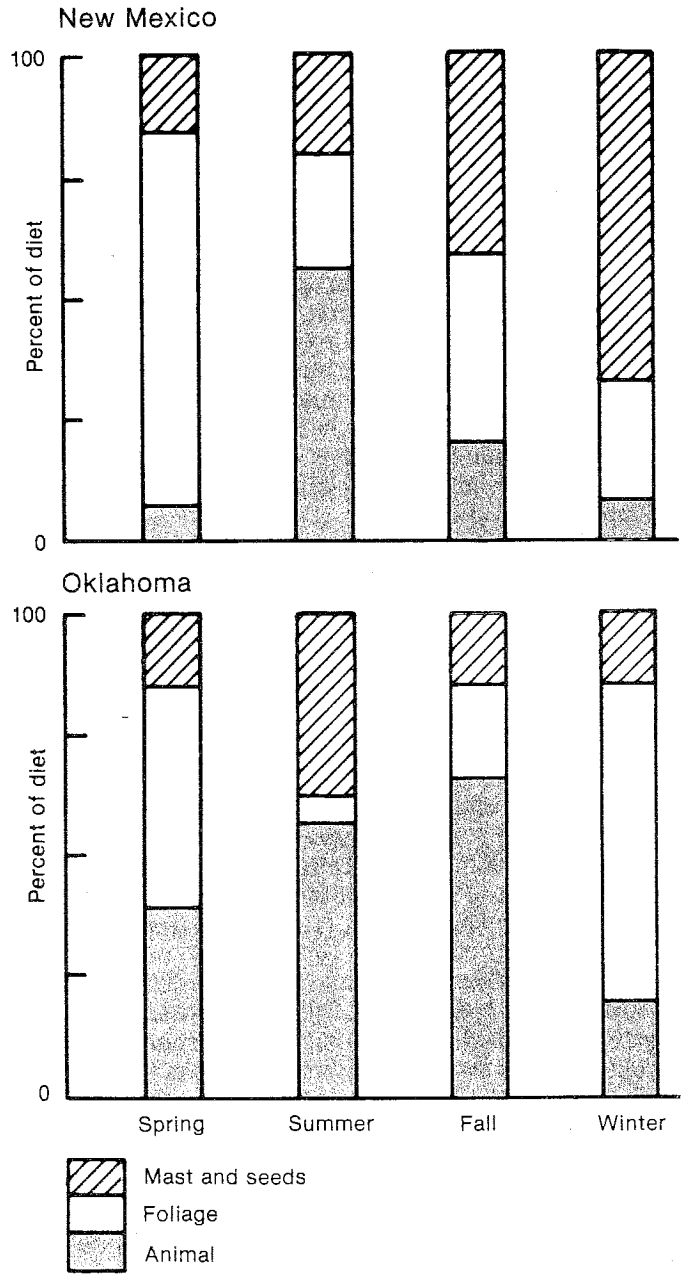

Figure 6.—Relative volumetric proportions of mast and seeds, foliage, and animal matter in the diets of lesser prairie chickens from New Mexico (Davis et al. 1979) and Oklahoma (Jones 1963a).

LIFE HISTORY

Lekking

Lesser prairie chickens congregate on leks (also termed display grounds, arenas, gobbling grounds, and—somewhat erroneously—booming grounds) for courtship displays in spring and fall. Leks are relatively void of vegetation and are usually on ridges where visibility is good (and perhaps where calls can be heard for greater distances). Copelin (1963) found that most leks are in short grass areas on slightly elevated terrain, but some are on flats. In the sand sagebrush vegetation type, display grounds are in valleys on shortgrass meadows if sand sagebrush is tall and dense. Jones (1963a) found leks on ridges where mean height of vegetation was 10.39 cm. Donaldson (1969) found most leks on ridges, but some were in large swales. He found that if the vegetation on leks grows rapidly, the leks are abandoned earlier in the season than leks where growth is slower. Cannon and Knopf (1979) observed leks on small ridges among scattered clumps of little bluestem.

In west Texas, undisturbed leks in native rangelands average more males than do leks subject to human disturbance (Crawford and Bolen 1976c). They found leks on oil well pads, roads, reverted cropland, and cultivated land. Taylor (1980) located 14 leks, separated by an average of 1.2 km to the nearest lek, on a 5,200-ha block of Havard oak rangeland. Two natural leks were on slightly elevated terrain where Havard oak was 10-20 cm tall. The remaining 12 leks were on open areas created by man, including oil well pads, tilled fields, and experimental plots treated with tebuthiuron.

Jones (1964a) found lesser prairie chickens on courtship grounds throughout the year except August and December. During early spring, when chasing is the primary activity, few birds establish regular territories, fighting is irresolute and lasts less than 1 minute, and birds are restless and easily flushed by raptors (often not returning to the lek until the next day). (We have flushed birds during spring trapping up to three times in the same morning with birds returning each time.) Calls are weaker than in late spring, when copulation takes place. As spring progresses, territories become more firmly established, defense of territories increases, and some birds fight continuously during morning. In late spring and early summer, little gobbling or fighting is seen, and the birds spend much time resting and preening.

Donaldson (1969) and Crawford (1974) found the most males on leks in late April and early May. Hens are present from March to May, but most are seen in April, when counts of males are more uniform (Donaldson 1969). The number of males using leks both early and late in the season varies considerably; usually more birds are on leks in mornings than evenings. Activity decreases during late May to mid June.

Fall lek activity begins early in September (possibly late August). Fighting and gobbling usually are of low

intensity at this time (Copelin 1963, Jones 1963a, Donaldson 1969), but occasionally approach the intensity of spring display (Donaldson 1969). In September, young males join adult males on leks, and in October hens appear (Copelin 1963). There are fewer birds on grounds by November, and activity decreases. During fall, territories are smaller, closer together, and more poorly defined than they are in spring (Jones 1964a, Taylor 1978). Birds usually do not return to leks when flushed, suggesting a less intensive drive to display. Daily visits to display grounds cease in late October or November, possibly because of foul weather (Copelin 1963) and, in some areas, to grain crop feeding.

Sharpe (1968) described lesser prairie chicken calls, courtship, and display in much greater detail than presented here. Grange (1940), Hjorth (1970), Robel (1970), Ballard and Robel (1974), and Wiley (1974, 1978) also present related information.

Lesser prairie chicken cocks show high fidelity to leks where they have established territories (Campbell 1972). Of 17 banded males identified two or more seasons, 15 occupied the same territory on leks and two changed locations but remained on the same ground (Copelin 1963). Of 55 leks mapped in 1930, Copelin found 28 in use in 1960, demonstrating the permanency of traditional sites. Many leks, however, were not used in one or more intervening years.

Females and juvenile males probably show less tendency to remain associated with a single lek than do adult males. Greater prairie chicken hens may visit several leks before mating, and if the nests are destroyed, may go to a different lek for remating. Cocks, mostly juveniles, visit different grounds when attempting to establish territories (Robel et al. 1970). We have seen interlek movements by banded juvenile lesser prairie chickens and the relocation of one banded adult male following break up of a lek overgrown with dense vegetation.

Certain factors cause a lek to be abandoned. Use may cease if vegetation becomes too tall or dense (Schwartz 1945, Hamerstrom et al. 1957), presumably interfering with the need to see and be seen during courtship displays. Lesser prairie chickens in Oklahoma have relocated leks to freshly burned sites nearby (Cannon and Knopf 1979).

Nesting and Brooding

Lesser prairie chicken hens frequent leks, where copulation occurs, from mid-March through mid-May (Copelin 1963). Nesting activities peak near mid-May (Snyder 1967).

Hens lay 11-14 grayish-olive or buffy-plain or spotted eggs (41.9 by 32 mm) (Bent 1932) in about 14 days (Snyder 1967) and incubate them about 23 days (Trippensee 1948). Hens renest when the first nest is lost early in incubation or before incubation begins; second nests are seldom begun if the loss is late in incubation (Edminster 1954). The precocial young leave the nest within hours.

Bailey (1928) described the nest as "a slight excavation in the open or among grass or weeds, sparingly or thickly lined, according to abundance of material at hand, with grasses and a few feathers." Copelin (1963) similarly found nests-bowls scratched in the sand, about 10.2 cm deep and 20.3 cm across, lined 3.8 cm deep with Havard oak leaves and grasses. Sell (1979) described nest bowl depth and diameter as 7.2 and 19.0 cm, respectively. Donaldson (1969) noted nests "scooped out" in sand 5 cm deep and 18 cm across, approachable through a west-facing tunnel. Riley (1978) found nests within small depressions, 15 m or less from small hills (1-2 m tall) located to the south, southwest, or west of the nest site. This orientation may have protected hens from high winds.

Bent (1932) found two nests under sand sagebrush in Kansas. Copelin (1958) found three nests situated between clumps of little bluestem, dropseed, and threeawn from the previous year's growth. Later, he found seven nests located between grass clumps, two under sand sagebrush, and one under Russianthistle (*Salsola kali*). No nests were found among shrubs more than 35 cm high. Jones (1963a) found a nest in a half-shrub short grass community consisting of purple threeawn (*A. purpurea*) and sand sagebrush, comprising 55% and 17%, respectively, of total plant cover. Vegetation averaged 45 cm high at nests. Donaldson (1969) found a nest in little bluestem, Scribner's panicum (*P. oligosanthes*), and Havard oak. Vegetation height at the nest ranged from 32-52 cm.

Sell (1979) studied nesting in the Havard oak sandhills of west Texas and found six of eight nests where the topography was relatively flat; Havard oak was lower and less dense and forb and grass frequencies were higher than in the surrounding community. Sand sagebrush overhung five of eight nests, two were in clumps of purple threeawn, and one was in dense Havard oak. He found an increase ($p<0.01$) in sand sagebrush canopy and structural density at nest sites.

Riley (1978) studied the nesting ecology of the lesser prairie chicken in Havard oak-tall grass and mesquite vegetation types in southeastern New Mexico. Of 18 nests, 16 were found in habitats with high canopy coverage by tall, perennial grasses. There was progressively more sand bluestem and total grasses within 90, 9, and 3 m of the nests. Havard oak, total shrubs, and total forbs decreased correspondingly. The average height of plants within 9 m of nests (28.5 cm) was less than ($p<0.10$) the average height of cover directly above nests (60.6 cm). There was a higher percentage of grasses within 3 and 9 m of nests in which young were hatched than near nests in which no young were hatched. Nests were hidden by dry vegetation from the previous year. Some data suggested that dense shrubs may substitute for grasses in providing security for nests.

Comparisons between the data of Sell (1979) and Riley (1978) indicate when tall grasses are less abundant, the lesser prairie chicken becomes more dependent on brush species (particularly sand sagebrush) for nesting. Sell's study area was heavily overgrazed

(unlike Riley's), and most nests were concealed by sand sagebrush.

Lesser prairie chicken broods use portions of available habitat that are in lower seral stages. In Oklahoma, areas for brooding are shrub and half-shrub sites with more forbs than are found in areas used for other activities (Jones 1963b). In west Texas, brood use was highest on areas with the most active sand dunes and the greatest coverage and height of Havard oak (Sell 1979). Broods in New Mexico preferred habitats with a lower percentage of sand bluestem and a higher percentage of Havard oak; the average height of vegetation in foraging sites was 25.3 ± 14.6 cm (Riley 1978). Copelin (1963) found 27 broods in Havard oak motts and one in low Havard, which apparently reflected their need for shade during the summer.

When broods are 8-10 weeks old, the hen leaves them and molts. The broods associate and form early fall flocks; by mid-September they begin visiting leks.

Population Characteristics

Sex Ratios

The presence of slightly more males than females may be normal for lesser prairie chicken populations. Davison (1940) found male:female ratios of 1:0.71, 1:0.68, and 1:0.61 in broods. The sex ratio of hunter-killed birds during 6 years in New Mexico ranged from 1:0.53 to 1:1.25; the ratio for the total sample (1,718 birds) was 1:0.77 (Snyder 1967). Campbell (1972) reported the ratio of 2,447 birds to be 1:0.73. Lee (1950), however, found a 1:1 ratio in 923 birds. The overall ratio for the samples of adult birds reported above is 1:0.78 (56% males, 44% females). It is unknown whether or not males and females are differentially susceptible to harvest. Therefore, the sex ratios reported above for adults may be biased, because they are based on bag checks.

Age Ratios

Juveniles usually outnumber adults in the hunting bag. The adult:juvenile ratio in New Mexico during 6 years ranged between 1:0.60 and 1:2.19 and was 1:1.01 for the sample of 1,718 birds (Snyder 1967). Campbell (1972) and Lee (1950) reported ratios of 1:1.20 and 1:1.14 for 2,447 and 923 birds, respectively. The overall age ratio for the above sample is 1:1.12 (47% adults, 53% juveniles). Again, it is unknown whether or not adults and juveniles are differentially susceptible to harvest; so, it is unknown whether or not the above age ratios represent the population.

Mortality Rates

Campbell (1972) has published the only data on the mortality rates of lesser prairie chickens. His analysis of 285 banded males indicated an annual mortality rate of 65%, which presumably was inflated 5% to 10% by failure to recapture banded birds. The period required for complete population turnover was calculated as 5 years.

The average percentage of juveniles in the fall population approximates the annual mortality rate if the population is stable. Thus, the percentage of juveniles (53) reported earlier for combined age ratio data roughly represents annual mortality. This figure is consistent with Campbell's (1972) analysis when the bias discussed above is taken into consideration.

Densities

Density estimates of lesser prairie chickens invariably have been derived from early morning counts of lekking males and must, therefore, be negatively biased because females are excluded. In Oklahoma, reported densities of males were 16.6-27.9 (Davison 1940), 13.5-16.2 (Jones 1963a), and 1.5-18.3 per section (259 ha) (Copelin 1963). If the combined male:female ratio (1:0.78) reported earlier is unbiased, the above densities can be multiplied by 1.78 to account for females in the population.

Movements and Home Ranges

The yearly home range of lesser prairie chickens during the 1800's apparently was larger than in modern times because of migration. It is impossible to determine the lengths of former migration, but Leopold (1933) considered the yearly cruising radius of prairie chickens to exceed 160 km. Migration of lesser prairie chickens is unknown in modern times, but residents of New Mexico have reported flocks traveling 40 km to grain fields (Frary 1956).

Daily mobility varies by sex, age, and season. Sell (1979) reported average minimum daily movements of 0.16-0.56 km for hens in west Texas during spring and summer. Daily movements gradually decreased from April through September, and the average minimum home range was 41.4 ha. Taylor and Guthery (1980b), working on the same areas as Sell (1979), reported October through February daily movements of 0.39-0.70 km for adult males, 0.50-1.07 km for juvenile males, 0.39-0.69 km for adult females, and 0.27-1.23 km for a single juvenile female. Minimum home ranges during fall and winter were 50-365 ha for adult males, 331-1,945 ha for juvenile males, 62-202 ha for adult females, and 35-495 ha for the juvenile female. During December, a juvenile male moved 12.8 km from the lek where trapped in 5 days or less, coincident with a passing cold front (Taylor and Guthery 1980a). Daily movements and home ranges increased from November through December and decreased from January through February.

Lesser prairie chickens apparently confine most of their activities within a radius of 3-4 km from the leks

they use. In west Texas, eight hens captured on leks moved an average distance of 1.2 km to nest sites (Sell 1979). Taylor and Guthery (1980b) reported over 50% of locations of telemetered birds to be within 1.6 km of the lek where the birds were captured, 90% within 3.2 km, and 97% within 4.8 km. Only during December and January did a juvenile male range further than 4.8 km from the lek. Copelin (1963), similarly, reported 79% of relocations within 3.2 km of the point of capture, 93% within 4.8 km, and 97% within 6.4 km. In New Mexico, the mean distance moved between the lek where a bird was banded and point where it was recovered was 8.8 km for juveniles and 3.4 km for adults (Campbell 1972).

Data on movements and ranges allow inferences on the minimum area required by a lesser prairie chicken population. The lek is the focal point of yearly activity because display grounds are relatively permanent and because territorial males return to the same lek each year. It appears that an area with a radius of 3.2 km centered about a lek (32 km^2) would meet minimum requirements of a lek population because about 90% of yearly activity occurs inside this limit (Taylor and Guthery 1980b). Circular areas of 72 km^2 would contain all activity except for some juvenile movements.

RESEARCH AND MANAGEMENT TECHNIQUES

Sex Determination

Because the plumage of male and female lesser prairie chickens is superficially similar, distinguishing sex of birds is difficult in the field. However, only cocks gobble and strut (females occasionally display weakly). Hence, females can be identified by their relative passivity on leks.

Sex is easily determined if specimens can be examined. Adult males have a supra-ocular comb that is lacking in females and poorly developed in juvenile males; males have black undertail coverts with a white "eye" near the tip of the tail whereas females have brown-barred undertail coverts (Ammann 1944); males have blackish tailfeathers with only the central feathers mottled or barred, whereas females have extensively barred tailfeathers (Copelin 1963); and the neck pinnae of males are 53-74 mm long, whereas the neck pinnae of females are rudimentary (because of molt, this character is not valid in fall) (Bailey 1928, Copelin 1963, Johnsgard 1973). Adult and juvenile cocks usually weigh more than hens (table 1).

Age Determination

Several plumage characteristics allow differentiation between young-of-year and adult lesser prairie chickens (Copelin 1963). The two outer primaries of juveniles have worn and frayed trailing edges whereas the outer primaries of adults lack such wear; the fore edge of the outermost primary of juveniles is spotted to the tip whereas that of adults is spotted only to within 2-3 cm of the tip; the shaft of the outer primary covert is light distally in juveniles whereas it is dark throughout in adults.

Enumeration

The number of males on leks and the number of leks in area may reflect population size (Hoffman 1963), although this has never been documented, and spring counts of gobbling cocks are used to determine trends in lesser prairie chickens populations. Because lekking activity is most intense during April and early May (Donaldson 1969, Crawford 1974), this appears to be the best time to make counts. Counts conducted from dawn to about 2 hours after daylight apparently show exceptional consistency, while afternoon counts are more variable (Davison 1940, Crawford and Bolen 1975). Overcast, rainy, or windy weather may stifle courtship behavior, so counts should be conducted on calm, clear days. In west Texas, we found substantial variation in fall counts of males on leks, suggesting

Table 1.—Mean weights (g) of lesser prairie chickens[1]

	Males				Females			
	Adult		Juvenile		Adult		Juvenile	
Source	n	weights	n	weights	n	weights	n	weights
Frary 1959	1	759	15	715	11	671	12	658
Taylor[2]	9	806	17	736	1	660	9	671
Taylor 1978	9	854	5	812	2	705	2	645
Sell 1979	11	750	10	748	10	740	9	706
Grand mean		789		740		702		674

[1]*Reported mean weights (sample size in parentheses) where sex and age were not determined are 715 g (700) (Lee 1950) and 781 g (5) (Baker 1953) and where age was not determined are 784 g (20) and 763 g (8) for males and 732 g (5) and 749 g (4) for females (Lehman 1941 and Frary 1957, respectively).*

[2]*Unpublished data.*

counts in this season would give imprecise indexes of population size.

Counts of males on gobbling grounds can be used to estimate population size if the proportion of females in the population is known. Moreover, it must be assumed that all males in the population display, or the proportion of nondisplaying males must be known.

Capture

Several techniques have been successfully used to capture lesser prairie chickens. Ligon (1946) used lead traps along feeding routes and Schwilling (1955) modified Ligon's trap for use at water. Copelin (1963) used the Davison[11] drive net when birds were in the shade of Havard oak motts. Mist nets have been used successfully at water troughs during dry springs (Davis et al. 1979) and on leks. In the latter case, three or four nets were arranged in a semicircle on one side of the lek and birds were flushed into them (Campbell 1972). Also, mist nets were successful when positioned on leks between the territories of displaying males in spring (Taylor 1978). Etheridge (1943) caught 104 birds in 3 days using a baited drop net during winter when food was scarce, and Sell (1979) caught hens at water with a drop net. Cannon and rocket nets have been used to capture prairie chickens on leks (Ammann 1957, Taylor 1978).

The relative efficiency of techniques used to capture lesser prairie chickens is largely undocumented. Riley (1978) found hens, which were more difficult to catch than cocks, less wary of cannon nets than of mist nets. Our experience indicates mist nets positioned between territories are considerably less effective than rocket nets when capturing birds on leks during the fall because fighting and chasing are less intense than in spring and the birds generally are more wary. However, Silvy and Robel (1968) had better success capturing greater prairie chickens with mist nets than with cannon nets because of fewer recaptures, greater selectivity for hens, less disturbance, and lower costs. Drop nets probably are the best technique if used over bait or water during nonlekking periods.

Habitat Management

General Principles

The goal of habitat management for lesser prairie chickens should be to maintain sandy rangeland in good to excellent condition with a diversity of plant life forms and with "good" interspersion of taller woody cover and lower successional areas. Achieving this goal is largely a function of grazing management and, in portions of lesser prairie chicken range, selective control of Havard oak.

[11]*Unpublished manuscript, Verne E. Davison, Oklahoma Department of Game and Fish, Oklahoma City.*

Any grazing system which promotes or maintains midsuccessional to climax grasses and which leaves adequate residual cover would benefit lesser prairie chickens. Thus, rotation, deferment, or moderate use of pastures is required.

Havard oak is exceedingly dense on some rangelands occupied by lesser prairie chickens, and the birds may increase with reduction of this plant (Donaldson 1969, Crawford 1974). Once established, the oak competes successfully with herbaceous vegetation and must be controlled to improve growth of grasses and forbs and improve habitat.

Fire and mechanical methods control Havard oak temporarily, but subsequent resprouting forms denser stands than before treatment (McIlvain 1956). Burning may increase production of sand bluestem and switchgrass while decreasing the production of little bluestem. During the year of burning, Havard oak acorns will be eliminated (McIlvain and Armstrong 1966). Frary (1955) believed fire of little benefit to lesser prairie chickens and warned of severe wind erosion following burning.

Foliar and root-absorbed herbicides, when applied properly, may be effective in controlling Havard oak and promoting growth of herbaceous vegetation (McIlvain 1954, Deering 1972, Pettit 1979). By varying the herbicide and its application rate, it is possible to mediate the response of Havard oak, grasses, and forbs.

Control of Havard oak must be done in a way that increases the diversity of habitat types. Control of extensive blocks could be counterproductive. Strip or topographical patterns (control flats and leave Havard oak on sandhills or other areas subject to erosion) offer the greatest potential for improving lesser prairie chicken habitat. Key habitat features, such as Havard oak motts, should be left intact.

Special Techniques

Although several habitat management techniques have been proposed, none has been evaluated. Nonetheless, the following recommendations are based on known ecological requirements of lesser prairie chickens.

Food plots.—Planting grain sorghum within 1.6 km of leks may provide winter food when natural foods are scarce (Jones 1963a, Donaldson 1969, Crawford 1974). However, supplemental feeders and food plots were not used by birds in New Mexico (Snyder 1967). Copelin (1963) found only 1 of 35 food plots used when natural foods were abundant, but all were used when natural foods were scarce. Supplemental foods may be essential following extensive herbicidal treatment of Havard oak because acorn production will be low for about 2 years (McIlvain 1956). The attractiveness of cropland to lesser prairie chickens can be enhanced by minimum tillage (Crawford 1974).

Grazing exclosures.—Grazing exclosures have been proposed to increase residual cover and thereby improve nesting and wintering habitat. Exclosures maintained on the Comanche National Grassland in Colorado averaged 6% more ground cover than grazed areas and resulted in improved nesting cover.[12] Davis et al. (1979) tentatively recommended 64-ha exclosures. Grazing exclosures are an expensive means of habitat improvement, and care must be taken not to create scattered islands of habitat where predation can become serious.

Water development.—Stock tanks may enhance survival of lesser prairie chickens during droughts (Crawford and Bolen 1973).

Lek development.—Clearing traditional display grounds overgrown with vegetation may enhance their value to the birds (Jones 1963a, Donaldson 1969, Taylor 1980). New space for lekking may be beneficial in extensive areas of dense vegetation (Jones 1963a, Crawford and Bolen 1976c, Taylor 1980). Sites should be slightly elevated with short, scattered vegetation (10-20 cm tall), within 3.2 km of suitable nesting and wintering habitat (Taylor 1980), and free of disturbances by man (Crawford and Bolen 1976c). Grounds should be at least 1.2 km away from active leks or use may be minimal (Taylor 1980).

RESEARCH NEEDS

There is much yet to learn about the ecology and management of lesser prairie chickens. Some of our present knowledge is tentative because of small samples and limited geographic or temporal scope. Thus, almost any facet of lesser prairie chicken ecology is worthy of further study. However, the topics enumerated below seem most essential for maintaining, multiplying, or managing the current resource.

Using multiple regression analysis, Crawford and Bolen (1976c) identified percentages of an area in rangeland, minimum tillage agriculture, and deep sand range sites as key habitat features for lesser prairie chickens in west Texas. This type of study needs expansion to include effects due to weather, stocking rates, grazing systems, and brush control practices. Because about 95% of currently occupied lesser prairie chicken range is on private land, it is essential we understand the effects of land use and management on the species. Armed with this knowledge, we can soundly advise individuals or agencies wishing either to increase populations of lesser prairie chickens or to minimize harmful effects of land management.

The above study presumes a high level of accuracy in enumeration of lesser prairie chickens if results are to be valid. However, there is no guarantee that the traditional spring counts of displaying males accurately reflect population size. First, such counts exclude females and, therefore, year-to-year variation in sex ratios renders the counts suspect. Second, we do not know the proportion of males in the population that displays, nor do we know the effects of lek size and density on this proportion. Additional detailed studies of daily and seasonal chronology of lek use would also help refine enumeration techniques.

Probably some areas formerly occupied by lesser prairie chickens provide suitable but unused habitat today. These areas need to be identified and successful transplanting techniques developed and implemented. Specifically, we need to know how many birds of what age and sex to release and what season is best for release. Attempts to re-establish lesser prairie chickens in Texas have failed for unknown reasons.[13]

[12]*Personal communication, Walter Graul, Division of Wildlife, Denver, Colo.*

[13]*Personal communication, Dick DeArment, Texas Parks and Wildlife Department, Wheeler.*

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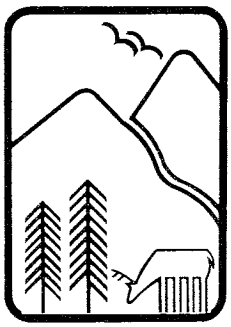
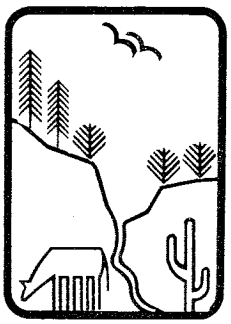
This report assesses past and recent distribution of the lesser prairie chicken; summarizes knowledge of its life history, ecology, and management; and identifies research needs.

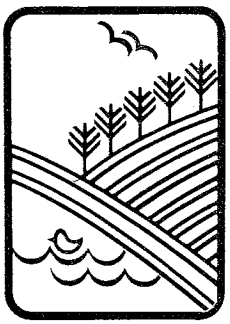
Keywords: *Tympanuchus pallidicinctus*



Rocky Mountains



Southwest



Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Bottineau, North Dakota
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Lubbock, Texas
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526

The status of the Lesser Prairie-chicken as â€˜â€˜warranted but precludedâ€™â€™ for listing as threatened or endangered under the Endangered Species Act (U.S. Department of Interior 2004) warrants a clear concern over this species, and as habitat becomes more fragmented it will be necessary to consider the importance of discrete populations.Â 1980. Status, ecology, and management of the Lesser Prairie-chicken. General Technical Report RM-77. USDA, For Legal Status of the Lesser Prairie-Chicken. William E. Van Pelt. ECOLOGY. Population Dynamics of the Lesser Prairie-Chicken. Edward O. Garton, Christian A. Hagen, Grant M. Beauprez, Sean C. Kyle, James C. Pitman, Doug D. Schoeling, and William E. Van Pelt. Genetic Variation and Population Structure in the Prairie Grouse: Implications for Conservation of the Lesser Prairie-Chicken.Â Since then, he has been associated with numerous research and conservation efforts related to the Lesser Prairie-Chicken, with numerous publications on the ecology and management of the species throughout its range. Clint W. Boal, PhD, is the assistant unit leader of the US Geological Survey, Texas Cooperative Fish and Wildlife Research Unit at Texas Tech University, Lubbock.