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LESSER PRAIRIE CHICKEN DENSITIES ON SHINNERY OAK AND SAND SAGEBRUSH RANGELANDS IN OKLAHOMA[1]

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The contemporary range of the lesser prairie chicken (*Tympanuchus pallidicinctus*) is restricted to scattered tracts of shinnery oak (*Quercus havardii*) or sand sagebrush (*Artemisia filifolia*) rangelands (Taylor and Guthery 1980) in Oklahoma, Kansas, Texas, Colorado, and New Mexico. Uncertainty over optimum or even tolerable limits of shinnery oak and/or sand sagebrush densities in prairie chicken habitats has resulted in conflicting management strategies (Copelin 1963, Jackson and DeArment 1963, Jones 1963, Donaldson 1969). This study was designed to evaluate the effects of habitat composition and land-use practices on lesser prairie chicken populations, as reflected by densities of displaying males.

STUDY AREAS

Eight 4,144-ha study areas were selected in Beaver, Beckham, Ellis, Harper, Roger Mills, Woodward, and Woods counties. Four study areas were shinnery oak rangeland while the remaining 4 were sand sagebrush rangeland. Specific locations of the study areas are available in Cannon (1980).

METHODS

We chose areas containing either relatively low- or high-density lesser prairie chicken populations, with a minimum of 60% of the area being rangeland. Density of displaying males was estimated for each study area during March–May 1978 and 1979. Each area was searched for leks from daylight to 2 hours after sunrise, along east–west transects approximately 0.8 km apart. Calls of displaying males were triangulated to locate leks (Hamerstrom and Hamerstrom 1973). Lek locations were plotted on topographic maps. Beginning 1 April, numbers of males at each lek were counted on at least 3 different days; the last count occurred between 20 April and 10 May.

In March, coverages (%) of grass, brush, forbs, and open ground (bare soil or litter) were measured to the nearest centimeter along 30 20-m transects located on the central 1,036 ha of each study area (Canfield 1941). The frequencies of grass, brush, forbs, and open ground also were determined for 2-m intervals along each transect. An index of residual cover, regardless of life form, was obtained from visual obstruction measurements (to the nearest 5 cm) on a density pole (Robel et al. 1970) at 2-m intervals along each transect. Variability (mean variance) in residual cover was derived from the visual obstruction measurements. The fall–winter agricultural components of each study area were recorded on aerial photographs. The area of each crop was quantified with a Numonics model 1224 electronic digitizer.

Land-use and vegetative parameters were compared to estimated density of displaying males using simple linear

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Table 1. Correlations between density of displaying male lesser prairie chickens and independent variables in shinnery oak and sand sagebrush rangelands.

Variable	Shinnery oak		Sand sagebrush	
	r	$P > r$	r	$P > r$
Brush, %	−0.81	0.02	0.83	<0.01
Grass, %	0.90	<0.01	−0.88	<0.01
Open ground, %	−0.30	0.48	0.83	<0.01
Forbs, %	−0.08	0.95	0.38	0.35
Brush frequency	−0.87	<0.01	0.90	<0.01
Grass frequency	0.70	0.05	0.80	0.02
Open-ground frequency	0.43	0.28	0.51	0.20
Forbs frequency	0.13	0.76	0.06	0.88
Residual cover	0.48	0.23	0.06	0.88
Residual cover variability	0.58	0.13	0.52	0.18

regression techniques. Each year's data were tested separately, and then combined if analysis of covariance failed to reject homogeneity of regression coefficients.

RESULTS

Habitat data for 1978 and 1979 (Cannon 1980) were pooled, as no year differences ($P \geq 0.16$) were found. Analysis of the pooled data for shinnery oak and sand sagebrush rangeland failed to identify vegetative or land-use parameters that could explain the variation in density of displaying males.

Density of displaying males was positively correlated with percent coverage of brush and negatively correlated with percent coverage of grass in sand sagebrush rangeland (Table 1). Density of displaying males in shinnery oak rangeland was negatively correlated with percent coverage of brush and positively correlated with percent coverage of grass. Percent open ground and density of displaying males were positively correlated in sand sagebrush rangeland, but were not correlated in shinnery oak rangeland. Frequency of open ground and density of displaying males were weakly correlated in both rangeland types. Percent open ground increased with percent coverage of brush ($r = 0.72$, $P = 0.05$) in sand sagebrush rangeland, but exhibited no apparent relationship in shinnery oak rangeland ($r = -0.10$, $P = 0.81$).

Brush frequency and density of displaying males were positively correlated in sand sagebrush rangeland and negatively correlated in shinnery oak rangeland. Grass frequency showed opposite relationships with density of displaying males in the 2 rangeland types. Density of displaying males showed no relationship with percent coverage of forbs or with forb frequency. Percent agriculture was not correlated with density of displaying males in sand sagebrush rangelands ($r = 0.07$, $P = 0.87$) or shinnery oak rangelands ($r = -0.40$, $P = 0.32$).

Residual cover and variability in residual cover were not correlated with density of displaying males in sand sagebrush or shinnery oak rangelands. Separate analysis of each year's data also revealed no relationships, except for variability in residual cover in sand sagebrush rangeland in 1978 ($r = 0.97$, $P = 0.03$) and 1979 ($r = 0.93$, $P = 0.07$).

DISCUSSION

Copelin (1963) noted that lesser prairie chickens did not occur in prairie grasslands or in low-density forests, and de-

scribed preferred habitat as low- to high-density shrub savannahs, where shrubs were less than 1 m tall. Donaldson (1969) described lesser prairie chicken habitat as an interspersion of open and partially closed canopy consisting of grass, brush, and forbs, in both shinnery oak and sand sagebrush rangelands. Our analyses indicate that lesser prairie chickens respond to the basic vegetative components of sand sagebrush and shinnery oak rangelands differently, suggesting that management strategies should emphasize brush cover in sand sagebrush rangelands and grass cover in shinnery oak rangelands.

The positive correlation between density of displaying males and sand sagebrush suggests that lesser prairie chickens prefer areas dominated by sand sagebrush. Nesting studies (Jones 1963, Sell 1979) indicate that sand sagebrush provides important nesting and brood-rearing cover, especially where tall grasses have been reduced or eliminated by overgrazing.

Although lesser prairie chickens use dense stands of shinnery oak (Taylor 1978, Sell 1979), our analyses indicate that in this rangeland type lesser prairie chickens prefer areas dominated by perennial mid- and tall-grass species. The positive correlation of density of displaying males with percent grass cover indicates a distinct preference for grasslands by prairie chickens, despite the considerable cover provided by extensive stands of shinnery oak. Taylor and Guthery (1980) noted that in winter, lesser prairie chickens avoided dense stands of shinnery oak, presumably because it represented inferior cover. Nesting studies (Copelin 1963, Riley 1978) also indicate that lesser prairie chickens prefer shinnery oak rangeland habitats dominated by mid- and tall-grass species.

Measurements of residual cover exhibited no relation with density of displaying males in either rangeland type. However, conclusions based on this result may be misleading. In dense stands of shinnery oak, high values for residual cover are countered by the avoidance of this habitat type by lesser prairie chickens (Taylor and Guthery 1980). The positive correlation between density of displaying males and variability in sand sagebrush cover suggests that intermediate values for residual cover in sand sagebrush rangeland may in fact represent an interspersion pattern that lesser prairie chickens prefer.

Percent coverage and frequency of forbs were not correlated ($P \geq 0.35$) with density of displaying males. However, the sampling period (Mar) did not measure warm-season species, which are an important habitat component for lesser prairie chickens (Copelin 1963, Jones 1963). Brood ranges typically consist of lower successional portions of available habitat with a high percentage of forbs (Copelin 1963, Jones 1963, Taylor 1978, Sell 1979) that support an abundant supply of insects.

The initially positive, then increasingly negative, effects of agriculture on lesser prairie chickens are well documented (Copelin 1963, Jackson and DeArment 1963, Crawford and Bolen 1976). Our results indicate that limited agriculture (0–32%) apparently had neither a simple nor singular influence upon density of displaying males in either shinnery oak or sand sagebrush rangelands. Although the presenee of some agriculture on our study areas probably influenced population numbers, we believe this influence was masked by the prairie chickens' sensitivity to changes in rangeland quality.

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RADIO TRANSMITTERS FOR MOURNING DOVES: A COMPARISON OF ATTACHMENT TECHNIQUES

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Numerous attachment techniques have been developed to instrument birds with radio transmitters (Schladweiler and Ball 1968, Werber 1970, Will and Patric 1972). To our knowledge, no large-scale telemetry study has been conducted to evaluate transmitter attachment techniques for mourning doves (*Zenaida macroura*). This report discusses techniques used to attach radio transmitters to captive and wild mourning doves during 1975–79 at the Migratory Bird and Habitat Research Laboratory, Laurel, Maryland, and at the mourning dove field station in McBee, South Carolina, and at its present location in Athens, Georgia.

The objective of our experiments was to develop a transmitter attachment system that would keep transmitters on male and female mourning doves for at least 2 weeks without causing overtly abnormal behavior during the breeding and nesting period.

METHODS AND OBSERVATIONS

Initial tests were conducted in pens on 28 wild-trapped mourning doves, 20 captive-reared ringed turtle doves (*Streptopelia risoria*), and 8 rock doves (*Columba livia*). Tests were conducted during spring and summer. Three major attachment techniques were used: surgical procedures, harnesses, and adhesives. The