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A COMPARATIVE STUDY OF THE HABITATS OF THE

LESSER AND GREATER PRAIRIE CHICKEN

IN OKLAHOMA

Thesis Approved:

Thesis Adviser

Dean of the Graduate School

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A COMPARATIVE STUDY OF THE HABITATS OF THE LESSER AND GREATER PRAIRIE CHICKEN IN OKLAHOMA

By

ROBERT EARL JONES

Bachelor of Science
University of Idaho
Moscow, Idaho
1956

Master of Science
University of Idaho
Moscow, Idaho
1959

Submitted to the Faculty of the Graduate School of
the Oklahoma State University
in partial fulfillment of the requirements
for the degree of
DOCTOR OF PHILOSOPHY
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The scientific names of plants mentioned here were taken from Waterfall (1960). The insect classification follows that of Borror and DeLong (1957). This book was also used as a key for all insect groups.

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* Oklahoma Department of Wildlife Conservation, Oklahoma State University, U. S. Fish and Wildlife Service, and Wildlife Management Institute cooperating.

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ecology of closely related animal species. Since small differences in behavior are more likely to be noted when the animals are being studied concurrently, it was thought desirable to conduct a combined investigation of both species of prairie chicken occurring in Oklahoma.

The lesser prairie chicken /Tympanuchus pallidicinctus (Ridgway)/ is found in the western portion of the state, and the greater prairie chicken /Tympanuchus cupido pinnata (Brewster)/ in the northeastern portion of the state. Appropriately located study areas were established for each species. These were visited upon a half-monthly basis.

Habitat is considered here to be the place where the species population carries out all of its life activities (Stebler, 1957). Within the habitat, there must be segments adequate to meet the birds' need for food, shelter, and reproduction. Habitat may be categorized into the portions used for feeding, resting, and reproduction. Each of these segments may be subdivided further by time, night roosting, and day resting sites or by the use to which it is put, such as the courtship grounds, nesting areas, or brood rearing situations. Combined they provide essential lebensraum.

The classical approach to habitat description is either in very general terms, or through detailed analysis of the presence of plant species. Pitelka (1941), however, was unable to find a constant relationship between specific dominants or groups of dominants and bird species, but did find a consistant relationship between birds and plant life-form. The more detailed analysis is very slow and time consuming, although relationship between plant and animal species can be pointed out. A more rapid and generalizing method of habitat evaluation is obviously needed.

INTRODUCTION

Prairie chickens of North America in the past half century have experienced considerable contraction in their geographical distribution. With the increase of intensive agricultural practices as well as other uses of land, much of their habitat has gradually disappeared. Greenway (1958) has cited both lesser and greater prairie chickens as birds being threatened with extinction.

For both of these species there persists a critical shortage of information pertaining to specific habitat requirements. An approach to the evaluation of habitat requirements is the measurement of the use a species makes of the various components of its environment. Until essential information of this category is available, effective management of any species will be hampered. It is not enough, for example, to recognize that prairie chickens need grasslands. Stands of grass vary in character and those useful or attractive to prairie chickens must be identified specifically. This report summarizes an attempt to define prairie chicken habitat in Oklahoma on the basis of <u>use</u> by these birds. Each of the various components of the habitat have been defined and an attempt to measure these is presented. Such habitat-use information is essential to purposeful and directive management.

MacArthur's (1958) study of five species of warblers, and McCabe and Blanchard's (1950) study of three species of peromyscus have emphasized the desirability of the comparative approach to studying the

The life-form approach, while generalizing, seems specific enough to pinpoint differences in habitat, but is not as time consuming as detailed vegetational surveys (Jones, 1959; Schemnitz, 1961). Elton and Miller (1954) state "Vegetation and life form, provide immediately recognizable features. With this approach, a method of classification can be devised by which the ordinary observer can fairly accurately record the time and place of ecological events without an intimate knowledge of plant ecology and its associated concepts and terms." Both detailed analysis and life-form are considered in this report.

Life-form has been defined by Du Reitz (1931) as a general designation for any classification of plants based upon any point of view other than of ideobiological taxonomy. His main life-form classification is based upon the "general physiognomy of the plants during the height of their annual vegetation-period." The "main life-form system" is divided into three principal categories, namely: woody plants, half-shrubs, and herbs. These are further subdivided according to height of vegetation.

Approximately two years were spent in the field gathering the data upon which this report is based. June to mid-September of 1959 were spent locating promising study sites and perfecting techniques used to measure quantitatively the various components of the habitat. Intensive field work began in February 1960 and continued until September of 1961.

DESCRIPTION OF THE STUDY AREAS

Study areas were located as close as possible to the center of the ranges of the two species of prairie chickens in Oklahoma (Fig. 1). These areas were approximately 250 miles from one another almost on the same degree of latitude. The greater prairie chicken area was situated in what Duck and Fletcher (1943) have called "the tallgrass prairie game type." The lesser prairie chicken study area was within the game type these authors termed "the sand-sagebrush grasslands."

Lesser Prairie Chicken Study Area

The lesser prairie chicken study area selected was the Maple Ranch and a portion of the adjoining Lloyd Barby Ranch in Beaver County, Oklahoma (Fig. 2). This area lies at the edge of the sand dune type of topography that lies north of the Beaver River. Relatively large portions of flat uplands extend into the dune areas. Elevations at the nearest towns range from 2675 feet at Forgan to 2447 feet at Knowles. The surface according to Gould and Lonsdale (1926) slopes approximately 12 1/2 feet per mile to the eastward.

Soils of the study area are for the most part sandy soils found under a mid grass and shrub vegetation. Their surface is undulating and hummocky, occasionally forming active or formerly active dunes. On the higher uplands, the physiography is flatter and a much higher clay content can be noted in the soils. These soils are covered by short

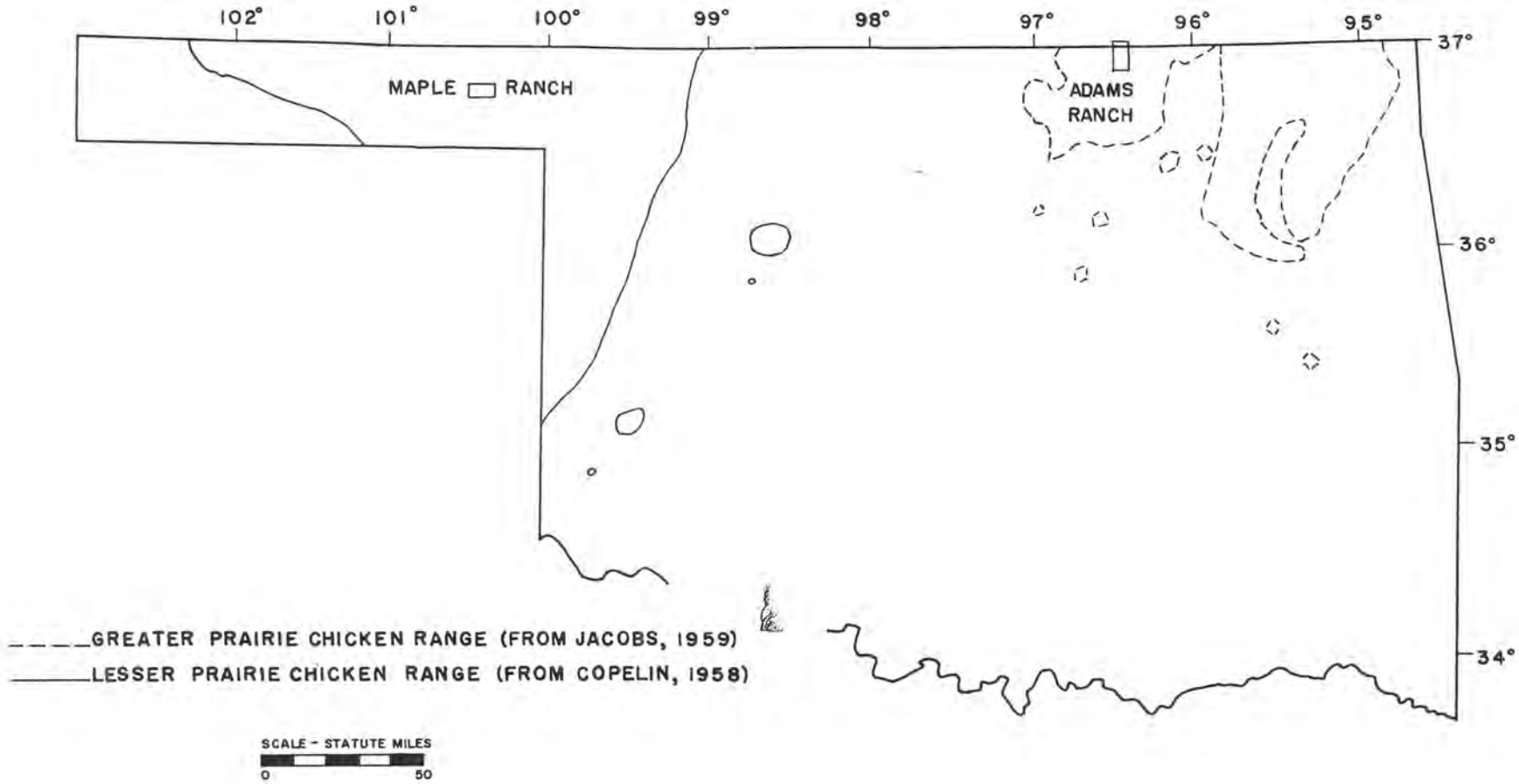

Fig. 1. Location of the study areas and prairie chicken distribution in Oklahoma.

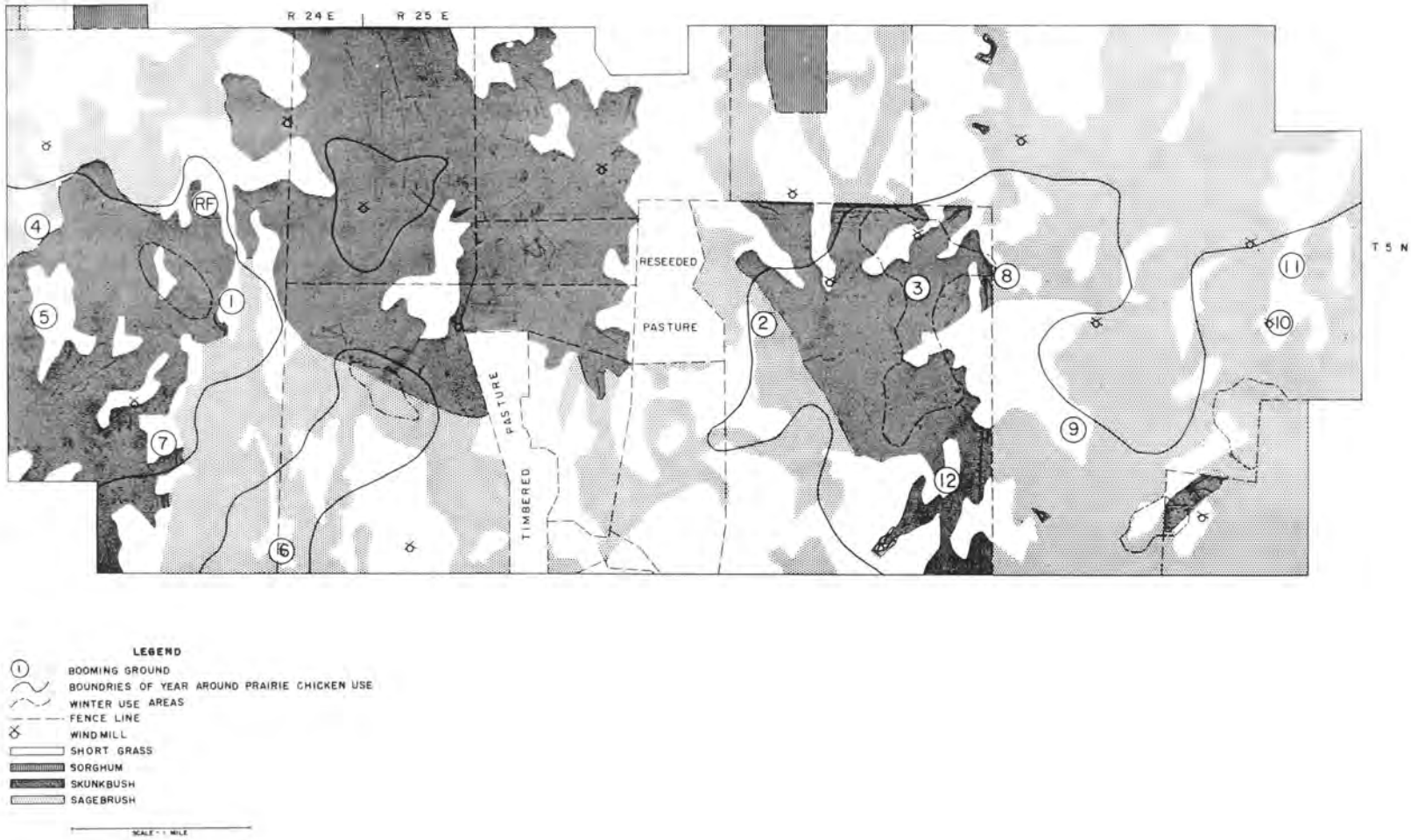

Fig. 2. Lesser prairie chicken study area showing the location and designation of booming grounds and vegetational distribution, Beaver County, Oklahoma.

grasses. The reader interested in the specific description and classification of these soils is referred to Gray and Galloway (1959).

The vegetation on the lesser prairie chicken study area can be broken into two major divisions, namely: plant communities associated with the sandy soils and plant communities associated with the clay upland soils. Sandy soil communities were broken further into three associations, which were separated on the basis of the principal plant life-form. These have been termed the half-shrub, shrub, and mid grass vegetation types. The upland community has been termed the short grass vegetation type.

The principal plant components present in these types have been presented in Table 1. Distinguishing plants of the short grass vegetation were buffalo grass and blue grama. Skunkbush sumac was the characteristic plant of the shrub association. Very little difference existed between the half-shrub and mid grass associations. The half-shrub type was distinguished by the presence of sand sagebrush while a high percent of the mid grass community was composed of side-oats grama, windmill grass, and sand paspalum. While sand dropseed was present in all communities, it was particularly common in the mid grass and half-shrub communities.

Statistical comparisons of height and coverage of these four associations were made by use of the analysis of variance (Snedecor, 1956) with the results following: for height an F value of 18.62** (313 and 3 df)[1] was calculated. When Duncan's Multiple Range test

[1] Throughout this report ** means significant to the 99 % level, * means significant to the 95 % level, and df means degrees of freedom.

Table 1. Random analysis of vegetation present on the Maple-Barby study area by vegetational type. One hundred 2 meter transects taken each season of study, Beaver County, Oklahoma.

Plant Species	Short Grass (48)*		Shrub (20)		Half-shrub (56)		Mid Grass (78)	
	% Occ.	% Comp.	% Occ.	% Comp.	% Occ.	% Comp.	% Occ.	% Comp.
Buchloe dactyloides	91.7	55.02	5	1.02	14.3	2.86	16.7	3.08
Bouteloua gracilis	52.1	16.01	-	-	7.1	2.70	3.8	0.75
Sporobolus cryptandrus	72.9	8.08	95	13.40	94.6	24.71	80.8	22.46
Aristida purpurea	25.0	4.11	5	0.38	7.1	1.55	15.4	2.68
Bouteloua curtipendula	16.7	2.34	10	0.83	19.6	5.26	56.4	18.97
Ipomoea leptophylla	10.4	2.22	5	1.15	7.1	1.92	2.6	0.74
Chloris verticillata	10.4	1.79	15	1.50	21.4	1.65	26.9	5.71
Chrysopsis	8.3	1.69	-	-	-	-	5.1	1.08
Opuntia sp.	10.4	1.57	-	-	-	-	2.6	0.06
Artemisia filifolia	12.5	0.83	55	9.25	89.3	28.08	20.5	2.64
Rhus aromatica	-	-	90	40.38	8.9	0.55	2.6	0.54
Eragrostis trichodes	-	-	35	8.07	16.1	1.26	3.8	1.26
Prunus angustifolia	-	-	15	3.13	-	-	-	-
Ambrosia psilostachya	16.7	0.48	30	3.09	33.9	5.71	48.7	6.26
Bouteloua hirsuta	4.2	0.12	25	2.55	17.9	1.48	43.6	8.66
Paspalum ciliatifolium	2.1	0.15	35	1.98	16.1	1.90	9.0	1.61
Eriogonum annuum	16.7	0.35	35	1.72	35.7	2.12	23.1	1.63
Heterotheca latifolia	-	-	15	1.63	12.5	0.75	2.6	0.20
Gutierrizia sarothrae	4.2	0.44	10	1.40	5.4	2.62	23.1	5.71
Andropogon saccharoides	4.2	0.09	-	-	-	-	3.8	2.56

* Sample size.

(Duncan, 1955) was applied, a definite separation can be made between the shrub mean height of 45.89 cm and short grass mean height of 15.58 cm. The other communities can not be separated from these two on the basis of height, nor can these communities be separated from one another. Mean height of the half-shrub vegetation was 34.30 cm and for mid grass was 28.53. When the analysis of the variance test was applied to plant coverage measures an F value of 26.10** (200 and 3 df) was obtained. Duncan's Multiple Range test pointed out that at the 95 % confidence level, only the shrub type with 80.43 % plant cover could be distinguished from the mid-grass type with a 59.21 % coverage value for all plants encountered. No distinction between short grass with 69.28 % plant coverage and half-shrub with 69.05 % plant coverage could be made.

The Sørensen Index of Floristic Similarity (Hanson and Dahl, 1957) also was applied to the number of species encountered in the various subdivisions of the lesser prairie chicken's habitat (Table 2). In this comparison, a low index value indicated a greater degree of diversity in the plant community and large value a greater degree of similarity in plant species composition. This index does not take into consideration the relative quantities of the respective plant species. From Table 2, we can see the greatest difference in plant composition existed between the short grass and shrub vegetation types and the greatest degree of similarity existed between half-shrub and mid-grass types.

Table 2. Sørensen Index of Floristic Similarity used to compare vegetational sub-units, as broken down by the predominating physiognomic characteristic, comparing habitat units from the greater and lesser prairie chicken study areas.

		Greater Prairie Chicken Vegetation Types					Lesser Prairie Chicken Vegetation Types		
		Mid Grass	Short Grass	Forbs	Cultivated Pasture	All plants of the lesser prairie chicken study area	Half-shrub	Mid Grass	Short Grass
Greater Prairie Chicken Vegetational Types	Tall Grass	78	65.8	61.8	31.3				
	Mid Grass		59.2	41.4	24.1				
	Short Grass			36.1	46.8				
	Forbs				30.4				
Lesser Prairie Chicken Vegetational Types	All plants of the greater prairie chicken study area					27.5			
	Shrub						72.5	59.0	50.7
	Half-shrub							75.0	60.8
	Mid Grass								71.3

The Greater Prairie Chicken Study Area

The greater prairie chicken study area was the K. S. Adams Ranch near Foraker, in Osage County, Oklahoma (Fig. 3). It is located in the northwestern portion of the county, which Gould (1911) has described as being a southern extension of the Flint Hills of Kansas. The rocks outcropping consist of alternating layers of limestones, shales, and sandstones. The elevation of the area reaches 1300 feet, but sharp breaks in the north and east portions of the ranch drop between 300 and 400 feet.

Soils on this study area are mostly of two kinds. There are the deep clay loams which are covered with tall grass vegetation. These soils intergrade into a shallow clay soil with limestone fragments imbedded in the surface or just below. These shallow soils which cover portions of the rolling uplands and escarpments, are covered with short and mid grasses. Gray and Galloway (1959), have classified and described these soils.

Vegetation on the greater prairie chicken study area can be considered into two main divisions excluding the cultivated pastures. These are the tall grass and the short grass associations. A third vegetational grouping, the mid grass association, is intermediate between these two, sometimes showing a greater affinity to the tall grass vegetation and at other times to the short grass association. Korean lespedeza and Bermuda grass have been planted on the cultivated pastures.

The principal components of the various plant communities as recognized are listed in Table 3. The distinguishing plants of the

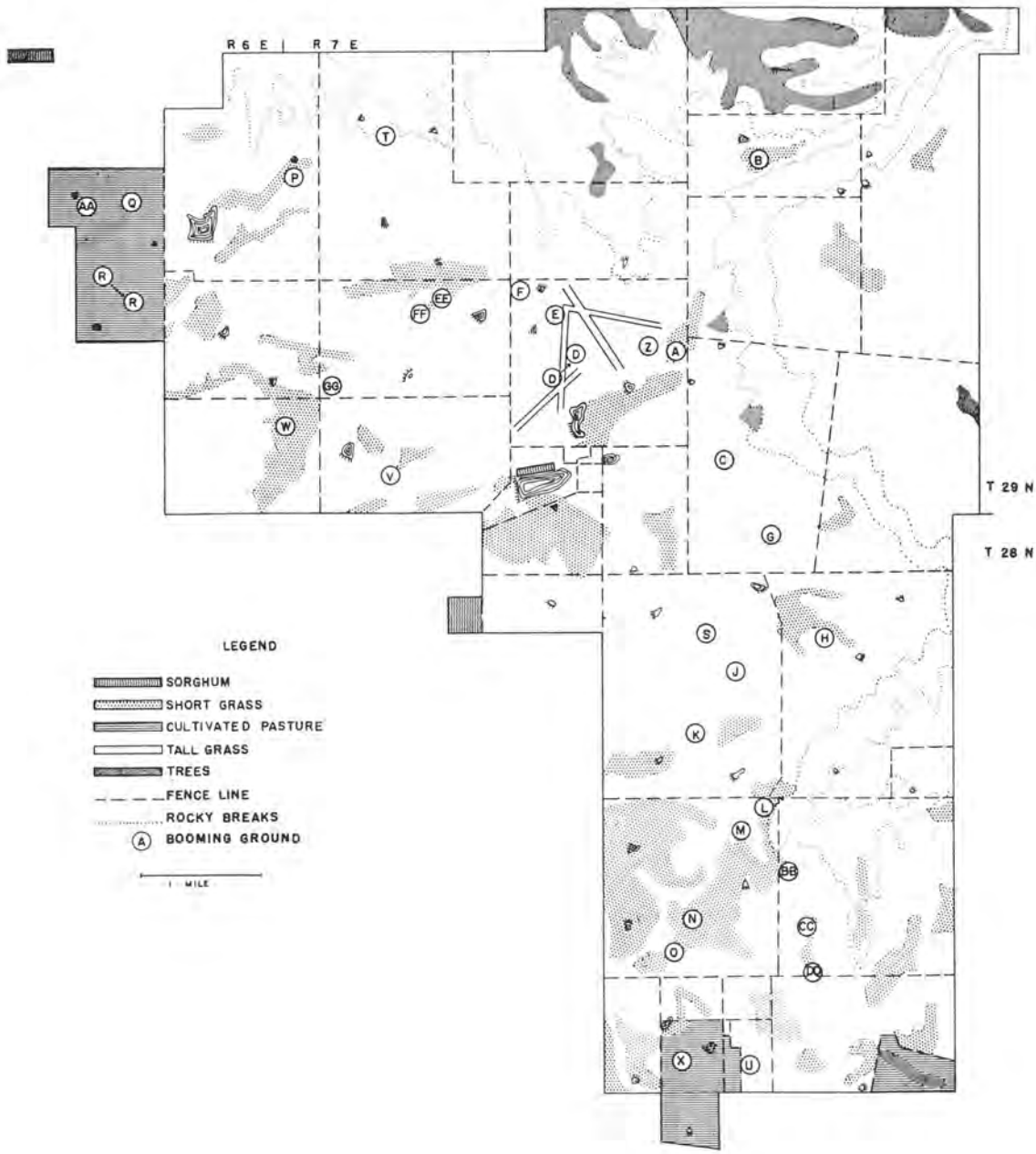

Fig. 3. Greater prairie chicken study area showing the location and designation of booming grounds and vegetational distribution, Osage County, Oklahoma.

Table 3. Random analysis of vegetation present on the Adams Ranch study area by vegetational type. One hundred 2-meter transects taken each season of study, Osage County, Oklahoma.

	Tall Grass (110)*		Mid-grass (50)		Short Grass (26)		Cultivated Pastures (20)	
	% Occ.	% Comp.	% Occ.	% Comp.	% Occ.	% Comp.	% Occ.	% Comp.
Andropogon scoparius	91.8	33.36	24	4.39	15.4	3.63	-	-
Andropogon gerardi	90.0	28.68	36	3.98	11.5	0.66	-	-
Ambrosia psilostachya	72.7	11.24	86	22.34	80.8	16.00	70	9.87
Panicum virgatum	57.3	5.60	32	1.45	11.5	0.53	-	-
Panicum oligosanthes	38.2	2.75	46	3.36	34.6	4.63	-	-
Sporobolus asper	36.4	2.36	56	14.21	50.0	5.25	35	1.32
Psoralea tenuiflora	22.7	2.03	24	2.33	6.7	1.37	-	-
Sorghastrum nutans	31.8	1.50	14	0.97	-	-	-	-
Aster ericoides	23.6	1.47	30	2.65	15.4	1.18	5	0.02
Vernonia baldwini	19.1	1.45	10	0.80	-	-	-	-
Bouteloua gracilis	-	-	42	10.52	53.8	16.34	-	-
Aristida oligantha	2.7	0.52	36	6.02	34.6	5.68	65	2.89
Gutierrezia dracunculoides	14.5	0.69	44	2.83	42.3	2.87	55	6.46
Buchloe dactyloides	7.3	0.50	24	3.35	80.8	20.65	-	-
Andropogon saccharoides	1.8	0.04	24	2.79	34.6	4.55	5	0.05
Juncus interior	27.3	0.69	34	1.98	46.2	4.16	-	-
Lespedeza stipulacea	-	-	2	0.03	-	-	100	59.20
Cynodon dactylon	-	-	-	-	3.8	1.47	65	13.61
Helianthus annuus	-	-	-	-	-	-	15	1.94
Grindelia squarrosa	-	-	-	-	-	-	5	0.85
Solidago sp.	-	-	-	-	3.8	0.05	20	0.80

* Sample size.

tall grass association were big and little bluestem. The mid grass association was dominated by either meadow dropseed or blue grama. This association had the greatest measured amount of western ragweed. The grasses that dominated the short grass vegetation were buffalo and blue grama.

Statistical comparisons of these vegetational units on the basis of height and coverage gave F values of 63.97** (302 and 3 df) for height and 18.45** (205 and 3 df) for cover. When the Duncan Multiple Range test was applied to the mean heights, a definite distinction could be observed between tall grass and both the short grass type and the cultivated pasture (tall grass $\bar{x}$ = 52.14, mid grass $\bar{x}$ = 34.25, short grass $\bar{x}$ = 26.00, and cultivated pasture $\bar{x}$ = 21.98). The Duncan Multiple Range test applied to plant cover produced a distinction at the 95 % confidence level between the cultivated and the three native grass associations. No significant difference was noted between the three native vegetations (tall grass $\bar{x}$ = 80.25, mid grass $\bar{x}$ = 80.15, short grass $\bar{x}$ = 73.79, and cultivated pastures $\bar{x}$ = 98.67). From this we can see that the short grass community can be safely segregated by height from the tall grass community as a separate entity, as can also the cultivated pastures. The mid grass can be separated from none of the other communities.

The Sørensen Index of Floristic Similarity has been calculated for all distinguishable plant communities of the greater prairie chicken study area as well as one which has not heretofore been mentioned. This one termed the forb association, occurred only on severely disturbed sites. A sufficient number of sample transects were not obtained for a

** Significant to the 99 % level.

satisfactory statistical analysis. It has been included here to show the floristic difference between it and the native grass communities. As expected, the tall grass and mid grass types showed the greatest degree of similarity, while the cultivated pastures showed the greatest differentiation. Surprisingly the short grass vegetation showed the greatest floristic similarity to the cultivated pastures. Perhaps this can be explained on the basis of the similar physiognomic level of the two associations.

When the plant species lists of the two study areas were compared, a Sørensen index value of 27.5 was obtained. This indicates very little floristic similarity between the ranges of the lesser prairie chicken and the greater prairie chicken.

The climate of the two study areas has been depicted in the hythergraphs in Figure 4. As can be observed, the greater prairie chicken is more tolerant of high temperatures and precipitation than the lesser prairie chicken. Conversely the lesser seems to get along better in a cooler and drier region.

Rainfall conditions during the study periods have been depicted in Figure 5. Very little annual variation in precipitation was noted for the lesser prairie chicken study area. For the same period, however, rainfall varied as much as 25 inches from year to year on the greater prairie chicken study area.

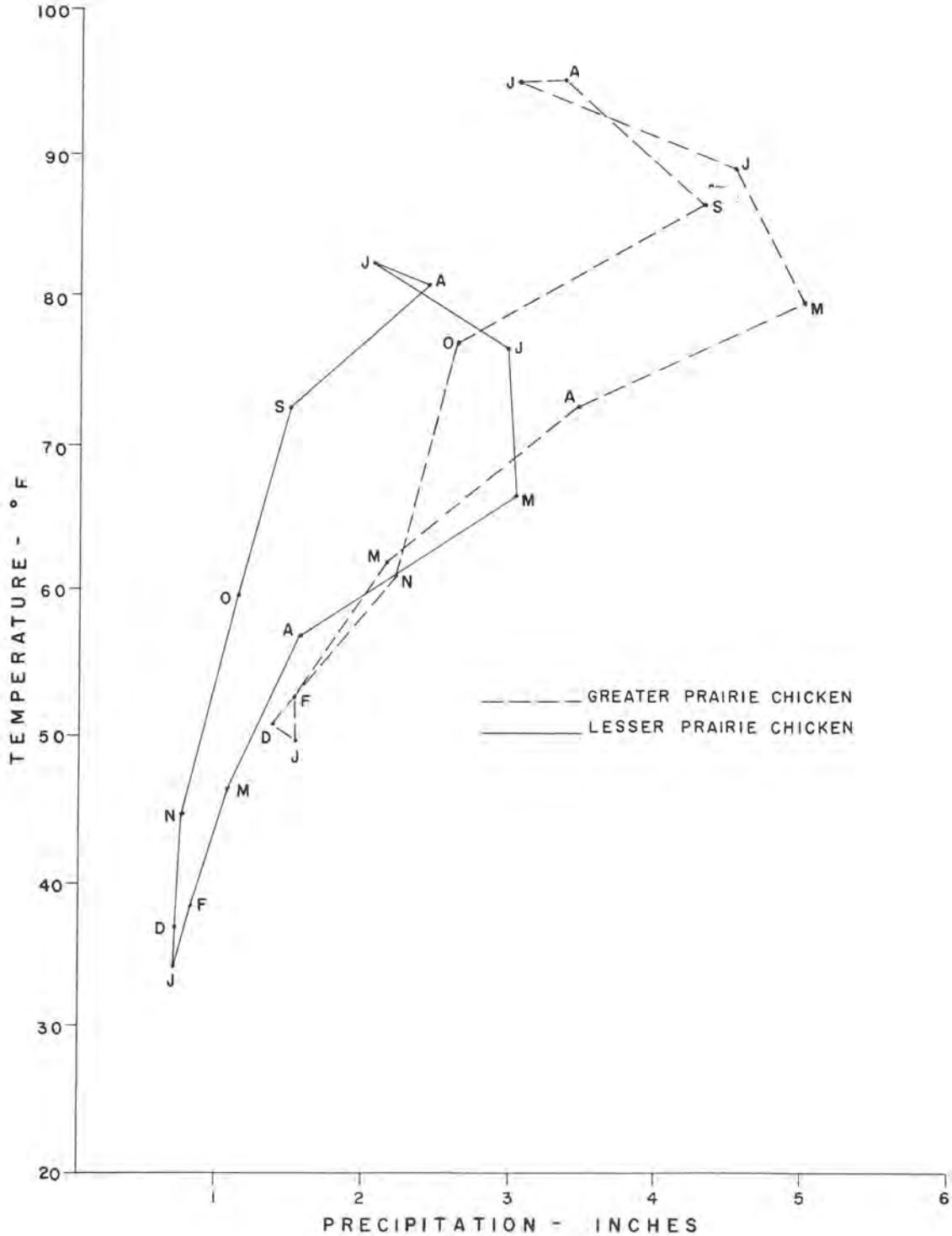

Fig. 4. Hythergraph for Beaver City, Beaver County, and Pawhuska, Osage County, contrasting temperature-precipitation records for Weather Bureau Stations nearest the study areas (Records for 22 years, data adapted from U.S. Dept. Comm., 1955).

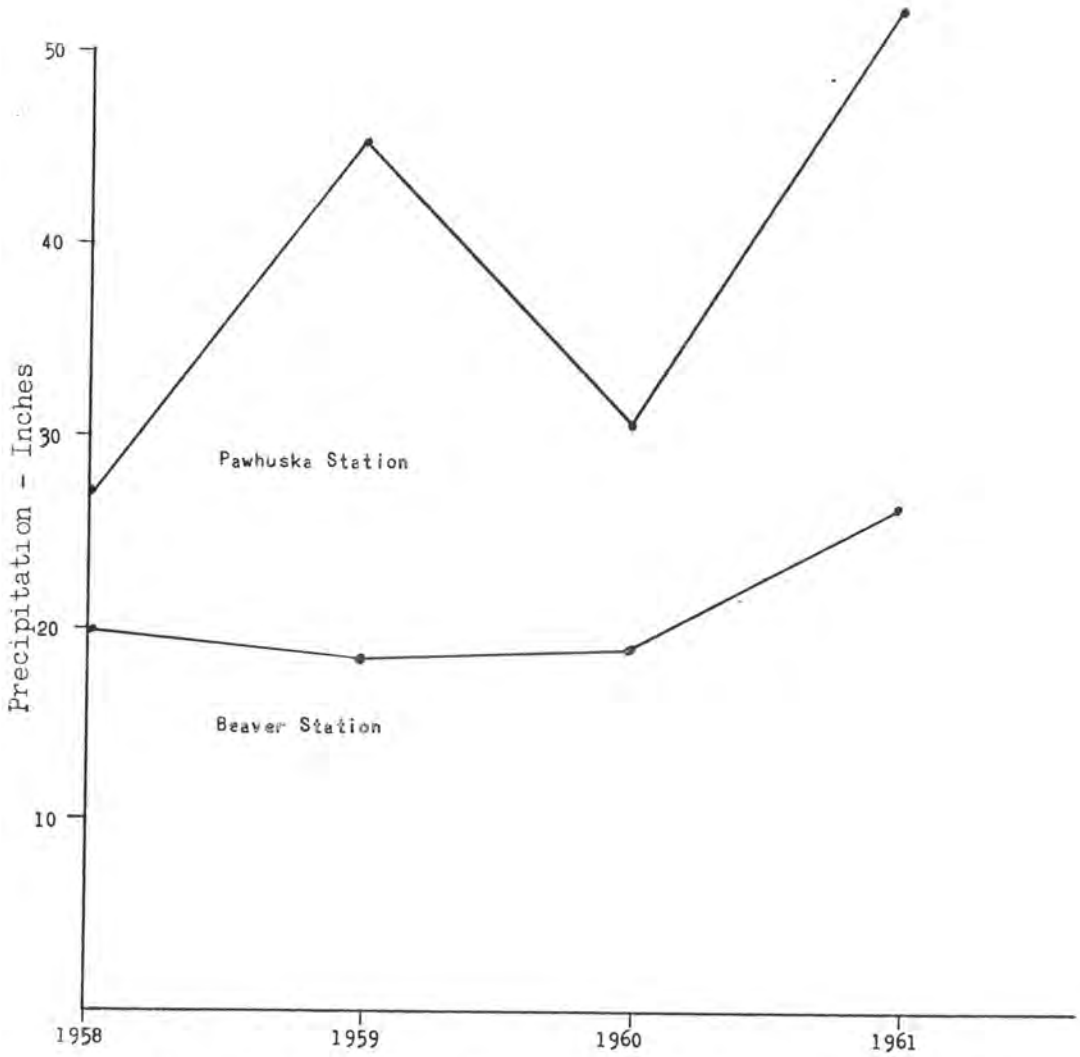

Fig. 5. Annual precipitation at the stations nearest the two study areas during the study period (adapted from U. S. Department of Commerce 1959, 1960, 1961, and 1962).

METHODS

Habitat Analysis

The methodology employed to gather data of habitat-use by prairie chickens consisted of observing the birds carefully under field conditions, flushing the birds from coverts in which they were resting or feeding, and on occasion tracking the birds through sand or snow. Each observation was recorded on a specially designed "key-sort" marginal punch card. The data recorded included the height of the vegetation in which the birds were seen, the life-form, the approximate coverage of the vegetation on the site, and the dispersion of the various plant components. Additional notes were made on such other items as were deemed by the investigator to be of some importance to the problem of habitat definition.

Life-form according to Du Reitz's (1931) system was classified as follows: Trees were any woody plants with a distinct main trunk remaining unbranched in its lower parts. Shrubs were woody plants higher than 80 cm and not developing a distinct main trunk, with the stem branched from its basal parts above or below the soil surface. Dwarf shrubs were woody plants less than 80 cm in height and conforming to the shrub description. Half-shrubs have only the lower parts of the stem lignified and perennial; the upper parts are annual and herbaceous. Half-shrubs were those more than 80 cm in height, and the dwarf half-shrubs which were less than 80 cm in height. Herbaceous growth on the

each vegetal type to that used by the prairie chicken for each of its life activities. Height measurements were taken at 300 random points at the same time. These measurements were made in July and August of 1960 and 1961, as near the height of the growing season as possible.

Food-use Analysis

Droppings were collected from both study areas throughout the two-year period of this study. An attempt was made to collect approximately 100 for each month in the year for each species of prairie chicken. A total of 1129 lesser prairie chicken droppings and 990 greater prairie chicken droppings was analyzed for this report. The analysis used was that of Korschgen (1952) modified as follows: The materials were first cleaned of foreign materials that had adhered to the dropping when collected (leaves, sticks, and sand). The dropping was then placed in a petri dish and soaked in a small quantity of water. After thorough softening, the dropping was separated with forceps and dissecting needle. Many items can be identified on sight, but some materials, such as leaves and insect wings, must be spread out and then usually can be identified. If the materials were dry this would not be possible. Both number of items per dropping and approximate volume were recorded.

The identification of plant leaves, buds, and stems was aided materially by comparison with collections of mounted plants from the study area. Seeds were compared with those in the Oklahoma Cooperative Wildlife Research Unit collection. Insects collected in the field were mounted to facilitate later identification of insect residues in the droppings.

study areas was divided into tall grasses or tall forbs, more than 80 cm in height; mid grasses or mid forbs, between 80 and 25 cm; and short grasses or short forbs, which were shorter than 25 cm.

Plants may be dispersed either evenly or they may be aggregated. The following categories were used as a basis for classifying plant dispersion: even, clumped, bunched, scattered, and rowed. The spatial distribution of the major plants has been pointed out by Emlen (1956) as an important feature of habitat for birds.

Visual estimates of the coverage of the major plant life-form category were made at each flush point. Estimates were also made of associated cover which might have been important to the birds. Brown (1954) has stated that plant "cover can be thought of as the vertical projection of the above-ground parts onto the ground."

When birds were flushed from an exact location which could be ascertained by the presence of droppings, another series of measurements were taken. A two-meter line transect was placed across the location and measurements of the plants intercepted were made. Specifications outlined by Anderson (1942) were followed. Bauer (1943) in comparing transects with quadrat sampling found ". . . the transect sample appears to have a slight advantage when percentages are based on cover." Height measurements were taken at the exact flush point and at points one meter on each side of this, at each end of the two-meter transect. Similar measurements were taken at night roost sites and nest location as well as at the flush points.

A series of 200 random two-meter line transects was measured on each study area for the purpose of comparing the average vegetation in

Insect availability in contrast to the availability of plant foods generally has received little attention by food habits investigators. An attempt to apply Hungerford's food index to this problem was made. The data gathered at the site were compared by using the frequency occurrence of the food item in the availability sample and this was related to percent utilization as determined by identification of insect remnants in the dropping samples.

A series of ten 0.1 square-meter plots was employed to determine the availability of food plants to the prairie chickens. A line of plots was set out at one-meter intervals at each flush point where dropping collections were made. On each line of plots, plant occurrence in each plot was recorded on special forms. Presence by plot then was easily converted to percentage occurrence of the plant species at the particular flush point. Availability of the important foods by seasonal periods has been calculated and appears in column 3 of each monthly food use table (Appendices A and B).

Insect collections were made at each flush point at which droppings were gathered during the months of March through November. These were made by 30 sweeps through vegetation with a standard 15-inch diameter sweep net. Sweeping the vegetation as a sampling method gives good indication of the distribution of the more common species (Whittaker, 1952). Limitations of this method of population estimation have been recognized as pointed out by Fenton and Howell (1957) who found certain beetles were not sampled by this method.

Prairie chickens observed feeding did not scratch as domestic fowl do, but fed in the vegetation layer and on those surface insects,

Food Availability

Glading, Biswell, and Smith (1940) formulated a coefficient of "desirability" to express quantitatively the desirability of certain foods to California quail. The calculation of this takes into account the proportion of the food item found in the crop, the percentage of birds using it, and the representation of the plant in the forage composition:

$$\text{Desirability coefficient} = \frac{\text{Percent volume X percent occurrence}}{\text{Percent forage composition}}$$

To correlate results of dropping analysis and the availability of food items the method of Hungerford (1957) was followed. This may be calculated by the following formula:

$$\text{Food Index} = \frac{\text{\% utilization X (100 - \% availability)}}{100}$$

Where percent of utilization equals the frequency occurrence of the various food items in grouse droppings, percent of availability equals the frequency occurrence of the food item at the flush point, and the denomination of 100 appears only for reducing the maximum index value to 100.

It appears that occurrence is a more realistic measure than volume when dealing with droppings (Jensen and Korschgen, 1947 and Swanson, 1940), principally due to the amount of digestion which has taken place. This digestion may be somewhat irregular in nature, and the data may overemphasize unimportant foods and underemphasized highly digestible foods. Swanson (1940) states that "practically anything eaten by these birds will have recognizable remnants in the feces." For this reason the "Food Index" method of evaluating food resources was followed.

RESULTS

Prairie Chicken Populations

Lesser Prairie Chicken. Lesser prairie chicken booming grounds were usually located on relatively high ridges overlooking a considerable area of land. The vegetation generally was short in stature; if tall vegetation was present it was scattered.

A total of 14 booming grounds was located on the lesser prairie chicken study area (Fig. 2). Birds on only five of these grounds were counted both years. Student's t test (Snedecor, 1956) was applied to see if the calculated mean was significantly different between the two years. The t-value ($t = .475$; 6 df) was well below the desired 5 % confidence level, suggesting a rather stable population. When the counts of birds on the grounds which were secured both years are compared (see the last row of figures of Table 4), a definite downward trend can be noted. The average number of birds using all booming grounds does not suggest such a change.

A special attempt was made to count the chickens on all grounds on a particular area two miles square. This size has been recommended by Davison (1940) as the minumum area to be censused as representative of a range. Counts from this area have shown a downward trend which may not be significant for the two census periods (Table 5). These counts were made on lands supporting a greater number of birds than surrounding areas.

presumably large and colorful enough to attract their attention. Sweeping, therefore, was deemed sufficiently accurate for the purposes of this study. The insects collected were counted and identified to sub-family where possible for comparison with insect residues found in the droppings.

Phenological data have been gathered at all times that field work was in progress. Quantitative aspects of these data have been published (Jones, in press). The time of flowering and of fruiting of those plants considered most important was noted for each flush point.

Other Methods

All booming grounds on the study area were located for vegetational analysis as well as to secure an estimate of the number of birds using them. Booming male counts were made following the method as outlined by Amman (1957). Counts were made from either an automobile or from a portable blind placed on the booming ground.

During the month of May in 1961, intensive search was made for nests of both greater and lesser prairie chickens. The method of search used was the rope count as described by Lehmann (1941), modified slightly by tying tin cans to wires at 3-foot intervals. This proved to be an excellent means of nest search for greater prairie chicken nests. With lesser chickens, this practice was less successful.

Brood counts of lesser chickens were obtained for all three years of the investigation (Table 7). A total of 28 broods was observed during this period. The average size of the broods was 5.85 young birds.

Table 6. Average brood size for prairie chickens by month disregarding yearly variations.

	Lesser			Greater		
	Number Broods	Number Young	Average Brood Size	Number Broods	Number Young	Average Brood Size
May	-	-	-	1	10	10.0
June	2	19	9.5	8	40	5.0
July	10	55	5.5	6	45	7.5
August	16	91	5.5	23	130	5.7

Table 7. Brood counts of the two species of prairie chickens made during the summer months of 1959, 1960, and 1961.

	Lesser				Greater			
	1959	1960	1961	Total	1959	1960	1961	Total
Number Broods	15	8	5	28	14	11	13	36
Number Young	74	50	41	165	102	44	79	225
Average	4.93	6.25	8.20	5.85	7.29	4.00	6.08	6.25

Booming ground counts for lesser chickens during the fall season revealed an upward trend in population numbers during the 1960 reproductive season. One fact that should be pointed out was the striking increase in bird numbers on the larger booming grounds, for example, booming grounds 1, 5, 7, and 8. On other grounds, the number of birds either remained the same or decreased.

All broods observed were counted, and tallies of complete broods counted are presented in Tables 6 and 7. Broods of lessers observed in June were quite large, averaging 9.5 young per brood, while in July and August broods were smaller. At that time the broods averaged 5.5 young per brood.

Table 4. Maximum numbers of male lesser prairie chickens on booming grounds observed on the Maple Ranch-Barby Ranch study area during the spring 1960, fall 1960, and spring 1961.

Booming Ground Identification	Spring 1960	Fall 1960	Spring 1961
R. F.	7	6	0
1	29	54	23
2	18	10	13
3	14	3	8
4	12	12	-
5	13	19	8
6	5	0	-
7	12	17	-
8		49	15
9			23
10			15
11			16
12			3
13			19
Total	110	170	150
Average number/ground	13.8	18.9	13.6
Average number when considering grounds counted both springs	16.2		10.4

Table 5. Four square-mile spring census counts for both species of prairie chickens.

	Lesser		Greater	
	1960	1961	1960	1961
Total	65	54	74	57
Number birds per square mile	16.2	13.5	18.5	14.2

Table 8. Maximum numbers of male greater prairie chickens counted on booming grounds observed on the Adams Ranch during the spring, 1960, fall, 1960 and spring, 1961.

Booming Ground Identification	Spring 1960	Fall 1960	Spring 1961
A	33	18	16
B	17	0	12
C	13	4	8
D	11	1	14
E	7	-	0
F	4	-	0
G	3	1	8
H	9	-	9
J	17	8	17
K	21	5	14
L	4	-	2
M	12	-	19
N	7	-	11
O	1	-	0
P	9	7	5
Q	9	5	8
R	4	-	13
S			16
T			14
U			16
V			19
W			26
X			6
Y			8
Z			11
AA			10
BB			2
CC			12
DD			4
EE			4
FF			10
GG			3
Total	181	49	317
Average number/ground	10.6	5.4	9.9
Average number when considering grounds counted both springs	10.6		9.8

Greater Prairie Chickens. Census methods used for ascertaining the populations of the greater prairie chickens were identical to those employed for the lesser prairie chicken. A total of 32 booming grounds was observed during the study period, of which 18 were counted both years of the investigation (Fig. 3). The average number of booming birds per ground revealed a slight decrease in total number of males on the grounds (Table 8). A t value computed for grounds checked both years ($t = 1.843$; 16 df), indicated that this difference would be significant only if we accept a 90 % confidence level; it is not significant at the 95 % level.

The number of males per square mile as determined by counting all booming males in an area four miles square again pointed out a slight decrease through the two year period (Table 5). From a high of 18.5 males in 1960, number of males per square mile dropped to 14.2 males in 1961.

Brood counts (Table 6) revealed a more gradual reduction in average brood size during the summer period than was noted for the lesser prairie chicken. In May, the average number of young per brood was ten birds. This was reduced to 7.5 in July and to 5.7 in August. The June counts were lower than either the July or August counts. A larger number of brood counts would probably have shown a progressive decrease in brood size.

Fall booming ground counts were not successful in showing the status of the population for greater prairie chickens. The average number of booming birds dropped to 5.4 males per ground during the fall period. It was possible that the fall peak in numbers in this area was missed.

grazed tall grass area for a more southern area in Oklahoma. His data points out several facets that have not been covered in the present report, for example his data are concerned with the germination of seedlings of the principal components of the association studied. These may be important to the birds nutritionally.

The phenological development of a group of the important native food plants discussed in this report for the lesser prairie chicken study area is depicted in Figure 6. This information was gathered through general observations at flush points of the birds, and through the measurement of 20 one-square-meter plots set out at random in the two main vegetative units. Dates of flowering were over-looked for some plant species, but flowers appear little used by the birds.

The phenologic changes of important food plants are shown in Figure 7, for the greater prairie chicken study area. This information was secured in a manner similar to that for the lesser prairie chicken study area. The cultivated plant, Korean lespedeza, is considered with the native species in this case because of its importance to the greater prairie chicken on this particular study area.

Winter Habitat Use. Early in the winter waste grains and weed seeds are abundant and taken in large quantities by the greater prairie chicken. These foods continue to be important through the entire winter to these birds. The lessers find the buds of skunkbush sumac and small green annuals to be the most prominent food items available. A general and gradual decrease in amount of perennial plant cover is noted. Very few insects are available to the birds during these months.

Yearly comparisons of brood numbers for the three summers of investigation (Table 7) show a decrease in brood size during the summer of 1960. The average brood size for the three investigational seasons was 6.25 young from an observed total of 36 broods.

Prairie Chicken Habitat

Grassland is of vital importance to prairie chickens, the keystone in their ecology. Hamerstrom et al. (1957) have stated that "such qualities as height and density of grass, and the land-use practices in which it is involved, seem clearly to be more important to the prairie chickens than species composition."

The recognition that prairie chickens need grass is not enough. Ways must be found of stating that prairie chickens need grass of a certain density, height, and character for their principal vital activities. It must be recognized that through the year there will be changes in these features within the plant communities and that changes in use by chickens may follow these events very closely.

Plant Phenology. One of the factors governing the use of various segments of the prairie chickens' habitat during any particular period of time is the phenology of the plant species present. The presence of green leafy material, seeds, and the associated insects varies through the year. These variations in turn affect the use of areas for foraging by the birds. Plants which provide cover in the summer, when green foliage is present, may have no cover value at all during the winter. The quantitative aspect of a study of this nature for the greater prairie chicken study area has been reported earlier (Jones, in press). Ahshapanek (1962) has very thoroughly discussed the phenology of a non-

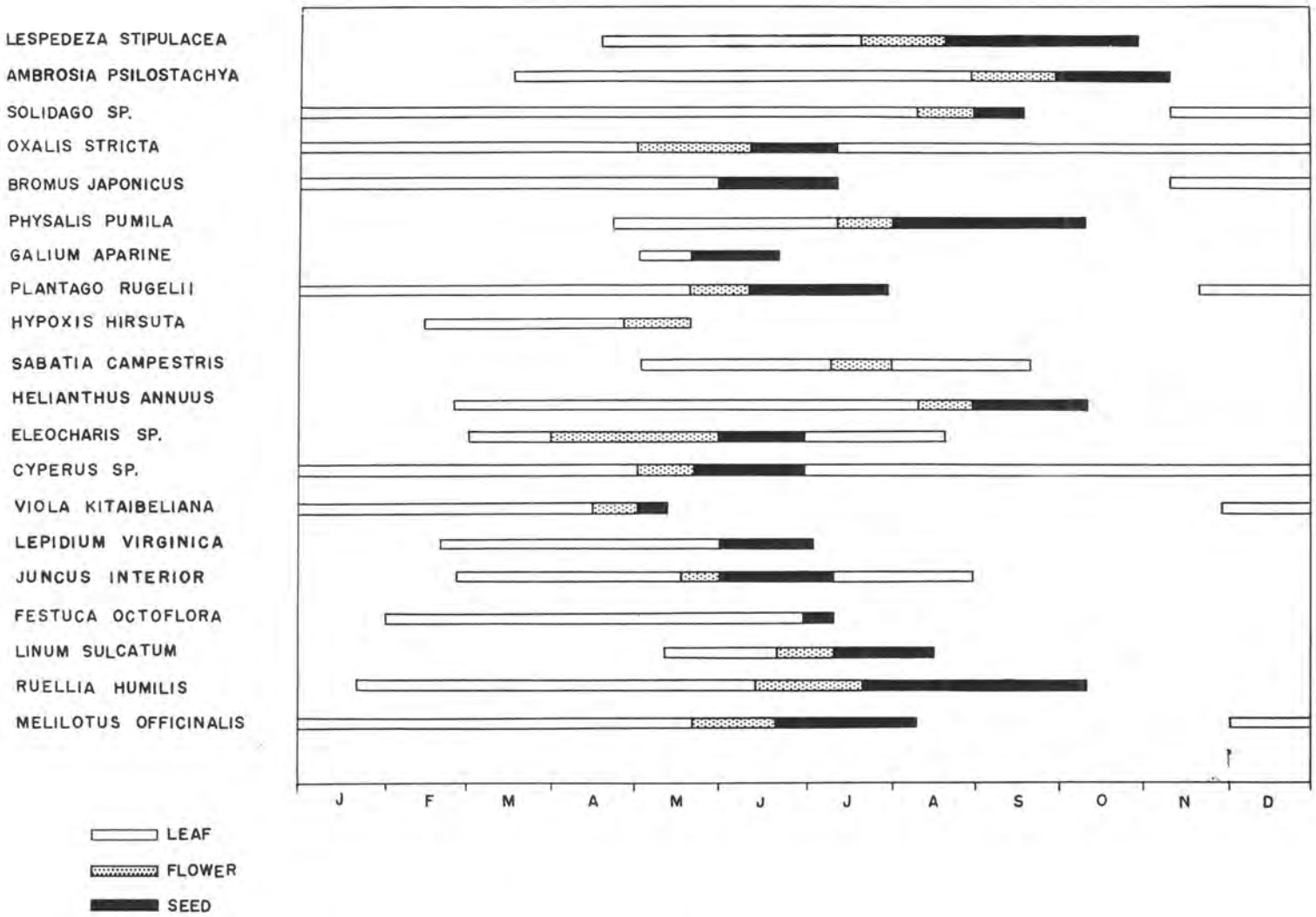

Fig. 7. Phenology of important plant foods of the greater prairie chicken on the Adams Ranch, Osage County, Oklahoma for the years 1960 and 1961.

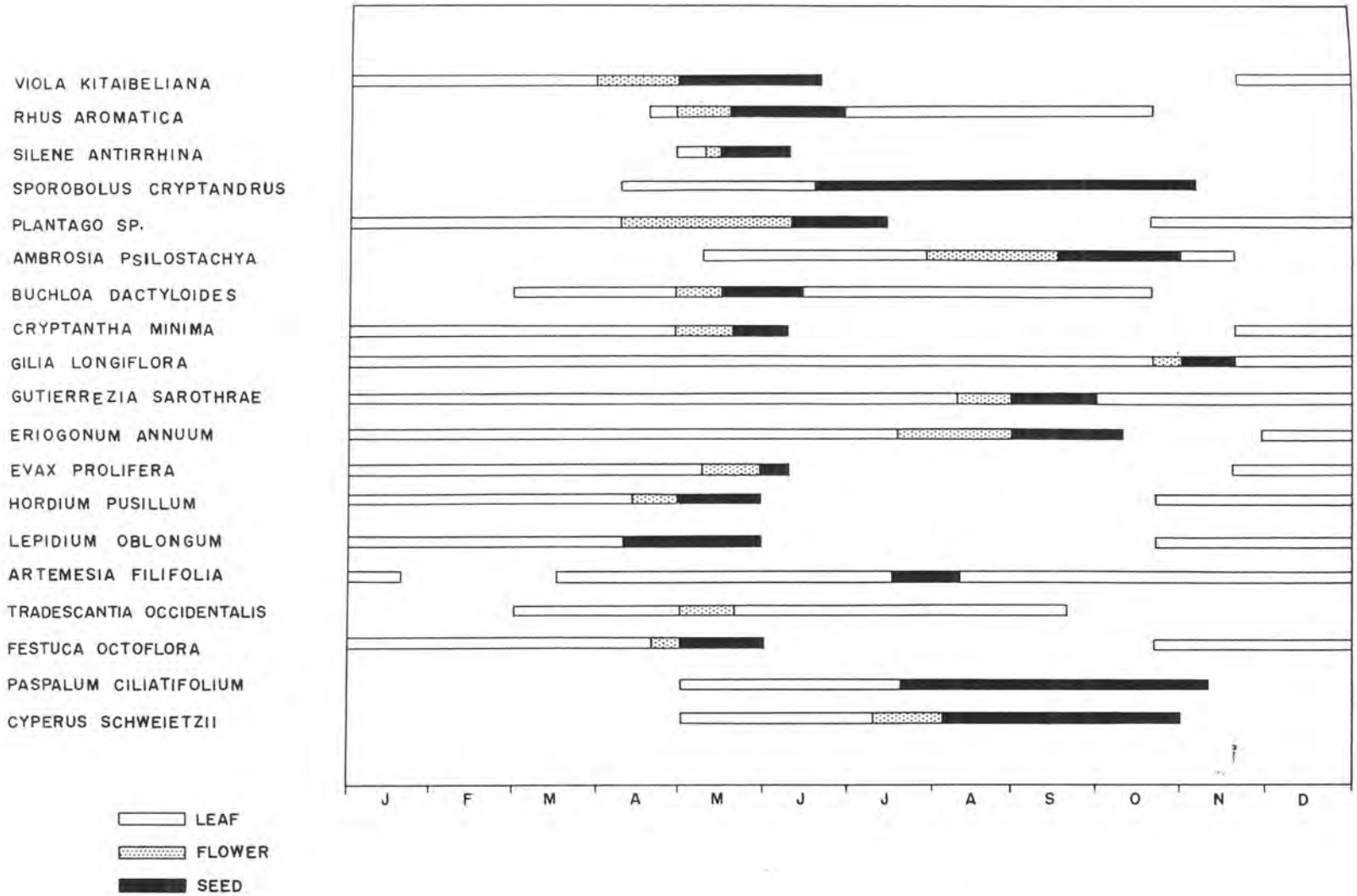

Fig. 6. Phenology of important plant foods of the lesser prairie chicken on the Maple Ranch, Beaver County, Oklahoma, for the years 1960 and 1961.

Table 9. Lesser prairie chicken food-use expressed in percent volume and food index for the birds using the half-shrub and shrub units during the winter period, Beaver County, Oklahoma, 1960-61.

Food Items	Percent Volume			Food Index			
	Dec.	Jan.	Feb.	Dec.	Jan.	Feb.	Avg.
Half-shrub unit							
Coleoptera	0.39	0.81	0.32	-	-	-	-
Orthoptera	3.89	1.09	0.46	-	-	-	-
Hymenoptera	0.42	-	-	-	-	-	-
Immature Insects	2.73	2.67	2.40	-	-	-	-
Festuca octoflora	2.86	3.75	0.60	17.4	18.4	5.2	13.7
Sorghum vulgare	6.75	2.57	-	-	-	-	-
Eriogonum annuum	2.82	4.14	0.53	20.2	42.2	16.2	26.2
Artemisia filifolia	1.64	1.03	1.00	33.7	31.2	18.9	27.9
Viola kitaibeliana	0.52	1.73	-	7.0	35.5	-	14.2
Evax prolifera	-	0.75	2.20	-	6.7	18.4	8.4
Bouteloua gracilis	0.16	0.96	0.13	-	-	-	-
Gutierrezia sarothrae	1.77	0.26	-	30.1	7.1	-	12.4
Rhus aromatica	-	-	3.79	-	-	-	-
Draba reptans	-	-	1.40	-	-	-	-
Shrub unit							
Coleoptera	0.77	1.15	0.29	-	-	-	-
Orthoptera	1.63	0.10	0.06	-	-	-	-
Hymenoptera	0.13	-	-	-	-	-	-
Immature Insects	0.60	1.00	2.20	-	-	-	-
Festuca octoflora	1.09	6.55	1.95	10.7	29.0	14.6	18.1
Eriogonum annuum	1.08	6.56	1.82	8.7	39.8	22.0	23.5
Gutierrezia sarothrae	3.93	0.10	0.29	79.5	-	9.4	29.6
Artemisia filifolia	4.16	1.10	1.10	48.9	32.6	28.9	36.8
Grass	1.08	0.15	0.64	-	-	-	-
Evax prolifera	0.04	0.15	7.12	1.3	8.2	54.4	21.3
Rhus aromatica	0.29	-	10.62	-	-	-	-
Viola kitaibeliana	0.77	1.60	1.54	14.5	29.5	25.5	23.2
Sorghum vulgare	-	-	1.21	-	-	-	-

Food Use. Several methods of evaluating food use were brought into play to evolve a set of use data that would allow the analyses to portray as close to actual use as possible. A total of 310 lesser prairie chicken droppings was analyzed for the period December, January, and February. These droppings were collected in the winter of 1960-1961. The data resulting from examinations are presented by monthly interval in Appendix A (Tables I, II, and XII). A summarization of important foods for this period by percent volume and food index is offered in Table 9. In this table insects are summarized to order only.

For the winter period, the following items were used by the lesser prairie chickens to the greatest extent. Leaf and flower buds of skunkbush sumac, leaves of sand sagebrush, and leaves of broom snakeweed were of greatest importance during the periods snow covered the ground, for example, during parts of December and February. When available the small annual plants; such as, six-week fesque, annual eriogonum, johnny-jump-up, and big-headed evax; were consumed by the birds. Sorghum was eaten in areas where it was available, particularly in the half-shrub vegetation near the food plots established by the Oklahoma Department of Wildlife Conservation and near commercially grown, shocked sorghums. Birds using areas where skunkbush sumac was an important component of the vegetational association did not appear to use sorghum fields to any appreciable extent. Grasshoppers were used by these birds in December, while beetles were used throughout the entire period. Birds in the half-shrub segment of the study area consumed large amounts of insect larvae. The reason for this was the tremendous abundance of phalaneid

Table 10. Plant composition of areas used by the lesser prairie chicken compared with random samples of plant communities on the Maple-Barby study area, for the winter period, comparison based on perennial plants only, 1960 and 1961.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites
	Short Grass	Mid Grass	Shrub	Half-shrub			
Buchloe dactyloides	55.02	3.08	1.02	2.86	-	1.18	6.69
Bouteloua gracilis	16.01	0.75	-	2.70	1.45	-	-
Sporobolus cryptandrus	8.08	22.46	13.40	24.71	9.71	25.14	25.67
Aristida purpurea	4.11	2.68	0.38	1.55	-	2.07	0.29
Bouteloua curtipendula	2.34	18.97	0.83	5.26	12.87	8.66	3.77
Chloris verticillata	1.79	5.71	1.50	1.65	6.11	0.89	2.92
Chrysopsis villosa	1.69	1.08	-	-	0.14	0.26	3.83
Opuntia macrorhiza	1.57	0.06	-	-	-	0.72	-
Artemisia filifolia	0.83	2.64	9.25	28.08	26.88	18.67	6.69
Rhus aromatica	-	0.54	40.38	0.55	-	1.57	-
Eragrostis trichodes	-	1.26	8.07	1.26	-	-	0.46
Prunus angustifolia	-	-	3.13	-	-	-	-
Ambrosia psilostachya	0.48	6.26	3.09	5.71	1.80	8.94	3.72
Bouteloua hirsuta	0.12	8.66	2.55	1.48	1.87	1.31	2.00
Paspalum ciliatifolium	0.15	1.61	1.98	1.90	0.07	0.59	0.29
Gutierrezia sarothrae	0.44	5.71	1.40	2.62	4.73	5.02	2.52
Andropogon saccharoides	0.09	2.56	-	-	-	0.03	0.40

larvae in the short grass type. This vegetation was more closely associated with half-shrub areas than with the shrub areas.

Measurements of the vegetal composition were made at the site from which birds were known to have been feeding. These consisted of measurements of height, plant cover, and life-form. Composition of the various feeding sites is presented in Table 10. This information indicates that most of the birds were feeding in what has been termed the mid-grass association. The measurements in this table point out that the birds did not always choose to feed in stands of mid grasses, but that some birds fed in sand sagebrush or short grasses.

A tabulation of the number of birds observed feeding in particular vegetational life-forms is offered in Table 11. These data emphasize the numbers of birds using sorghum fields (tall grass life-form) in particular. It needs to be pointed out, when considering the larger number of birds using this situation, that these fields were centers where large numbers of birds are gathered. It was considerably easier to see birds in the sorghum fields than it was in the scattered flocks of feeding birds on the native prairies. Food use information gathered from the birds using sorghum fields indicated that these flocks had eaten large amounts of the small annual plant foods before coming to the fields.

These life-form observations also point out another use that was not satisfactorily demonstrated by the use of plant composition measurements. During periods of snow fall, birds were frequently found feeding on skunkbush sumac buds. The life-form records indicate this fact, but plant composition measurements could not be taken when the plant species

were covered with snow. To clarify use of habitat at these times, tracking data were obtained to supplement the preceding information.

During the three periods of snow cover, tracking data for lesser prairie chickens were obtained. The birds were traced from a point where the tracks were encountered to their flush point. All stops made by them were noted, and if possible the purpose of the stop as well (Table 12). The data in Table 13 indicates one food item used by the birds that might otherwise have been overlooked. Leaves of the half-shrub evening primrose were observed to be an extremely important food item, forming 26 % of the total feeding stops. Skunkbush sumac contributed 28 % of the total stops, followed closely by broom snakeweed with 23 %. When the data presented in Table 13 are examined, it is apparent that the plants are used differently by the birds in different parts of the study area. Data from the 10-13 December 1960 period were gathered from the portion of the study area dominated by the shrub life-form. The period 5-8 February 1961 was spent, except for portions of the 6th and 8th, on areas with no skunkbush sumac present. For these areas, the use of the sand sagebrush and broom snakeweed increased markedly.

The lesser prairie chicken used different vegetative societal groupings for feeding and resting (Table 14). These data were consistant through all seasons of the year, with only small variations in use of feeding cover. For feeding, these birds usually selected the bunch grass cover, although they also used scattered and continuous cover. Resting use was even more consistant, with the scattered half-shrub cover being the societal grouping most often used. Large clumps

Table 13. Lesser prairie chicken use separated into resting and feeding stops as observed by snow tracking, Beaver County, Oklahoma, 1960-61.

Plant Species	10-13 Dec. 1960				5-8 Feb. 1961				Total			
	Rest	%	Feed	%	Rest	%	Feed	%	Rest	%	Feed	%
Artemisia filifolia	19	50	2	2	77	85	37	21	96	74	39	13
Gutierrezia sarothrae	8	21	16	13	12	12	54	31	20	15	70	23
Rhus aromatica	9	24	55	44	1	1	31	18	10	8	86	28
Gilia longiflora	1	2	6	5	-	-	1	T	1	1	7	2
Andropogon hallii	1	2	-	-	-	-	-	-	1	1	-	-
Ambrosia psilostachya	-	-	1	1	-	-	-	-	-	-	1	T
Oenothera serrulata	-	-	36	29	-	-	42	24	-	-	78	26
Eriogonum annuum	-	-	3	2	-	-	2	1	-	-	5	2
Sporobolus cryptandrus	-	-	3	2	-	-	2	1	-	-	5	2
Leptoloma cognatum	-	-	2	2	-	-	-	-	-	-	2	1
Chloris verticillata	1	2	1	1	-	-	-	-	1	1	1	T
Haplopappus spinulosis	-	-	1	1	-	-	1	T	-	-	2	1
Prunus angustifolia	-	-	-	-	1	1	-	-	1	1	-	-
Helianthus annuus	-	-	-	-	-	-	1	T	-	-	1	T
Heterotheca latifolia	-	-	-	-	-	-	1	T	-	-	1	T
Bouteloua curtipendula	-	-	-	-	-	-	1	T	-	-	1	T
Eragrostis trichodes	-	-	-	-	-	-	1	T	-	-	1	T
Croton texensis	-	-	-	-	-	-	1	T	-	-	1	T
Eragrostis curtipedicellata	-	-	-	-	-	-	1	T	-	-	1	T

Table 12. Habitat use observed by tracking for periods of snowfall on the lesser prairie chicken study area. The vegetation used during this period as was indicated by number of stops made by the bird, Beaver County, Oklahoma, 1960-61.

Plant Species	Stops 16 Mar. 1960 18 Birds	10-13 Dec. 1960 45 Birds	5-8 Feb. 1961 53 Birds	Total	Percent of Total
Rhus aromatica	83	95	61	239	23
Gutierrezia sarothrae	42	85	138	265	26
Artemisia filifolia	41	61	197	299	29
Ambrosia psilostachya	6	15	5	26	3
Yucca glauca	4	-	-	4	T
Cyperus schweinitzii	1	-	-	1	T
Prunus angustifolia	1	-	2	3	T
Gilia longiflora	-	21	2	23	2
Andropogon hallii	-	1	1	2	T
No cover	9	2	4	15	1
Oenothera serrulata	-	43	58	101	10
Bouteloua curtipendula	-	1	5	6	1
Croton texensis	-	2	1	3	T
Eriogonum annuum	-	6	4	10	1
Sporobolus cryptandrus	-	6	12	18	2
Leptoloma cognatum	-	3	-	3	T
Chrysopsis villosa	-	2	-	2	T
Haplopappus spinulosis	-	1	2	3	T
Helianthus annuus	-	-	2	2	T
Heterotheca latifolia	-	-	3	3	T
Grindelia squarrosa	-	-	1	1	T
Eragrostis trichodes	-	-	3	3	T
Eragrostis curtipedicellata	-	-	1	1	T
Total				1033	

by monthly intervals in Appendix B (Tables XIII, XIV, and XXIV), and they are also summarized as to the more important food items in Table 15.

Two food items, both originating in the cultivated situations, were by far the most important food items during the winter period. These were sorghum and Korean lespedeza. Corn was used by the birds in December, as was wheat from the cultivated pastures of the study area. Pastures over-planted to wheat and rye to provide additional green forage for the cattle during the winter period received intense use by the birds. Japanese brome, an important food material during January, was eaten to some extent throughout the study period. An interesting observation was made in the old field areas on the Adams Ranch. Four birds were flushed from the vicinity of one field several times during the winter period. This field was located approximately 3 1/2 miles from the nearest cultivated field or pasture. Dropping collections made at the flush points of these birds indicated they were subsisting on the leaves of johnny-jump-up and Japanese brome, the seeds of ground cherry, and on grasshoppers. Insect residues were not found in quantities in the droppings, although grasshoppers, beetles, and lepidopterous larvae were eaten when the birds found them. The large proportion of grasshoppers taken by the birds from the cultivated pastures suggested that they were more available in these areas than in the native pastures.

The plant composition of the feeding sites frequented by the birds indicates one comparable to that of the random samples taken in the

comprised the only other stand type used to any extent for resting, and this use was primarily during the summer.

The greater prairie chicken, on the contrary, used continuous plant groupings for feeding to the greatest degree (Table 14). This was consistant throughout the year with changes in feeding area mainly within the continuous vegetation, for example, change from native short grass areas to Bermuda grass pastures. Use of various plant societal groupings for resting was more variable, and the birds selected all

Table 14. Prairie chicken use of the various plant sociological groupings.

Dispersion of Plants	Feeding		Resting	
	Number	Percent	Number	Percent
Lesser Prairie Chicken				
Scattered	27	22.3	115	72.8
Bunched	44	36.4	13	8.2
Large Clumps	16	13.2	28	17.7
Continuous	28	23.1	2	1.1
Rowed	6	5.0	-	-
Greater Prairie Chicken				
Scattered	13	10.2	15	12.5
Bunched	5	3.9	37	30.8
Large clumps	6	4.7	19	15.8
Continuous	88	69.3	48	40.0
Rowed	15	11.8	1	0.8

groupings available for this purpose. Most important for this purpose was the continuous and bunched cover. Usually this cover consisted of tall grasses.

A total of 288 greater prairie chicken droppings, representative of the winter period, was collected and analyzed. These data are presented

cultivated pastures (Table 16). Other relationships are obscured by the procedure of analysis and are more apparent from the life-form data presented below.

Life-form data recorded for feeding birds indicated the sorghum fields to be the main feeding areas, with cultivated pastures following closely in importance (Table 11). The sorghum fields have been classed as tall grasses in the table, and the cultivated pastures either short forbs or short grasses, depending on whether they were dominated by Korean lespedeza or Bermuda grass. During this period, birds also were observed feeding in tree tops on two occasions. On 30 December 1960, thirty-eight birds flew to several hackberry trees to feed on the plentiful berries they offered. The second case was observed during a period of heavy snow, 28 February to 5 March 1960, when groups of five to eight birds were observed feeding on the buds of several elm trees in the yard of the ranch headquarters. Oak mast has also been reported as used by birds in parts of Osage County (Mathews, 1945). That these birds use trees as feeding sites in more northern areas has been brought out by Hamerstrom et al. (1941). Feeding in trees on buds and fruits is probably of greater value to birds located further from cultivated fields than the study area birds.

Night Roosting. Lesser prairie chickens selected for night roosting the half-shrub cover type. Vegetal composition of the night roosts measured during this period is given in Table 10. A total of 76 night roosts was discovered in December, January, and February. Plant height measurements were made above each of these roosts as well as two height measurements at one-meter intervals on either side of the night

Table 15. Greater prairie chicken food use expressed in percent volume and food index for the birds using the native pastures during the winter, K. S. Adams Ranch, Osage County, Oklahoma, 1959-61.

Food Items	Percent Volume			Food Index			
	Dec.	Jan.	Feb.	Dec.	Jan.	Feb.	Avg.
Native Pasture Unit							
Orthoptera	0.69	0.61	2.32	-	-	-	-
Coleoptera	-	-	0.20	-	-	-	-
Lespedeza stipulacea	7.84	3.34	7.94	-	-	-	-
Sorghum vulgare	1.46	33.23	20.25	-	-	-	-
Grass	5.00	3.98	5.51	-	-	-	-
Corn	4.84	0.09	-	-	-	-	-
Melilotus officinalis	0.61	-	-	-	-	-	-
Solanum carolinense	0.76	-	0.11	-	-	-	-
Bromus japonicus	-	8.55	1.17	-	18.6	6.9	12.8
Physalis sp.	-	1.01	0.14	-	-	-	-
Oxalis stricta	-	0.59	-	-	10.4	-	5.2
Cultivated Pasture Unit							
Coleoptera	0.08	-	-	-	-	-	-
Orthoptera	3.12	0.94	2.57	-	-	-	-
Immature Insects	0.02	-	0.06	-	-	-	-
Lespedeza stipulacea	3.80	5.76	4.82	43.5	22.6	5.1	23.7
Sorghum vulgare	10.78	17.85	21.90	-	-	-	-
Grass	7.91	3.74	4.34	-	-	-	-
Corn	1.78	0.28	-	-	-	-	-
Wheat	4.95	-	-	22.4	-	-	7.5
Symphoricarpos orbiculatus	0.93	0.06	-	-	-	-	-
Solanum carolinense	0.60	-	0.76	-	-	-	-
Bromus japonicus	0.89	7.62	1.05	2.2	11.9	4.0	6.0
Physalis sp.	0.18	1.88	0.69	-	-	-	-
Oxalis stricta	0.04	0.51	-	1.1	8.2	-	3.1

roosts. Analysis of the variance of the plant heights at the roost compared with those one meter on each side give an F value of 21.71** (191 and 2 df) for winter roosts without snow cover. Mean height of the vegetation over the roost was 5.72 cm, while the heights one meter away were 21.42 cm and 19.67 cm. Eleven of these were roosts used while snow covered the ground. An F value of 1.15 (30 and 2 df) was obtained for height of vegetation when snow covered the ground. Mean height over the roost was 42.55 and at the one-meter intervals was 40.18 cm and 28.27 cm. Thus it is suggested, that during the periods of snow fall and storm, the birds were using a tall uniform cover for night roosting. Ordinarily they selected an opening in the uniform cover for the exact position of the roost.

When snow fell on the study area and drifted into sizeable drifts, lesser prairie chickens roosted in the snow banks. A similar phenomena has been noted for the greater prairie chicken (Amman, 1957) and sharp-tailed grouse (Baumgartner, 1939). Snow roosting has been used by Seiskari and Koskimies (1956) to show in part the ecological distinctness of two races of capercaillie (Tetrao urogallus L.). In the case of the lesser prairie chicken it perhaps suggests the closeness of its relationship to the greater.

The greater prairie chicken selected as its winter night roost the tall grass and mid grass vegetation. Plant composition at the 13 night roosts measured is given in Table 16. A total of 31 night roosts was discovered and measured for height. Mean height of the vegetation above the roosts was 13.2 cm, while at one meter on either side of the roost it averaged 31.9 cm and 35.3 cm. An F value of 11.75**

Table 16. Plant composition of areas used by the greater prairie chicken compared with random samples of plant communities on the Adams Ranch study area, for winter period, based on perennial plants only, Osage County, Oklahoma 1960 and 1961.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites
	Tall Grass	Mid Grass	Short Grass	Cult. Past.			
Andropogon scoparius	33.36	4.39	3.63	-	1.92	30.56	2.40
Andropogon gerardi	28.68	3.98	0.66	-	11.80	24.60	1.08
Ambrosia psilostachya	11.24	22.34	16.00	9.87	3.46	4.80	7.93
Panicum virgatum	5.60	1.45	0.53	-	1.28	4.10	2.44
Panicum oligosanthes	2.75	3.36	4.63	-	1.09	1.22	0.39
Sporobolus asper	2.36	14.21	5.25	1.32	21.60	12.88	1.08
Sorghastrum nutans	1.50	0.97	-	-	-	0.26	-
Aster ericoides	1.47	2.65	1.18	0.02	-	-	-
Vernonia baldwinii	1.45	0.80	-	-	-	-	-
Bouteloua gracilis	-	10.52	16.34	-	1.21	-	0.27
Andropogon saccharoides	0.04	2.79	4.55	0.05	4.22	0.70	0.04
Juncus interior	0.69	1.98	4.16	-	0.11	-	0.23
Cynodon dactylon	-	-	1.37	13.61	0.08	-	7.74
Grindelia squarrosa	-	-	-	0.85	-	-	-
Solidago rigida	-	-	0.05	0.20	0.11	-	0.15
Buchloe dactyloides	0.50	3.35	20.65	-	11.60	-	1.74
Chloris verticillata	-	0.30	1.82	0.12	1.13	0.64	7.89

birds observed had selected this vegetative arrangement. This use pattern is considerably different than that for feeding use, where bunched vegetation was the primary pattern selected.

The greater prairie chicken rested in the ecotone between the tall grasses and mid or short grasses. This is illustrated in the life-form data gathered (Table 11), and in the vegetative composition data (Table 16) for example, the large percentage of tall grass components (Andropogon gerardi and A. scoparius) as well as the high percentage of mid grass components (Andropogon saccharoides and Sporobolus asper). Several resting birds were flushed from the cultivated pastures; however, in this situation they used only the unmowed rather rank Bermuda grass and Korean lespedeza stands. Mohler (1952) reports that typical loafing and (night) roosting cover consisted of stands of mixed grasses having 1) numerous stems over two feet (60 cm), 2) fairly dense understory of fallen and tangled grasses covering the ground to a depth of eight inches or more.

Statistical comparisons were made between resting and feeding activities with regard to plant height and coverage. Student's t was used to compare cover and was found to be non-significant ($t = .399$; 39 df). Analysis of the variance tests were made of height over the flush point as contrasted to measurements taken one meter away. These also were found to be non-significant ($F = 0.866$; 117 and 4 df). In the same calculations, contrasts were made between height of feeding cover versus resting cover. These also proved to be non-significant ($F = 0.456$; 1 and 117 df) for this period.

(90 and 2 df) was obtained when these measurements were compared. This suggests the greater prairie chicken also selects a tall cover area for roosting, but within the tall cover selects small pockets of short vegetation for the exact roost location.

Day Resting. For its day resting site during the winter period, the lesser prairie chicken chose half-shrub vegetation. While both the dwarf half-shrub and the half-shrubs were chosen, use of the dwarf half-shrub was favored (Table 11). The plant composition of the usual day resting points is presented in Table 10 and compared to random samples as well as to the other use activities.

Statistical tests made of plant cover of the resting and feeding flush sites showed no significant difference between the two when compared by Student's t test ($t = 1.219$; 36 df). Analysis of the variance was calculated for the height relationships of the feeding and resting covers. Tests between these two activities also failed to show height to be of significance ($F = 2.040$; 1 and 149 df). The tests of height above the activity site, when compared to measurements one meter away, were indicated significant at the 95 % level ($F = 2.869^*$; 4 and 149 df). This when subjected to Duncan's multiple range test proved to be of rather dubious value, as height of the feeding cover one meter on one side of the feeding site was significantly different than that one meter away on the other side. This might be a peculiarity of the sampling procedure or it might be indicative of the tendency of the birds to feed at the edge of a cover taller than the usual.

Resting lesser prairie chickens were found primarily in plants of scattered sociological arrangement (Table 14). More than 72 % of the

Table 17. Lesser prairie chicken food use expressed in percent volume and food index for the birds using the half-shrub and shrub units during the spring.

Food Items	Percent Volume			Food Index			
	Mar.	Apr.	May	Mar.	Apr.	May	Avg.
Half-shrub							
Coleoptera	1.87	3.40	6.61	-	-	-	-
Hemiptera	-	1.53	0.41	-	-	-	-
Orthoptera	1.03	-	0.02	-	-	-	-
Homoptera	-	-	0.08	-	-	-	-
Immature Insects	12.69	6.30	0.08	-	-	-	-
Festuca octoflora	3.42	2.66	0.99	9.1	7.5	3.5	6.7
Evax prolifera	3.50	9.76	-	26.9	44.7	-	23.9
Rhus aromatica	-	2.00	-	-	-	-	-
Silene antirrhina	-	-	7.50	-	-	-	-
Lepidium oblongum	-	-	1.52	-	-	41.7	13.9
Shrub							
Coleoptera	2.07	3.49	5.55	-	-	-	-
Hemiptera	-	0.53	0.68	-	-	-	-
Orthoptera	0.22	0.11	0.16	-	-	-	-
Hymenoptera	-	0.02	0.01	-	-	-	-
Immature Insects	4.14	0.63	0.21	-	-	-	-
Festuca octoflora	2.42	3.05	1.03	17.4	19.7	9.4	15.5
Evax prolifera	5.44	6.23	-	30.6	49.4	-	26.7
Rhus aromatica	9.16	0.46	-	-	9.9	-	3.3
Sorghum vulgare	1.00	0.02	-	-	-	-	-
Viola kitaibeliana	0.92	0.39	0.02	12.2	7.1	-	6.4
Grass	0.27	1.10	0.73	-	-	-	-
Silene antirrhina	-	-	3.28	-	-	-	-
Lepidium oblongum	-	-	1.08	-	-	15.9	5.3
Plantago sp.	-	0.59	1.10	-	8.7	9.1	5.9

the life-form observations above in emphasizing the importance of the half-shrubs as the principal feeding situation of the birds during this season.

Table 18. Relative availability of insect food materials expressed in percent for the lesser prairie chicken study area, as ascertained by sweep net collections made at the flush site during the months of March, April, and May, Beaver County, Oklahoma, 1960.

	Half-shrub Sample of (6)*	Short Grass Sample of (1)	Shrub Sample of (1)
Orthoptera			
Cyrtacanthacridinae	3.4		
Other	21.5		
Homoptera	39.4		33.0
Hemiptera	25.2	50.0	33.0
Coleoptera			
Chrysomelidae			
Eumolpinae	3.4		
Immature Insects	7.1	50.0	33.0
No. Insects/sample	4.65	2.00	3.00

* Sample size.

Collections of greater prairie chicken droppings totaled 267 specimens for the months of March, April, and May of 1960 and 1961. Monthly data have been summarized and placed in Appendix B (Tables XV, XVI, and XVII). This information has also been summarized for the more important food items in Table 21. Most of the samples were collected in the native prairie sections of the study area. This was for two reasons, namely: 1) most of the birds flushed were using this vegetation, and 2) more time was spent by the investigator on the native

Table 20. Plant composition of areas used by the lesser prairie chicken compared with plant communities present on the Maple-Barby study area, for the spring period, comparison based on perennial plants only, Beaver County, Oklahoma, 1960 and 1961.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites	Percent Comp. on Booming Grounds
	Short Grass	Mid Grass	Shrub	Half-Shrub				
Buchloe dactyloides	55.02	3.08	1.02	2.86	1.64	3.41	5.23	26.19
Bouteloua gracilis	16.01	0.75	-	2.70	0.25	-	-	3.80
Sporobolus cryptandrus	8.08	22.46	13.40	24.71	15.09	19.43	10.20	4.18
Aristida purpurea	4.11	2.68	0.38	1.55	-	-	0.13	2.14
Bouteloua curtipendula	2.34	18.97	0.83	5.26	4.80	7.85	10.20	8.84
Chloris verticillata	1.79	5.71	1.50	1.65	1.22	5.00	2.77	0.59
Chrysopsis villosa	1.69	1.08	-	-	-	0.40	-	0.06
Opuntia macrorhiza	1.57	0.06	-	-	-	-	-	0.98
Artemisia filifolia	0.83	2.64	9.25	28.08	22.65	13.16	11.16	0.45
Rhus aromatica	-	0.54	40.38	0.55	6.80	4.52	1.32	0.83
Eragrostis trichodes	-	1.26	8.07	1.26	-	-	-	-
Prunus angustifolia	-	-	3.13	-	-	0.40	-	-
Ambrosia psilostachya	0.48	6.26	3.09	5.71	1.19	1.27	2.42	0.30
Bouteloua hirsuta	0.12	8.66	2.55	1.48	0.62	0.95	0.35	1.66
Paspalum ciliatifolium	0.15	1.61	1.98	1.90	0.50	0.50	-	0.05
Gutierrezia sarothrae	0.44	5.71	1.40	2.62	6.37	3.65	1.71	0.23
Andropogon saccharoides	0.09	2.56	-	-	-	-	-	0.75

Table 19. Comparative use of vegetational life-forms for feeding and resting by greater and lesser prairie chickens during the spring period, 1960-61.

Life-form	Lesser					Greater				
	Mar.	Apr.	May	Total	Percent	Mar.	Apr.	May	Total	Percent
Feeding Use										
Tall Grass	-	-	-	-	-	(45)*2	14	-	(45) 16	(22) 8
Mid Grass	25	4	3	32	21	5	19	3	27	13
Short Grass	4	14	13	31	20	31	49	6	86	47
Shrub	4	-	-	4	3	-	-	-	-	-
Dwarf Shrub	11	1	-	12	8	-	-	-	-	-
Dwarf half-shrub	37	7	28	72	47	-	-	-	-	-
Mid Forb	-	-	-	-	-	-	4	7	11	5
Short Forb	-	-	1	1	1	22	1	-	23	11
Total	81	26	45	152		105	87	16	208	
Resting Use										
Tall Grass	1	-	-	1	-	35	38	17	90	46
Mid Grass	3	3	2	8	4	43	6	7	56	29
Short Grass	-	4	-	4	2	12	22	-	34	17
Shrub	-	1	-	1	-	-	-	-	-	-
Dwarf Shrub	10	8	2	20	10	-	-	-	-	-
Half-shrub	1	2	-	3	1	-	-	-	-	-
Dwarf half-shrub	38	75	60	173	83	-	-	-	-	-
Mid Forbs	-	-	-	-	-	-	-	2	2	1
Short Forbs	-	-	-	-	-	4	7	-	11	6
Total	53	93	64	210		94	73	29	195	

* Numbers in parentheses are birds using sorghum fields.

prairies at this time. The table therefore, contains no summary of foods used by the birds in the cultivated pasture areas.

Spring food use by the greater prairie chicken follows the same general pattern as for the lesser prairie chicken, except the increase in the use of insect food was smaller. Sorghum was the principal food in March. This changed rapidly as the birds moved from the areas surrounding the sorghum fields to the vicinity of the booming grounds. Grass blades and spikerush heads now replaced sorghum in the diet of the greaters. Japanese brome was important throughout this period. Leaf tips of yellow star-grass, used by the birds in March, gradually dwindled in amount of use as it bloomed and went to seed (Fig. 6). Seed of wild indigo was important the last week in March. Carex seed was used in May. The use of beetles for food increased through the entire period. Other insect matter was of little importance during this season.

Even fewer insects per sample were available to the greater prairie chicken than was found to be true for the lesser chicken (Tables 22 and 18). More insects were available in the disturbed forb association, than in the other vegetation types.

Feeding situations used by the greater prairie chicken consisted primarily of the short grass life-form, from which 47 % of the birds flushed were observed (Table 19). Second in importance was the tall grass life-form, from which 30 % of the birds were flushed (22 % of these from the sorghum).

Table 21. Greater prairie chicken food use during the spring season expressed in percent volume and food index for the birds using the native pastures during the spring, K. S. Adams Ranch, Osage County, Oklahoma, 1960 and 1961.

	Percent Volume			Food Index			
Food Items	Mar.	Apr.	May	Mar.	Apr.	May	Avg.
Native Pasture Unit							
Coleoptera	0.53	1.25	3.72	-	-	-	-
Orthoptera	1.59	0.07	-	-	-	-	-
Homoptera	-	0.05	-	-	-	-	-
Hemiptera	-	0.03	0.18	-	-	-	-
Immature Insects	0.02	0.01	0.03	-	-	-	-
Sorghum vulgare	10.77	-	-	-	-	-	-
Grass	6.70	3.71	10.68	-	-	-	-
Hypoxis hirsuta	3.38	1.47	0.19	28.9	20.4	2.2	17.2
Bromus japonicus	2.38	2.53	1.11	16.5	20.1	6.4	14.3
Baptisia sp.	1.70	T	-	10.3	-	-	3.4
Viola kitaibeliana	0.70	0.49	-	9.5	13.4	-	7.6
Lespedeza stipulacea	0.61	0.62	-	-	-	-	-
Eleocharis sp.	-	4.44	5.93	-	-	-	-
Juncus interior	0.20	0.92	0.07	-	14.1	-	4.7
Cyperus sp.	0.05	0.81	0.04	-	7.3	-	2.4
Carex sp.	-	0.60	6.77	-	6.8	27.2	11.3
Krigia occidentalis	-	-	1.10	-	-	-	-
Convolvulus arvensis	-	-	1.31	-	-	-	-

The vegetal composition (Table 23) of the feeding situation was closely related to the short grasses in consisting mainly of buffalo grass. Some use of the cultivated pastures was noted through the presence of Bermuda grass in the sample.

Night Roosting. Vegetation types used for night roosts by lesser prairie chickens for the spring period were similar to that for the winter period. Plant composition of the two-meter transects for the 13 roosts so measured this period is given in Table 20. The half-shrub and mid-grass plant associations were used chiefly for night roosting during the spring months. Height measurements were made to

Table 22. Relative availability of insect food materials expressed in percent for the greater prairie chicken study area, as ascertained by sweep net collections made at the flush site during the months of March, April, and May, K. S. Adams Ranch, Osage County, Oklahoma, 1960 and 1961.

	Tall Grass (10)*	Forb (4)	Short Grass (3)
Homoptera	61.1	80.0	75.2
Hemiptera			
Miridae	-	20.0	-
Other	27.8	-	-
Coleoptera			
Coccinellidae	-	-	24.8
Other	11.1	-	-
No. Insects/ Sample	1.80	2.50	1.33

* Numeral indicates sample size.

compare the 23 night roosts, contrasting the measurements above the nest with those one meter away. Analysis of the variance was computed for these measurements and found to be highly significant ($F = 284.2^{**}$; 2 and 66 df). The calculated means for this test were 11.87 cm over the roost and 19.48 cm on one side with 22.52 cm on the other side. This suggests again that the birds were selecting areas of tall vegetation within which areas of shorter vegetation were selected for the actual roost.

The greater prairie chicken roosted at night in the tall grass association. Often the exact location was in isolated stands of tall grasses within large areas of short grass, and occasionally in the tall grasses at the edge of the booming ground. Five roosting sites were measured for plant composition and these data are presented in

Table 23. Plant composition of areas used by the greater prairie chicken compared with random samples of plant communities on the Adams Ranch study area, for the spring period, comparison based on perennial plants only, Osage County, Oklahoma, 1960 and 1961.

Plant species	Random Samples				Percent Comp. at Day Resting Site	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites	Percent Comp. on Booming Grounds	Percent Comp. over Nesting Sites
	Tall Grass	Mid Grass	Short Grass	Cult. Past.					
Andropogon scoparius	33.36	4.39	3.63	-	19.84	19.75	5.42	7.56	44.51
Andropogon gerardi	28.68	3.88	0.66	-	13.58	25.10	5.17	8.28	6.09
Ambrosia psilostachya	11.24	22.34	16.00	9.87	5.01	7.20	9.44	11.84	19.86
Panicum virgatum	5.60	1.45	0.53	-	2.87	1.44	0.70	1.47	5.29
Panicum oligosanthes	2.75	3.36	4.63	-	2.12	1.03	0.06	3.16	2.65
Sporobolus asper	2.36	14.21	5.25	1.32	1.81	5.35	-	2.14	4.79
Sorghastrum nutans	1.50	0.97	-	-	-	-	-	-	-
Aster ericoides	1.47	2.65	1.18	0.02	0.19	-	0.45	0.30	0.60
Vernonia baldwinii	1.45	0.80	-	-	-	1.23	-	0.16	-
Bouteloua gracilis	-	10.52	16.34	-	1.06	5.14	2.81	1.03	-
Andropogon saccharoides	0.04	2.79	4.55	0.05	0.39	-	-	-	3.79
Juncus interior	0.69	1.98	4.16	-	1.92	1.23	1.28	3.09	2.69
Cynodon dactylon	-	-	1.37	13.61	2.14	-	3.00	3.64	-
Grindelia squarrosa	-	-	-	0.85	-	-	-	-	-
Solidago rigida	-	-	0.05	0.20	0.33	-	-	0.37	-
Buchloe dactyloides	0.50	3.35	20.65	-	5.37	-	11.42	8.87	-
Chloris verticillata	-	0.30	1.82	0.12	0.53	0.41	-	1.45	-

Table 23. Another four roosts were measured for height as well as the five above. These were tested statistically comparing the height measurements on either side of the roosts to that above the roost. The computed F value was found to be highly significant ($F = 6.05^{**}$; 2 and 24 df). The mean values were 3.9 cm over the roost, and 13.0 cm on one side with 21.1 cm on the other. It appears, therefore, that the birds were selecting a very short vegetation for the actual roost, within a vegetation of moderate height.

Day Resting. For daytime resting during the spring, the lesser prairie chicken used the dwarf half-shrub life-form. Eighty-three percent of 210 resting birds were flushed from this life-form. Dwarf shrubs, mainly skunkbush sumac, formed the second most important resting type, with 10 % of the birds using this cover. Other types less important numerically, are listed in Table 19. The plant composition of these was closely related to that ascertained for the half-shrub association in the random samples (Table 20), which indicated comparable amounts of sand sagebrush, sand dropseed, and purple three-awn.

Statistical tests were employed to compare the plant cover of feeding and resting flush points used during the spring period by the lesser prairie chicken. Student's t test revealed no difference between the two activities ($t = .021$; 50 df). Analysis of the variance of plant heights indicated a significant difference between feeding with a mean of 18.4 cm and resting with a mean of 24.5 cm ($F = 4.698^{*}$; 150 and 1 df). This test also indicated a difference within the microhabitat in that the birds selected for resting, the higher cover within the measurement area ($F = 3.552^{**}$; 150 and 4 df). The mean height for the flush points above the resting site was 31.1 cm, and at the one-meter intervals the heights were 21.1 cm and 21.6 cm.

Day resting greater prairie chickens were found using the tall and mid grass life-forms, with 46 % of 195 birds flushed from the tall grasses and 29 % from the mid grasses (Table 19). As in the winter season, several were flushed from the cultivated pastures. Plant composition at the resting sites showed a close affinity to the tall grass association as determined by the random samples (Table 23).

Statistical tests were used to compare the plant cover of resting and feeding use areas of the greater prairie chicken. No difference could be detected using the t test ($t = .759$; 51 df). The analysis of variance tests of the height differences between the activities of feeding and resting proved to be highly significant ($F = 9.479^{**}$; 150 and 1 df). The mean feeding height was 9.08 cm and the mean resting height was 21.48 cm again indicating the use of a shorter cover for feeding. The tests of height over the resting point contrasted to plant height one meter away also proved to be significant ($F = 2.480^{*}$; 150 and 4 df). A reason for this apparent anomaly is not readily apparent.

Courtship Areas. The short grass association is the vegetation type used by the lesser prairie chicken to the greatest extent for courtship, although several of the smaller booming grounds were located in the mid grass type. This is reflected in the relatively high percentage of side-oats grama grass shown in Table 20. The booming grounds were all on high ground, usually on ridges where short vegetation and elevation with consequent good visibility were in concurrence. Several grounds were at the highest point of a ridge, but only

where the short vegetation happened to coincide with this feature. Almost all booming grounds served also as feeding sites in the early spring.

The greater prairie chickens' courtship areas were located in short grass vegetation on level prairie areas, or when an elevation with short grass vegetation was present, this was used in preference. Their general tendency was to select vegetation of a low physiognomic level (Table 23). Most of the booming grounds located consisted of small patches of native short grasses. It is doubtful that it made a difference to the birds whether this was native, cultivated, or mowed so long as a proper height relationship existed.

Booming grounds used by the two prairie chicken species could not be distinguished statistically from one another on the basis of plant cover ($t = 1.05$; 44 df). The means were 64 % cover for the lesser prairie chicken and 45.3 % cover for the greater prairie chickens on these areas. This similarity in plant coverage is undoubtedly related to the similarity in life-form and plant associations found on the booming grounds of both birds. Both birds prefer low, continuous plant cover for these sites.

Vegetation height, as measured by 10 samples per booming ground was found significantly different for the two species of prairie chicken. Mean height of the vegetation used for booming by the greater prairie chickens was 15.13 cm and for the lesser's 10.39 cm. The difference between the two is significant to the 99 % level ($t = 2.60^{**}$; 348 df). This suggests the greater prairie chickens were more tolerant of tall vegetation on the booming area than was the lesser.

Nesting. A total of 272 acres of possible lesser prairie chicken nesting cover was checked. Not one nest was found on this area. One nest was located during the random analysis of the vegetation in July. This was an old one from which the eggs had evidently hatched the preceding month. This nest was located about 750 feet south of booming ground No. 8. The principal vegetation was purple three-awn which composed 55 % of the total plant cover, and sand sagebrush which formed 17 % of the plant cover. The height of the vegetation above the nest was measured at 45 cm, and one meter at either side was 15 cm and 21 cm.

Other investigators have run into similar problems in finding the nests of lesser prairie chicken. Coats (1955) stated that the " . . . vegetation in which nests are found, their extreme concealment and the behavior of the incubating hen make it very unlikely that nests will be discovered." Bent (1932) describes three nests, two located under bunches of sand sagebrush and one situated under a tumbleweed, which had lodged between two tufts of grass. Coplin (1958) found three nests in his study of the lessers. "Each was situated between two or three clumps of grass, little bluestem, sand dropseed, or aristida, which remained from the previous years' growth."

On the greater prairie chicken study area, a total of 254 acres of potential nesting cover was checked, on which nine nests were discovered. Baker (1953) found slightly fewer per acre, 16 nests in 610 acres of unburned pastures and meadows. Nesting situations were characterized by taller and heavier cover than was usual for the tall grasses. All nests were located within one quarter mile of open water. Hamerstrom (1939) reported nine out of 23 nests located within a half

mile of a booming ground and 10 between a half mile and a mile and a quarter. Nests located in the present study were all within a half mile to a mile of the nearest booming ground. All nests discovered were either very close to cultivated pastures or old fields. These areas can be characterized by shortness in height of the vegetation and greater number of forbs.

The range of heights above the nests was from 25 to 70 cm with a mean of 45 cm. An average plant cover of 62.8 % was calculated from measurements taken by a transect directly over the nest. Plant composition of the nesting cover is given in Table 23. Little bluestem made up the principal plant cover at all but two nests. Of these two, one was placed in a clump of silver bluestem and the other was situated in a clump of the three tall grasses, namely: switchgrass, big bluestem, and little bluestem. Schwartz (1945) has given an idea of the variety of cover types in which the greater prairie chicken will nest. Of 57 nests, 56 % were found in ungrazed meadows, 21 % in lightly grazed pastures, and 22 % in sweet clover, fence rows, sumacs, old cornfields and barnyard grass.

Summer Habitat Use. During the late spring and early summer, the young birds begin to appear on the prairies. It is the period of rapid growth for perennial plants. Many plants bloom and seed in both study areas. Insects are available everywhere, particularly in the disturbed prairie sites where forbs abound. Cover is abundant and toward the end of the period, the late summer perennial grasses and forbs begin to bloom and seed.

Food Use. A total of 246 lesser prairie chicken droppings was collected during June, July, and August for the years of 1959, 1960, and 1961. The information resulting from the examination of these has been summarized by month in Appendix A (Tables VI, VII, and VIII). The important foods have been condensed further in Table 24.

Table 24. Summer use of food materials by the lesser prairie chicken expressed in percent volume and food index for the birds using the half-shrub and shrub units, Beaver County, Oklahoma, 1959, 1960 and 1961.

	Percent Volume			Food Index			
Food Items	June	July	Aug.	June	July	Aug.	Avg.
Half-shrub Unit							
Coleoptera	5.05	5.20	4.99	-	-	-	-
Hemiptera	1.29	0.96	0.50	-	-	-	-
Orthoptera	11.11	6.68	10.50	-	-	-	-
Diptera	-	0.11	-	-	-	-	-
Immature Insects	0.14	-	-	-	-	-	-
Rhus aromatica	4.76	8.11	1.33	-	-	-	-
Silene antirrhina	1.85	0.07	-	-	-	-	-
Tradescantia occidentalis	0.72	1.38	2.33	8.5	18.1	-	8.9
Grass	0.63	0.92	0.66	-	-	-	-
Sporobolus cryptandrus	0.04	-	0.50	-	-	-	-
Shrub Unit							
Coleoptera	14.78	2.64	1.63	-	-	-	-
Hemiptera	0.20	-	0.01	-	-	-	-
Orthoptera	7.28	12.55	21.43	-	-	-	-
Diptera	-	0.19	0.17	-	-	-	-
Hymenoptera	-	0.01	-	-	-	-	-
Immature Insects	0.32	-	-	-	-	-	-
Rhus aromatica	24.99	22.19	8.13	67.4	54.2	30.5	50.7
Silene antirrhina	1.67	0.03	T	28.1	-	-	9.4
Grass	1.32	0.44	0.62	-	-	-	-
Tradescantia occidentalis	0.65	2.19	1.22	-	28.3	13.3	13.9

Insects dominated the diet of the lesser prairie chicken during the summer (Table 24). Beetles were important in June but their use declined through the summer while grasshoppers increased in usage. By August, the latter were the principal item of diet of the birds in the vegetational units studied. Other insects were unimportant during this period. In the part of the study area dominated by the shrub life-form, skunkbush sumac fruits became the principal food. Seeds of the spring annuals were relatively unimportant, although sleepy catch-fly is well represented in June. Leaves of the dayflower were comparatively important through the entire summer period.

The relative availability of insect foods for this period is expressed in Table 25. The true bugs and leafhoppers occurred in the greatest numbers. When this information is compared to the numbers taken by the bird, it is apparent that these are not eaten in very large quantities. The important insect foods, beetles and grasshoppers, were found in considerably smaller numbers. It is to be noted again that the disturbed forb areas were the best producers of large numbers of insects, averaging 67.77 insects per collection. Each of the other vegetative divisions averaged only slightly above twenty insects per sample.

At this time of the year, feeding lesser prairie chickens, when flushed, were usually using the mid forb or mid grass life-forms (Table 26). Of the 97 feeding birds observed, 26 % were using the mid forbs and 22 % were using the mid grasses. This heavy use of the forb life-form at this time was probably related to the greater insect availability in this vegetation. More birds were flushed from the shrub

Table 25. Relative insect availability on the lesser prairie chicken study area expressed in percent catch, as ascertained by sweep net collections made at the flush site during the months of June, July, and August, Beaver County, Oklahoma, 1959, 1960, and 1961.

	Half-shrub (8)*	Shrub (19)	Mid Grass (4)	Forb (7)
Orthoptera				
Acrididae				
Acridinae	1.7	1.0	-	-
Oedipodinae	0.6	-	-	-
Cyrtacanthacridinae	8.6	3.3	15.9	3.0
Tettigoniidae				
Conocephalinae	-	0.2	-	-
Gryllidae				
Oecanthinae	-	0.4	-	-
Phasmatidae	-	-	1.2	-
Other	9.1	6.5	6.1	7.8
Total	20.0	11.4	27.4	10.8
Coleoptera				
Chrysomelidae				
Eumolpinae	-	0.4	-	0.4
Galerucinae	0.6	-	-	0.2
Halticinae	-	-	-	0.4
Camptosomatinae	0.6	-	-	0.2
Curculionidae				
Curculioninae	1.1	-	-	0.4
Otiorhynchinae	0.6	-	1.2	-
Carabidae	-	0.2	-	-
Malachiidae	-	-	-	0.8
Buprestidae	-	-	-	0.4
Cleridae	0.6	-	3.7	0.2
Mordellidae	-	0.2	-	-
Other	2.9	3.0	1.2	2.3
Total	6.4	3.8	6.1	4.9
Hemiptera				
Scutelleridae	1.1	0.2	-	-
Pentatomidae	0.6	0.2	-	0.2
Other	38.8	53.3	41.5	60.6
Total	40.5	53.7	41.5	60.8
Homoptera				
Cicadellidae	2.3	2.0	8.5	0.8
Other	29.7	29.0	15.9	24.1
Total	32.0	31.0	24.4	24.9
Immature Insects	2.3	0.2	4.9	1.9
No. Insects/Sample	21.91	26.68	20.50	67.66

* Number in parenthesis is size of sample.

Insects dominated the diet of the lesser prairie chicken during the summer (Table 24). Beetles were important in June but their use declined through the summer while grasshoppers increased in usage. By August, the latter were the principal item of diet of the birds in the vegetational units studied. Other insects were unimportant during this period. In the part of the study area dominated by the shrub life-form, skunkbush sumac fruits became the principal food. Seeds of the spring annuals were relatively unimportant, although sleepy catch-fly is well represented in June. Leaves of the dayflower were comparatively important through the entire summer period.

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Table 26. Comparative use of vegetational life-forms for feeding and resting by greater and lesser prairie chickens during the summer, Oklahoma 1959, 1960, and 1961.

Life-form	Lesser					Greater				
	June	July	Aug.	Total	Percent	June	July	Aug.	Total	Percent
Feeding Use										
Tall Grass	-	-	-	-	-	1	5	-	6	2
Mid Grass	3	10	9	22	23	10	11	19	40	17
Short Grass	16	-	-	16	16	27	6	27	60	25
Shrub	5	-	11	16	16	-	-	-	-	-
Dwarf Shrub	1	2	5	8	8	-	-	-	-	-
Half-shrub	-	6	-	6	6	-	-	-	-	-
Dwarf half-shrub	1	2	-	3	3	-	-	-	-	-
Tall Forb	-	-	-	-	-	-	-	40	40	17
Mid Forb	-	1	25	26	27	11	4	39	54	22
Short Forb	-	-	-	-	-	15	7	20	42	17
Total	26	21	50	97		64	33	145	242	
Resting Use										
Trees	-	-	-	-	-	2	-	-	2	2
Tall Grass	-	10	-	10	6	5	2	5	12	10
Mid Grass	9	-	-	9	6	4	-	19	23	20
Short Grass	1	-	1	2	1	4	-	10	14	12
Shrub	13	13	11	37	23	-	-	-	-	-
Dwarf Shrub	5	24	2	31	19	-	-	-	-	-
Half-shrub	6	12	1	19	12	-	-	-	-	-
Dwarf half-shrub	9	21	17	47	30	-	-	-	-	-
Tall Forb	-	-	-	-	-	3	1	2	6	5
Mid Forb	-	1	3	4	3	6	4	50	60	51
Total	43	81	35	159		24	7	86	117	

life-form than had been seen altogether during the other seasons in this life-form. Here they were feeding on the fruits of skunkbush sumac.

The plant composition of the average feeding situation reflects use of forbs, short grasses, and shrubs during the summer (Table 27). The large amount of western ragweed in the sample is noteworthy. This plant was one of the principal components of the disturbed forb situations. Another item brought out in these data was the considerable use of the short grasses as evidenced by the high amounts of buffalo grass present. Skunkbush sumac was also emphasized again as being important in summer feeding situations.

A total of 199 droppings was collected in the greater prairie chicken study area during June, July, and August of 1959, 1960 and 1961. The food use data resulting from examination of these are presented by month in Appendix B (Tables XVIII, XIX, and XX). A summary of the most important foods used during the summer is given in Table 28.

The principal foods of the greater prairie chicken during summer in both the native prairie and cultivated pasture situations consisted of plant seeds and leaves. This was in contrast to the importance of insects to the lesser. Korean lespedeza made up 53 % of the volume of the food residue in the droppings collected in the cultivated pastures. Other plant foods in this association were comparatively minor. They consisted primarily of seed of the last of the spring annuals in addition to a small amount of perennial seeds that appeared in July and August.

Table 27. Plant composition of areas used by the lesser prairie chicken compared with random samples of plant communities on the Maple-Barby study area, for the summer period, comparison based on perennial plants only, Beaver County, Oklahoma, 1959, 1960, and 1961.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites	Percent Comp. on Brood Ranges
	Short Grass	Mid Grass	Shrub	Half-Shrub				
Buchloe dactyloides	55.02	3.08	1.02	2.86	-	-	14.59	-
Bouteloua gracilis	16.01	0.75	-	2.70	0.79	-	1.87	2.12
Sporobolus cryptandrus	8.08	22.46	13.40	24.71	15.61	15.54	14.03	7.83
Aristida purpurea	4.11	2.68	0.38	1.55	0.82	-	0.56	-
Bouteloua curtipendula	2.34	18.97	0.83	5.26	3.89	6.22	3.75	2.31
Chloris verticillata	1.79	5.71	1.50	1.65	1.81	-	4.04	1.37
Chrysopsis villosa	1.69	1.08	-	-	-	-	-	-
Opuntia macrorhiza	1.57	0.06	-	-	-	-	0.06	-
Artemisia filifolia	0.83	2.64	9.25	28.08	18.61	10.88	8.47	22.79
Rhus aromatica	-	0.54	40.38	0.55	22.60	-	16.81	17.22
Eragrostis trichodes	-	1.26	8.07	1.26	1.70	-	0.70	1.27
Prunus angustifolia	-	-	3.13	-	2.98	-	-	2.45
Ambrosia psilostachya	0.48	6.26	3.09	5.71	4.78	2.59	12.24	15.65
Bouteloua hirsuta	0.12	8.66	2.55	1.48	1.92	14.51	4.28	1.34
Paspalum ciliatifolium	0.15	1.61	1.98	1.90	1.74	-	1.11	3.72
Gutierrezia sarothrae	0.44	5.71	1.40	2.62	3.06	33.68	0.82	2.12
Andropogon saccharoides	0.09	2.56	-	-	0.85	-	-	-

Table 28. Greater prairie chicken food use expressed in percent volume and food index for the birds using the native pastures during the summer, K. S. Adams Ranch, Osage County, Oklahoma, 1959, 1960, and 1961.

Food Items	Percent Volume			Food Index			
	June	July	Aug.	June	July	Aug.	Avg.
Native Pasture Unit							
Coleoptera	6.93	6.32	3.01	-	-	-	-
Hemiptera	1.16	0.18	0.53	-	-	-	-
Homoptera	-	0.53	-	-	-	-	-
Hymenoptera	-	0.72	0.31	-	-	-	-
Orthoptera	-	4.30	4.37	-	-	-	-
Plantago rugelii	7.08	-	-	41.4	-	-	13.8
Solidago sp.	4.38	1.36	15.16	32.9	9.0	41.4	27.8
Lespedeza stipulacea	5.00	-	0.34	10.9	-	4.6	5.2
Krigia occidentalis	2.50	-	-	-	-	-	-
Galium aparine	1.44	-	-	66.0	-	-	22.0
Oxalis stricta	1.11	0.09	0.09	41.0	-	5.7	15.6
Silene antirrhina	0.86	-	-	-	-	-	-
Carex sp.	0.77	-	-	11.3	-	-	3.8
Grass	3.00	0.86	1.34	-	-	-	-
Lepidium virginianum	0.80	-	-	30.2	-	-	10.1
Sabatia campestris	-	15.77	2.67	-	-	-	-
Linum sulcatum	-	1.31	0.23	-	35.1	9.1	14.7
Physalis sp.	0.05	0.81	-	-	-	-	-
Penstemon cobaea	-	-	2.44	-	-	-	-
Cultivated Pasture Unit							
Coleoptera	6.74	3.24	3.27	-	-	-	-
Hemiptera	0.43	0.26	-	-	-	-	-
Orthoptera	0.30	1.18	0.38	-	-	-	-
Hymenoptera	0.08	0.81	0.06	-	-	-	-
Lespedeza stipulacea	28.26	53.63	53.43	9.7	15.5	16.8	14.0
Krigia occidentalis	1.34	-	-	-	-	-	-
Silene antirrhina	1.13	0.27	-	-	-	-	-
Grass	0.73	0.90	0.23	-	-	-	-
Sabatia campestris	1.08	-	-	-	-	-	-
Polygonum convolvulus	0.95	0.18	0.81	-	-	-	-
Cassia fasciculata	0.65	-	-	-	-	-	-
Elymus canadensis	-	-	1.16	-	-	16.5	3.3
Cynodon dactylon	-	0.90	0.73	-	15.6	7.6	7.7
Rumex crispus	-	0.63	-	-	-	-	-

Table 29. Relative insect availability expressed in percent catch on the greater prairie chicken study area as ascertained by sweep net collections made at the flush site during the months of June, July, and August, Osage County, Oklahoma, 1959 and 1960.

	Tall Grass (3)*	Forbs (18)	Short Grass (7)	Mid Grass (13)
Orthoptera				
Tettigoniidae				
Conocephalinae	6.1	8.4	23.3	11.8
Copiphorinae	-	1.0	-	-
Gryllidae				
Oecanthinae	-	2.0	2.3	0.9
Acrididae				
Cyrtacanthacridinae	3.0	6.2	0.6	3.2
Oedipodinae	-	0.1	-	1.4
Acridinae	-	0.2	0.6	-
Blattidae	-	-	0.6	-
Other	6.1	6.2	19.2	9.5
Total	15.2	24.1	46.6	26.8
Coleoptera				
Carabidae	-	0.2	-	0.5
Staphylinidae	-	0.7	0.6	-
Curculionidae				
Curculioninae	-	0.2	-	0.9
Chrysomelidae				
Camptosomatinae	-	0.3	-	0.5
Halticinae	-	0.2	1.2	1.8
Cassidinae	-	-	1.8	-
Galerucinae	6.1	3.2	2.9	4.6
Chrysomelinae	-	-	-	0.5
Scarabaeidae				
Aphodiinae	-	-	0.6	-
Scolytidae	-	0.3	1.2	0.5
Coccinellidae	-	0.1	0.6	-
Mordellidae	-	0.1	-	-
Cleridae	-	0.1	-	-
Other	24.3	5.5	4.6	10.5
Total	30.4	10.9	13.5	19.8
Hemiptera				
Pentatomidae	-	0.1	-	0.5
Miridae	-	4.0	-	-
Reduviidae	6.1	1.7	-	-
Scutelleridae	-	0.2	0.6	-
Other	3.0	42.9	14.5	9.1
Total	9.1	48.9	15.1	9.6
Homoptera				
Cicadellidae	3.0	2.9	1.2	-
Cercopidae	-	0.1	-	-
Other	42.4	13.0	23.3	42.8
Total	45.5	16.0	24.5	42.8
No. Insects/Sample	11.01	55.02	24.54	16.90

* Number in parenthesis is size of sample.

In the native grass situations, the plant foods were more diversified and a larger number of species were important as foods. During June, for example, the seed of Rugels plantain had the highest observed value to the bird. It was followed closely by Korean lespedeza and goldenrod leaves. Prairie gentian leaves proved to be the main plant food in July. These were supplanted by goldenrod in August as the main food. Beetles were the principal animal food eaten during this time. They gradually decreased in importance through the collection period. Grasshoppers increased in value during the period, particularly in the native pastures.

Again the disturbed forb sites proved to be the best source of an abundance of insects, affording 55.02 insects to a sample (Table 29). Second in insect production were the short grasses. This vegetation was particularly high in the production of grasshoppers.

During the summer, feeding birds were found in all of the important vegetational life-forms in about equal numbers (Table 26). Short grass and mid forbs were the cover types most used by the birds at this time. Tall grass was the only life-form apparently not providing food for the birds at this time.

Plant composition at the feeding sites is presented in Table 30. It can be noted that there seems to be a definite relationship of plant composition to the cultivated pastures in that large quantities of Bermuda grass were present in the sample.

Table 30. Plant composition of areas used by the greater prairie chicken compared with random samples of plant communities on the Adams Ranch study area, for the summer period, comparison based on perennial plants only, Osage County, Oklahoma 1959, 1960, and 1961.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites	Percent Comp. on Brood Ranges
	Tall Grass	Mid Grass	Short Grass	Cult. Past.				
Andropogon scoparius	33.36	4.39	3.63	-	4.62	12.19	4.46	4.46
Andropogon gerardi	28.68	3.88	0.66	-	6.18	14.48	5.69	2.71
Ambrosia psilostachya	11.24	22.34	16.00	9.87	13.86	16.16	6.43	13.13
Panicum virgatum	5.60	1.45	0.53	-	1.72	3.27	1.77	2.42
Panicum oligosanthes	2.75	3.36	4.63	-	1.06	5.85	2.61	0.33
Sporobolus asper	2.36	14.21	5.25	1.32	2.61	4.53	3.24	4.69
Sorghastrum nutans	1.50	0.97	-	-	0.17	0.21	0.54	0.62
Aster ericoides	1.47	2.65	1.18	0.02	0.01	0.84	0.14	0.11
Vernonia baldwinii	1.45	0.80	-	-	0.96	0.49	0.39	0.51
Bouteloua gracilis	-	10.52	16.34	-	2.67	9.19	3.35	2.51
Andropogon saccharoides	0.04	2.79	4.55	0.05	1.64	3.55	1.82	5.11
Juncus interior	0.69	1.98	4.16	-	0.60	0.98	0.76	0.42
Cynodon dactylon	-	-	1.37	13.61	3.95	-	10.47	11.95
Grindelia squarrosa	-	-	-	0.85	-	-	0.23	-
Solidago rigida	-	-	0.05	0.20	0.30	-	0.73	2.22
Buchloe dactyloides	0.50	3.35	20.65	-	3.62	6.89	4.89	1.78
Chloris verticillata	-	0.30	1.82	0.12	0.38	1.46	1.27	0.76

Night Roosting. Only two lesser prairie chicken summer night roosts were discovered. These showed again the tendency of the birds to roost in the mid grasses and the sagebrush vegetal types (Table 27). Average heights of cover were similar to spring and winter situations, with an average of 2 cm above the roost and 11 cm one meter on one side with 27 cm on the other side.

A larger number of greater prairie chicken night roosts were found and measured during this period. The vegetal composition of the nine measured roosts is presented in Table 30. These data indicated the preference of the tall and mid grass associations for night roosting by these birds. Heights taken over the roost as well as one meter on either side were compared and found to be non-significant ($F = 3.08$; 24 and 2 df), the mean height over the roost was 31.8 and at one meter distance it averaged 51.6 cm and 36.9 cm.

Day Resting. In the summer, resting lesser prairie chickens were flushed from the shrub-like life-forms for the most part (Table 26). The dwarf half-shrub type was the principal cover chosen at this time of the year with 30 % of 159 birds observed using it. Second in importance were the shrub and dwarf shrub cover types which is at variance with information for this activity earlier in the year. Its use was probably related to the fully leafed condition and the provision thereby of adequate shade for the birds during the hot summer months. Half-shrubs were also important. Vegetal structure reflects the life-form findings well (Table 27). Here skunkbush sumac and sand sagebrush proved to have been the principal components of the vegetation.

Statistical comparisons were made of the plant cover of the feeding situations as compared with the resting sites. No significant difference could be measured between the covers used for the two activities ($t = 0.328$; 73 df). Height contrasts were also made between activities and between the height above flush point and the vegetation one meter away on either side. Statistical evidence indicated a significance at the 99 % level between the activities ($F = 5.404^{**}$; 108 and 1 df). The mean heights of these two activities were 24.6 cm for feeding and 40.6 cm for resting, again revealing the height difference between cover chosen for feeding and for resting. Comparison of the heights of the vegetation between the flush point and measurements taken one meter away did not prove to be significant, ($F = 1.696$; 108 and 4 df).

Resting greater prairie chickens during this period selected a variety of plant life-forms. The main one was the mid forb cover associated with cultivated pastures and other disturbed areas (Table 26). Of 117 resting birds flushed, 51 % used the mid forb life-form, while another 20 % used mid grasses as resting sites.

Composition of the vegetation at the resting site again pointed to the mid forbs as the main point of use for resting (Table 30). No other tendencies are apparent from these data, except that the composition at the individual site was variable.

Tests of plant cover used for resting and feeding proved non-significant ($t = .780$; 87 df). Analysis of variance tests of plant height associated with these activities also proved to be non-significant ($F = 1.604$; 129 and 1 df). When height above activity site was compared to height one meter away the calculations again indicate

non-significance (F = 1.497; 129 and 4 df). This suggests that during summer, the greater prairie chicken shows no tendency to choose vegetation of specific heights or densities, but are distributed at random through the available cover types.

Brood Ranges. Vegetational composition of the brood ranges showed several interesting features (Table 27). The lesser prairie chickens used a vegetation dominated by the shrub and half-shrub life-forms. Vegetation used by broods usually had a greater percentage of forbs. For example, the amount of western ragweed present was greater than for any other of the activities, averaging in excess of 15 % of the total vegetation. Statistical comparisons of the height and cover of the brood ranges also were made. Comparisons with random samples of shrub and half-shrub cover types indicated these data were not significant.

Insects comprised the principal food used by the young lesser prairie chickens (Table 31). More than 85 % of the total content of the brood droppings collected was insect residue with grasshoppers being the most common item. Ground beetles (Carabidae) and June beetles (Scarabaeidae) also were important items to them. Some plant materials were eaten but these formed a minor part of the total array of foods.

Rajala (1960) studying another member of the grouse family, the capercaillie, in Finland, found by observation of the juveniles that only 30 % of the pickings of these birds was aimed at vegetable matter. He says that "it is very likely that the bacterial action (in the intestines) at (the age of 7 to 9 days) has not reached full effect,

Table 31. Food use by lesser prairie chicken broods, based on seven droppings collected in June, and the crop and gizzard of a day old chick collected May 31, 1961, Beaver County, Oklahoma.

Food Item	Number of Insects in Crop and Gizzard of Day Old Chick	Volume Food of Broods in June in CC's	Percent Volume
Coleoptera	1	-	-
Chrysomelidae			
Eumolpinae	1	-	-
Cleridae	1	-	-
Carabidae	-	137	26.5
Scarabaeidae			
Melolonthinae	-	40	7.8
Orthoptera	-	215	41.7
Acrididae			
Cyrtacanthacridinae	4	7	1.4
Oedipodinae	1	-	-
Gryllidae			
Oecanthinae	1	30	5.8
Hemiptera			
Corimelaenidae	3	-	-
Scuterlleridae	1	-	-
Pentatomidae	3	10	1.9
Homoptera			
Corizidae	1	-	-
Cicadellidae	4	-	-
Lepidoptera			
Phalaenidae			
(larvae)	3	-	-
Plant			
Silene antirrhina (s)*	3	-	-
Panicum capillare (s)	1	-	-
Grass	-	10	1.9
Green vegetation	T	27	5.2
Lithospermum incisum (s)	-	15	2.9
Rhus aromatica (s)	-	25	4.8

* (s) = Seed.

but increases gradually during the following weeks of living as feeding on plant matter increases correspondingly."

Vegetational composition, of the brood ranges used by greater prairie chicken shows an orientation similar to that noted for the lesser prairie chicken in the large amount of forbs (Table 30). The choice of a vegetation with an abundance of forb cover was probably related to the quantities of insects available to the broods in this cover type. The primary cover selected by the birds with broods was the cultivated pasture associations. Statistical comparison revealed no significant differences between either height or plant cover of the brood ranges when compared to the random samples of cultivated pasture.

Foods of the greater prairie chicken broods are presented in Table 32. Insects made up the main item consumed by the young birds, forming 97 % of the total of food material used. The dominating insect foods were beetles which made up more than 23 % of the identified foods. Most important of the beetles were the phytophagous leaf beetles (Chrysomelidae). These beetles are colorful and often feed on low growing herbs, and hence were easily seen and reached by the young prairie chickens.

Fall Habitat Use. Fall is a season of change. Broods break up as such, and during November greater prairie chickens re-group in large flocks. These large bands were rarely observed on the lesser prairie chicken study area. During this period, where seeds of Korean lespedeza, western ragweed, and sunflower are ripe and available to the greater prairie chicken, seeds of flatsedge, annual erigonum, and western

Table 32. Food use by greater prairie chicken broods, based on 14 droppings collected in June and July, Osage County, Oklahoma.

Food Items	Volume of June Foods in CC's	Volume of July Foods in CC's	Total Volume	Percent Volume
Coleoptera				
Chrysomelidae				
Eumolpinae	43	36	79	9.3
Galerucinae	5	15	20	2.4
Halticinae	5	1	6	0.7
Camptosomatinae	3	-	3	0.4
Curculionidae				
Otiorhynchinae	5	21	26	3.1
Curculioninae	-	1	1	0.1
Scarabaeidae				
Aphodiinae	12	-	12	1.4
Melolonthinae	-	10	10	1.2
Malachiidae	-	2	2	0.2
Coccinellidae	-	4	4	0.5
Carabidae	14	8	22	2.6
Orthoptera	7	47	54	6.4
Acrididae	3	-	3	0.4
Acridinae	-	5	5	0.6
Hemiptera	6	-	6	0.7
Neuroptera	5	-	5	0.6
Homoptera	-	6	6	0.7
Hymenoptera				
Formicidae	2	-	2	0.2
Other Insects	355	207	562	66.2
Plant				
Lespedeza stipulaceae (L)*	10	-	10	1.2
Sabatia campestre (L)	-	7	7	0.8
Grass Bits	-	9	9	1.1
Panicum capillare (S)	-	1	1	0.1

ragweed become available to the lesser prairie chicken. Large grasshoppers, plentiful during September, gradually decrease in number as the season wanes. The available cover is at its best now as this season sees the close of the growing season, and as yet has not been subjected to the attrition from weather and grazing.

Food Use. Collections of lesser prairie chicken droppings totaled 271 for the months of September, October, and November 1960. These data are assembled by month in Appendix A (Tables IX, X, and XI). This information is condensed for the important components of the fall diet in Table 33.

Again in the fall, as in the summer, insects provided the principal food for the lesser prairie chicken. Grasshoppers ranked high during September and October, beetles were used throughout the period, particularly during the first months, and in November plant foods became more important, notably leaves of sixweek fesque. This and broom snakeweed leaves were foods that became even more important in the winter. While flatsedge seed was used through the entire three-month period, it reached a peak in useage during October along with western ragweed.

During this season, insects were most available to the lesser prairie chicken in the half-shrub vegetation, and only slightly less so among the mid grasses (Table 34). Very few collections were made in the short grass and forb associations.

Life-form use for feeding by the lesser prairie chicken was principally within the mid grasses, with 55 % of 143 observations

Table 33. Lesser prairie chicken food use expressed in percent volume and food index for the birds using the native pastures during the fall, Beaver County, 1960.

Food Items	Percent Volume			Food Index			
	Sept.	Oct.	Nov.	Sept.	Oct.	Nov.	Avg.
Half-shrub Unit							
Coleoptera	6.37	4.91	1.79	-	-	-	-
Orthoptera	9.21	11.68	4.13	-	-	-	-
Hemiptera	-	0.70	0.04	-	-	-	-
Hymenoptera	-	-	0.26	-	-	-	-
Immature Insects	0.09	-	0.52	-	-	-	-
Cyperus schweinitzii	1.27	3.52	1.48	40.5	79.4	25.1	48.3
Ambrosia psilostachya	-	1.44	1.09	-	17.8	7.9	8.6
Festuca octoflora	0.02	-	5.92	-	-	46.5	15.5
Grass	0.64	0.82	1.73	-	-	-	-
Sorghum vulgare	-	-	1.34	-	-	-	-
Bouteloua gracilis	-	-	0.95	-	-	-	-
Leptoloma cognatum	-	-	0.97	-	-	-	-
Artemisia filifolia	-	-	0.80	-	-	25.3	8.4
Gutierrezia sarothrae	0.29	-	0.56	-	-	21.0	7.0
Monarda punctata	-	0.68	-	-	-	-	-
Shrub							
Coleoptera	8.25	6.56	2.81	-	-	-	-
Hemiptera	0.06	3.72	0.69	-	-	-	-
Hymenoptera	0.02	-	0.09	-	-	-	-
Orthoptera	8.86	10.54	6.15	-	-	-	-
Immature Insects	-	0.12	-	-	-	-	-
Cyperus schweinitzii	2.21	3.18	2.42	59.9	63.2	32.8	51.9
Ambrosia psilostachya	-	1.66	0.80	-	17.6	12.1	9.9
Festuca octoflora	T	0.14	1.52	-	6.4	20.1	8.8
Grass	0.69	0.35	3.97	-	-	-	-
Artemisia filifolia	-	-	0.59	-	-	7.1	2.4
Sporobolus cryptandrus	0.08	0.20	0.59	-	3.5	8.0	3.8

Table 34. Relative insect availability expressed in percent capture on the lesser prairie chicken study area, as ascertained by sweep net collections made at the flush site during the months of September, October, and November.

	Half-shrub (15)	Short Grass. (2)	Mid Grass (11)	Forb (1)
Orthoptera				
Acrididae				
Cyrtacanthacridinae	0.7	-	2.5	-
Gryllidae				
Oecanthinae	-	-	5.3	-
Phasmatidae	0.3	-	-	-
Other	0.3	-	-	-
Total	1.3	-	7.8	-
Homoptera				
Cicadellidae	0.5	-	-	-
Other	23.1	77.8	12.8	-
Total	23.6	77.8	12.8	-
Hemiptera				
Pentatomidae	8.5	-	7.8	25.0
Miridae	-	7.4	-	-
Other	54.4	3.7	43.6	75.0
Total	62.9	11.1	51.4	100.0
Coleoptera				
Malachiidae	1.2	-	-	-
Curculionidae				
Curculioninae	0.3	-	-	-
Chrysomelidae				
Galerucinae	2.7	-	4.9	-
Cerambycidae				
Lepturinae	0.5	-	7.8	-
Cleridae	0.3	3.7	0.8	-
Other	1.9	3.7	4.1	-
Total	6.9	7.4	17.6	-
Immature Insects	5.6	3.7	10.3	-
No. Insects/Sample	27.45	13.50	22.10	4.00

being made there (Table 35). The short grass and half-shrub life-forms were equally important during this period with 15 % use in each type.

Plant composition at the feeding site was reflective of the composition of the random samples taken in the mid-grasses (Table 36). This can be seen from the large amounts of sand dropseed and sideoats grama that were present. Some use of the short grasses and half-shrubs was also indicated by the presence of sand sage, broom snakeweed, and buffalo grass.

A total of 250 greater prairie chicken droppings was collected and analyzed for the months of September 1959 and 1960, October 1960, and November 1960. These data are presented by month in Appendix B (Tables IX, X, and XI). In Table 37 they are condensed to emphasize important foods.

Western ragweed showed the greatest degree of use during this period, comprising more than 51 % of the food of the birds using the native pasture unit during October. In the cultivated pasture, Korean lespedeza was much used, declining in use later in the season. Sorghum and corn were used to some degree in November, while sunflower seed also was important in the cultivated situations. Native foods such as the leaves of goldenrod and prairie gentian were predominant in the native prairie sample for September. During the months of October and November, western ragweed was the principal food. Grasshoppers were high in use in October and November in both vegetational units, but were particularly important on the native prairie areas. Beetles were used by these birds throughout the period.

Table 35. Comparative use of vegetational life-forms for feeding and resting by greater and lesser prairie chickens during the fall, Oklahoma, 1960.

Life-form	Lesser					Greater				
	Sept.	Oct.	Nov.	Total	Percent	Sept.	Oct.	Nov.	Total	Percent
Feeding Use										
Tall Grass	-	-	(6)*	(6)	4	2	-	(36)	(36) 2	(12) 1
Mid Grass	27	29	23	79	55	2	2	1	5	2
Short Grass	4	17	-	21	15	-	8	152	160	55
Half-shrub	-	6	16	22	15	-	-	-	-	-
Dwarf half-shrub	13	-	-	13	9	-	-	-	-	-
Tall Forb	-	-	-	-	-	1	-	-	1	-
Mid Forb	-	2	-	2	2	8	52	-	60	20
Short Forb	-	-	-	-	-	1	10	18	29	10
Total	44	54	45	143		14	72	207	293	
Resting Use										
Tall Grass	-	-	-	-	-	5	15	5	25	24
Mid Grass	7	-	3	10	11	2	4	5	11	11
Short Grass	-	-	-	-	-	-	11	25	36	35
Shrub	-	-	-	-	-	-	3	-	3	3
Half-shrub	2	10	9	21	22	-	-	-	-	-
Dwarf half-shrub	16	19	28	63	67	-	-	-	-	-
Tall Forb	-	-	-	-	-	3	-	-	3	3
Mid Forb	-	-	-	-	-	24	-	1	25	24
Total	25	29	40	94		34	33	36	103	

* Numbers in parentheses are birds using sorghum fields.

Table 36. Plant composition of areas used by lesser prairie chicken compared with random samples of plant communities on the Maple-Barby study area, for the fall period, comparison based on perennial plants only, Beaver County, Oklahoma, 1960.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites
	Short Grass	Mid Grass	Shrub	Half-shrub			
Buchloe dactyloides	55.02	3.08	1.02	2.86	-	-	9.19
Bouteloua gracilis	16.01	0.75	-	2.70	-	-	2.97
Sporobolus cryptandrus	8.08	22.46	13.40	24.71	12.92	26.19	25.16
Aristida purpurea	4.11	2.68	0.38	1.55	-	-	2.05
Bouteloua curtipendula	2.34	18.97	0.83	5.26	9.58	9.71	7.86
Chloris verticillata	1.79	5.71	1.50	1.65	2.70	2.77	5.67
Chrysopsis villosa	1.69	1.08	-	-	0.43	0.35	0.16
Opuntia macrorhiza	1.57	0.06	-	-	0.21	-	-
Artemisia filifolia	0.83	2.64	9.25	28.08	31.88	12.07	5.97
Rhus aromatica	-	0.54	40.38	0.55	3.34	1.41	0.68
Eragrostis trichodes	-	1.26	8.07	1.26	2.52	-	0.88
Prunus angustifolia	-	-	3.13	-	-	-	-
Ambrosia psilostachya	0.48	6.26	3.09	5.71	0.77	4.65	0.68
Bouteloua hirsuta	0.12	8.66	2.55	1.48	1.80	1.12	2.67
Paspalum ciliatifolium	0.15	1.61	1.98	1.90	1.50	1.77	0.16
Gutierrezia sarothrae	0.44	5.71	1.40	2.62	8.43	3.77	8.02
Andropogon saccharoides	0.09	2.56	-	-	-	-	0.59

Table 37. Greater prairie chicken food use expressed in percent volume and food index for the birds using the native pastures during the fall, Osage County, Oklahoma, 1959 and 1960.

Food Items	Percent Volume			Food Index			
	Sept.	Oct.	Nov.	Sept.	Oct.	Nov.	Avg.
Native Pasture Unit							
Coleoptera	3.42	0.70	1.40	-	-	-	-
Orthoptera	5.42	14.10	29.80	-	-	-	-
Hemiptera	0.14	0.36	-	-	-	-	-
Sabatia campestre	8.50	-	-	-	-	-	-
Solidago rigida	7.50	-	-	-	-	-	-
Linum sulcatum	2.07	-	-	-	-	-	-
Penstemon cobaea	2.50	0.40	-	-	-	-	-
Ambrosia psilostachya	1.21	51.76	14.63	10.9	30.6	23.7	21.7
Ratibida columnifera	2.14	-	-	-	-	-	-
Grass	0.85	0.18	1.55	-	-	-	-
Cassia fasciculata	0.71	-	-	-	-	-	-
Ruellia humilis	0.92	-	-	13.5	-	-	4.5
Helianthus annuus	-	0.69	-	-	-	-	-
Corn	-	-	1.13	-	-	-	-
Lespedeza stipulacea	-	-	1.08	-	-	-	-
Cultivated Pasture Unit							
Coleoptera	2.64	1.49	0.53	-	-	-	-
Hemiptera	0.15	-	-	-	-	-	-
Hymenoptera	0.11	-	-	-	-	-	-
Orthoptera	0.84	3.71	3.33	-	-	-	-
Solidago sp.	0.66	-	-	-	-	-	-
Ambrosia psilostachya	1.48	31.49	14.23	6.5	62.5	38.7	35.9
Lespedeza stipulacea	68.37	16.21	2.85	49.0	32.9	15.2	32.4
Physalis sp.	1.17	-	0.01	18.6	-	-	6.2
Cynodon dactylon	0.17	0.71	0.21	-	-	-	-
Grass	0.37	-	2.03	-	-	-	-
Sorghum vulgare	0.02	-	0.98	-	-	-	-
Helianthus annuus	-	0.35	3.59	-	7.0	19.9	9.0

During the fall, disturbed forb vegetation situations were again the best source of insects, with the mid and tall grass situations being important also (Table 38). Grasshoppers dominated the mid-grass unit, while beetles did the tall grass areas. This perhaps accounts for the larger amount of insects consumed by birds using the native prairie unit of the study area.

Life-form use for feeding by the greater prairie chicken indicated the short grasses being used by 55 % of the birds (Table 35). Most of this use occurred in November and was mainly within the cultivated pastures. If these are excluded, the heaviest use would be in the areas of disturbed mid forbs and short forbs.

Plant composition data again are indicative of the heavy use of the cultivated and native short grass areas, where Bermuda and buffalo grasses abound (Table 39). Most other components have no definite associative value.

Night Roosting. As its night roost in the fall the lesser prairie chicken chose the half-shrub or mid grass cover type (Table 36). Vegetative composition from a total of 20 night roost sites is presented in the table. Statistical tests of the height of eleven of these roosts as compared to the vegetation one meter in either direction proved to be highly significant ($F = 8.262^{**}$; 30 and 2 df). The mean heights were 4.9 cm over the roost and 14.8 cm on one side with 30.2 cm on the other. This is a clear indication of the birds' choice of moderately tall roosting cover, but selecting within this covert vegetation that is extremely short for the actual roost.

Table 38. Relative availability of insect food materials expressed in percent for the greater prairie chicken study area, as ascertained by collections made at the flush site during the months of September, October, and November, Osage County, Oklahoma, 1959 and 1960.

	Tall Grass (10)	Forbs (14)	Short Grass (6)	Mid Grass (6)
Orthoptera				
Tettigoniidae				
Conocephalinae	-	1.8	-	4.9
Copiphorinae	1.0	0.9	-	-
Gryllidae				
Oecanthinae	1.9	0.9	4.4	1.7
Acrididae				
Acridinae	-	-	-	1.7
Cyrtacanthacridinae	1.9	0.9	-	-
Oedipodinae	-	-	4.4	-
Other	3.9	0.9	-	4.9
Total	8.7	5.4	8.8	13.2
Coleoptera				
Chrysomelidae				
Chrysomelinae	1.0	0.4	-	-
Camptosomatinae	-	0.4	-	-
Galerucinae	6.8	2.3	-	1.7
Halticinae	-	0.4	-	-
Scolytidae	1.9	-	-	1.7
Carabidae	1.9	-	-	3.2
Mordellidae	-	0.4	-	-
Coccinellidae	-	0.4	-	-
Other	7.8	4.1	-	6.6
Total	19.4	8.4		13.2
Homoptera				
Cicadellidae	5.8	1.3	8.6	6.6
Other	29.1	32.8	52.1	49.1
Total	34.1	34.1	60.7	55.7
Hemiptera				
Scutelleridae	1.0	-	-	-
Pentatomidae	2.9	3.2	-	1.7
Reduviidae	-	-	-	3.2
Miridae	1.9	-	4.4	3.2
Other	36.9	48.7	26.0	9.8
Total	42.7	51.9	30.4	17.9
No. Insects/Sample	10.30	15.69	3.84	10.18

Table 39. Plant composition of areas used by the greater prairie chicken compared with random samples of plant associations on the Adams Ranch study area, for the fall period, comparisons based on perennial plants only, Osage County, Oklahoma, 1959 and 1960.

Plant Species	Random Samples				Percent Comp. at Day Resting Sites	Percent Comp. at Night Roosting Sites	Percent Comp. at Feeding Sites
	Tall Grass	Mid Grass	Short Grass	Cult. Past.			
Andropogon scoparius	33.36	4.39	3.63	-	12.72	7.21	3.12
Andropogon gerardi	28.68	3.98	0.66	-	9.37	47.80	0.76
Ambrosia psilostachya	11.24	22.34	16.00	9.87	19.32	9.78	9.32
Panicum virgatum	5.60	1.45	0.53	-	2.58	7.82	0.30
Panicum oligosanthes	2.75	3.36	4.63	-	1.10	5.01	0.72
Sporobolus asper	2.36	14.21	5.25	1.32	6.36	10.27	2.70
Sorghastrum nutans	1.50	0.97	-	-	0.07	1.22	-
Aster ericoides	1.47	2.65	1.18	0.02	0.66	-	0.49
Vernonia baldwinii	1.45	0.80	-	-	0.26	-	0.07
Bouteloua gracilis	-	10.52	16.34	-	0.16	-	-
Andropogon saccharoides	0.04	2.79	4.55	0.05	6.27	-	0.76
Juncus interior	0.69	1.98	4.16	-	0.14	0.37	0.58
Cynodon dactylon	-	-	1.37	13.61	10.50	-	6.73
Grindelia squarrosa	-	-	-	0.85	-	-	0.02
Solidago rigida	-	-	0.05	0.20	-	-	0.07
Buchloe dactyloides	0.50	3.35	20.65	-	3.50	0.37	6.59
Chloris verticillata	-	0.30	1.82	0.12	1.57	-	1.11

The greater prairie chicken, by contrast, selected tall grass vegetation for fall roosting (Table 39). The vegetal composition of six night roosts is presented in the table. Statistical examination of plant heights over the roosts and at one meter intervals proved highly significant ($F = 11.38^{**}$; 6 and 2 df) with a mean of 5.3 cm over the roost and 50.7 cm on one side with 52.0 cm on the other. Illustrating again their choice of a very short vegetation for roosting, within a cover of taller vegetation.

Day Resting. The lesser prairie chicken's choice for resting situations was usually within the half-shrub life-forms (Table 35). The taller half-shrub life-form formed 22 % of 94 resting observations. The shorter dwarf half-shrub life-form accounts for 67 % of the observations, making a total of 89 % of the resting birds. Mid grasses were the only other vegetational life-form utilized for this purpose.

Vegetational composition at the resting points of the lesser prairie chicken was also closely related to the half-shrub vegetation (Table 36). The birds selected situations with heavier brush cover than found in the random samples as indicated by the heavier proportion of sagebrush and broom snakeweed. Skunkbush sumac and sand lovegrass were also indicative of the somewhat heavier plant cover preferred for resting by these birds at this time of the year.

A statistical comparison of plant cover values of feeding and resting situations for the lesser prairie chicken showed no significance ($t = .175$; 44 df). A highly significant difference was indicated between the feeding and resting associations when plant heights for

the two activities were compared ($F = 12.47^{**}$; 133 and 1 df). The mean heights of the vegetation at the feeding site was 31.5, while the resting birds were flushed from vegetation 44.4 cm in height.

The greater prairie chicken selected a variety of situations for resting, with the short cultivated grasses being favored (Table 35). These formed 35 % of the 103 resting birds flushed. Tall grasses and mid forbs were second in importance with 24 % of the total in both cases.

Vegetational composition verifies the importance of the short cultivated grasses for feeding (Table 39), with tall grass and mid forb habitat components being next highest on the list.

Plant cover comparisons again reveal no significant difference in resting and feeding situations ($t = .245$; 57 df). Analysis of variance comparisons of plant height show a highly significant difference of the height of the plants between the activities of feeding and resting ($F = 54.81^{**}$; 112 and 1 df). The mean height of the resting cover was 41.3 cm while the mean height of feeding covers was 18.9 cm. No significant difference was found between the plant height over the site of the activity and the plant height one meter away on either side.

COMPARISON OF THE HABITAT USE OF THE GREATER AND LESSER PRAIRIE CHICKEN

Much has been written about the food resources used by the greater prairie chicken (Baker, 1953; Gross, 1930; Schmidt, 1936; Schwartz, 1945; and Yeatter, 1943). The same apparently is not true of the lesser prairie chicken, as only two short lists have been found (Davison, 1935; and Frary, 1957). Agreement as to the most used items in these lists for each species of prairie chicken were close to the data presented in this report. What differences there were appear primarily attributable to differences concerning the resources available in the respective areas and time periods reported.

Foods were chosen by the prairie chickens according to preference and to availability. Certain foods, such as, stink bugs (Pentatomidae) which appeared in 50 % of the availability samples taken by sweep-netting during the fall on the lesser prairie chicken study area, occurred in only 0.6 % to 3.6 % of droppings analyzed for this period. Even more striking was the difference between the relative numbers of Hemiptera and Homoptera in the availability samples, and the food residue found in the droppings. For example, the summer use of Hemiptera rose above 1 % during only one month, yet these insects ranged between 40 % and 60 % of the available insects (Tables 24 and 25). Conversely Orthoptera ranged between 30 % and 94 % occurrence in samples taken in the fall in Beaver County, yet the availability of

grasshoppers at this time was calculated as between 1.3 % and 7.8 % of the total insects captured. These results differ in principle with McAttee's (1932) theory that the predator (in this case the prairie chicken) is " . . . largely guided in choice of food by availability as practically to ignore protective adaptation." The lesser prairie chicken appears to exercise a high degree of selection in its use of insect prey, a selectivity as shown by the examples pointed out above, which is exercised despite the low relative abundance of the prey selected.

Specific foods of the lesser and of the greater prairie chickens are noticably different (Tables 40 and 41). Comparison of the residues representative of insect orders found in the droppings of the two bird species shows that both like grasshoppers and beetles. These insects are, however, among the three most favored foods of the lessers. When insect residues down to sub-family are compared for each prairie chicken, very little similarity is noted (see monthly food data in Appendices A and B). Differences in the principal foods used within the various vegetative units on the study areas were small (Table 40). When the food items are ranked by a food index, which in reality amounts to a comparison of the food preferences of the two birds, an even greater difference in the food materials used by them is noted as Table 41 shows. Only one food species, johnny-jump-up, was found common among the more important foods of the two species of prairie chicken. From the above contrasts, it is evident that the diets of these two species of prairie chickens were distinctly dissimilar.

Table 40. The ten most used foods ranked by approximate volume for the two species of prairie chicken in Oklahoma, 1959 to 1961.

	Greater Prairie Chicken		Lesser Prairie Chicken	
Food Items	Native Habitat Type	Cultivated Habitat Type	Half-shrub Habitat Type	Shrub Habitat Type
Orthoptera	3	7	1	1
Rhus aromatica	-	-	4	2
Coleoptera	7	6	2	3
Festuca octoflora	-	-	6	4
Evax prolifera	-	-	5	5
Grass	4	4	7	6
Eriogonum annuum	-	-	10	7
Immature Insects	-	-	3	8
Artemesia filifolia	-	-	-	9
Cyperus schweinitzii	-	-	-	10
Silene antirrhina	-	-	8	-
Hemiptera	-	-	9	-
Ambrosia psilostachya	1	3	-	-
Sorghum vulgare	2	2	-	-
Solidago rigida	5	-	-	-
Sabatia campestre	6	-	-	-
Lespedeza stipulacea	8	1	-	-
Bromus japonicus	9	5	-	-
Eliocharis	10	1	-	-
Wheat	-	9	-	-
Physalis sp.	-	10	-	-

The differences between the major categories of seeds, leaves, and insects used by the two prairie chickens also are striking (Table 42). It might be assumed that difference in specific foods could be an artifact of sampling two areas so different ecologically. Yet when the major categories of seeds, green vegetation, and insects are examined differences are still significant. Of particular interest in this respect was the large percentage of insect material consumed by the lessers and conversely the greaters' extensive use of the seed resource.

Table 41. The ten most used plant foods ranked by food index for the two species of prairie chicken, in Oklahoma, 1959 to 1961.

	Greater Prairie Chicken		Lesser Prairie Chicken	
Food Items	Cultivated Habitat Type	Native Habitat Type	Half-shrub Habitat Type	Shrub Habitat Type
Solidago rigida	-	1	-	-
Ambrosia psilostachya	3	2	-	-
Bromus japonicus	4	3	-	-
Galium aparine	-	4	-	-
Oxalis stricta	2	5	-	-
Plantago rugelii	-	6	-	-
Hypoxis hirsuta	-	7	-	-
Carex sp.	-	8	-	-
Linum sulcatum	-	9	-	-
Viola kitaibeliana	9	10	6	8
Lespedeza stipulacea	1	-	-	-
Physalis sp.	5	-	-	-
Wheat	6	-	-	-
Melilotus officinalis	7	-	-	-
Cynodon dactylon	8	-	-	-
Elymus canadensis	10	-	-	-
Festuca octoflora	-	-	1	5
Cyperus schweinitzii	-	-	2	2
Artemesia filifolia	-	-	3	4
Eriogonum annuum	-	-	4	7
Evax prolifera	-	-	5	3
Plantago purshii	-	-	7	-
Gutierrezia sarothrae	-	-	8	6
Sporobolus cryptandrus	-	-	9	10
Lepidium virginianum	-	-	10	-
Rhus aromatica	-	-	-	1
Tradescantia occidentalis	-	-	-	9

Plant life-form types used for feeding activity showed some similarity for the two species of prairie chicken (Table 43). Both species spent most of their feeding time in grass cover. The differences in feeding area were principally as to height divisions. The life-form most used by the lesser prairie chicken for feeding consisted of mid grasses, while the tall grass, short grass, and dwarf half-shrub life-form were frequented less often. The greater prairie

Table 42. Comparison of food composition when broken into the categories of seeds, green vegetation, and insects in Oklahoma, 1959-1961.

	Percent Volume Seeds	Percent Volume Green Vegetation	Percent Volume Insects	Percent Volume Seeds	Percent Volume Green Vegetation	Percent Volume Insects
	Lesser Prairie Chicken					
	Half-shrub			Shrub		
January	3.61	21.27	4.60	2.05	15.46	2.25
February	1.27	6.32	3.18	5.04	21.13	2.55
March	.65	9.30	15.59	3.84	18.86	6.43
April	.72	16.50	11.23	.44	12.81	4.78
May	10.31	3.80	7.76	5.02	4.67	6.64
June	7.24	.90	17.95	25.17	2.29	22.58
July	8.59	2.41	12.95	23.09	2.67	15.39
August	1.99	2.99	15.99	8.34	2.04	23.24
September	1.51	1.27	15.67	3.06	.65	18.11
October	5.08	1.74	17.32	5.36	1.05	20.41
November	4.54	12.17	6.74	3.16	7.86	9.74
December	7.41	12.39	7.43	1.56	12.11	3.14
Total Percent Volume	18.9	32.5	48.6	26.7	31.5	41.8
	Greater Prairie Chicken					
	Native Prairie			Cultivated Pastures		
January	35.03	16.51	.61	24.96	13.97	.94
February	21.70	15.27	2.52	28.27	6.15	2.63
March	12.99	14.71	2.14	9.89	20.88	1.99
April	.14	17.88	1.39	-	-	-
May	11.26	18.57	3.92	-	-	-
June	15.89	12.51	8.08	4.61	31.06	7.76
July	2.97	18.12	12.05	1.20	55.43	5.50
August	4.69	23.48	8.33	5.26	53.66	4.14
September	8.20	18.62	9.08	4.21	68.75	3.80
October	53.46	.18	15.26	36.25	14.06	5.27
November	17.24	1.94	31.10	25.80	2.08	3.90
December	7.67	12.84	.69	21.06	12.18	3.22
Total Percent Volume	41.8	37.4	20.8	33.7	58.1	8.2

Table 43. Summary of life-form use emphasizing change in seasonal aspect throughout the year by both species of prairie chickens for the activities of feeding and resting expressed in percent use, 1959 to 1961, Oklahoma.

Plant Life-form	Lesser Prairie Chicken					Greater Prairie Chicken				
	W.	Sp.	Su.	F.	Avg.	W.	Sp.	Su.	F.	Avg.
FEEDING										
Trees	-	-	-	-	-	5	-	-	-	1.3
Tall Grass	59	-	-	4	15.7	50	30	2	13	23.8
Mid Grass	23	21	23	55	30.5	-	13	17	2	8.0
Short Grass	-	20	16	15	18.8	32	47	25	55	39.8
Shrub	6	3	16	-	6.3	-	-	-	-	-
Dwarf Shrub	4	8	8	-	5.0	-	-	-	-	-
Half-shrub	-	-	6	15	5.3	-	-	-	-	-
Dwarf half-shrub	8	47	3	9	16.8	-	-	-	-	-
Tall Forbs	-	-	-	-	-	1	-	17	-	4.5
Mid Forbs	-	-	27	2	7.3	1	5	22	20	12.0
Short Forbs	-	1	-	-	0.3	11	11	17	10	12.3
RESTING										
Trees	-	-	-	-	-	-	-	2	-	0.5
Tall Grass	-	-	6	-	1.5	17	46	10	24	24.3
Mid Grass	9	4	6	11	7.5	45	29	20	11	26.2
Short Grass	-	2	1	-	0.8	30	17	12	35	23.5
Shrub	-	-	23	-	5.8	-	-	-	3	0.8
Dwarf Shrub	-	10	19	-	7.3	-	-	-	-	-
Half-shrub	18	1	12	22	13.3	-	-	-	-	-
Dwarf half-shrub	73	83	30	67	63.3	-	-	-	-	-
Tall Forbs	-	-	-	-	-	-	-	5	3	2.0
Mid Forbs	-	-	3	-	0.8	-	1	51	24	19.0
Short Forbs	-	-	-	-	-	8	6	-	-	3.5

chicken used for feeding the short grass life-form, with the tall grass life-form ranking second in importance. When the life-form categories were grouped without considering height, grassy situations were most important to both birds for feeding, with half-shrubs ranking second for lesser chickens and forbs ranking second for greater chickens.

The plant life-form used by the lesser prairie chicken for feeding most consistantly through the year was the mid grass, while short grasses were the most consistantly used life-form by greater prairie chickens. Other life-forms used for feeding activity were more short term in utility, providing the principal food items during one season only. Examples of the seasonal importance of certain life-forms were tall grasses (sorghum) in the winter for both species, and trees in the winter for the greaters.

Differences in the plant life-forms used for resting by the two prairie chickens were even more striking (Table 43 and Fig. 8). Half-shrubs were used to the greatest degree by the lesser prairie chickens, while grass was used in almost the same proportion by the greater prairie chicken. Seasonal use of these life-forms points up even further dissimilarity. During the summer, shrubs and half-shrubs were used to a great degree by resting lessers, while at the same time mid-forbs were used similarly by the greaters.

The measure of total plant cover, as has already been pointed out earlier, proved to have no significance (neither between activities $F = 1.77$; 431 and 3 df: nor between seasons $F = 1.29$; 431 and 15 df) for either one of the species. Percent of cover did prove, however, to be an effective means of differentiation between the total plant cover

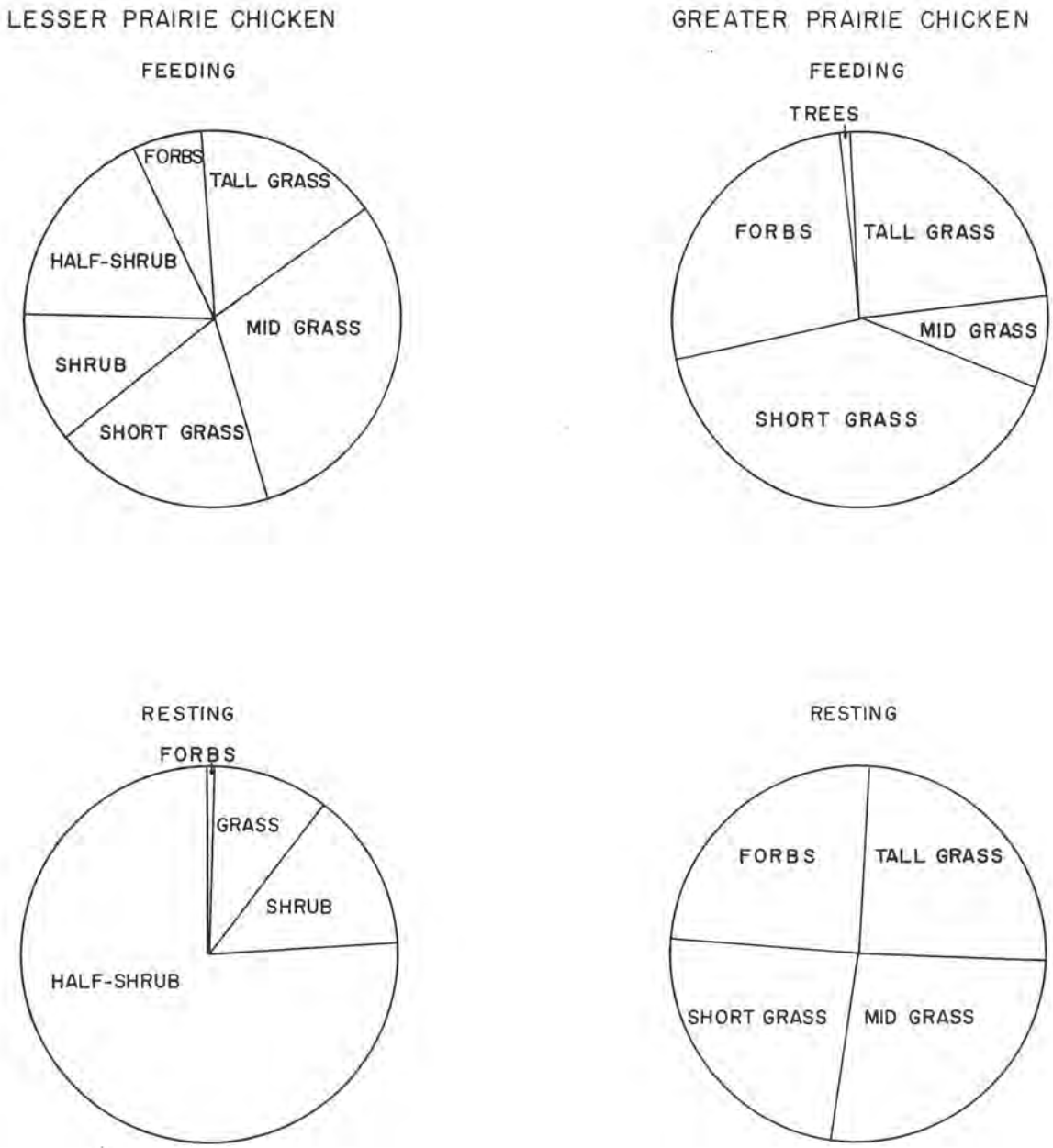

Fig. 8. Proportional prairie chicken use of plant life-forms for feeding and resting.

used by the two species of prairie chicken ($F = 14.04^{**}$; 431 and 1 df). The percent of plant cover averaged 64.6 for the lesser prairie chicken and 72.6 for the greaters. This is suggestive of the readily apparent difference in plant cover between the two study areas.

Plant height was compared for differences in use by the two species of prairie chicken with regard also to the activities of night roosting, day resting and feeding for the four seasons of the year. For these activities, plant height by itself, did not form a basis of habitat difference between the two species. In other words, the plant heights used for these activities were similar for both prairie chickens ($F = 1.03$; 1587 and 1 df). If these activities are taken for either species of prairie chicken, and the use of plant height is contrasted season by season as has been pointed out in the text or by grouping the seasons into activity segments, the difference between plant heights used for the several activities was highly significant ($F = 13.72^{**}$; 1587 and 5 df). If we do not consider the differential use based upon activity, and separate the data only on the basis of the four seasons of the year, the differences in height use proves to be non-significant ($F = 1.30$; 1587 and 22 df).

Adequate statistical models are not available for computation relating the abundance of the floral components in the random samples to those components which the prairie chickens actively used. When the quantitative plant distribution data were compared to the random samples of the same type, some idea of particulate use of the vegetation can be obtained (Tables 10, 16, 20, 23, 27, 30, 36, and 39). A satisfactory measure of floristic similarity for comparing presence of

floral elements of two vegetational units is the Sørensen Index of Floral Similarity. When the study areas are compared by means of this test, very little floristic similarity can be demonstrated (Table 2). Even less similarity could be discerned when comparison of the various uses were attempted.

Mohler (1952), working in an area of greater prairie chicken range which contained half-shrub areas, found the greater to prefer grassy cover to the half-shrub sagebrush. " . . . only temporary or short time use of dense sage cover was noted during the study." His study, made in an area where both half-shrub and grasses were present, points out clearly the non-essential character the half-shrubs play in the habitat of the greater prairie chicken.

Courtship areas used by the two species of grouse proved to be slightly, but significantly different in plant height. When plant cover on these areas is considered, no significant difference can be demonstrated between the two prairie chickens. Similarities in composition also can be discerned as in the high percentage of buffalo grass in the courtship areas of both species. Plant cover was usually continuously distributed on the booming grounds studied. Hamerstrom et al. (1957) have pointed out the following characteristics of booming area of the greater prairie chicken:

1. "They are placed in open, exposed places with wide horizons."
2. "They have short cover, as on grazed or mowed meadows, where grass has been flattened under snow or no cover at all."

The findings of this study are in agreement with these conclusions.

It is a common assumption that the nesting and brood rearing coverts are similar if not alike and Hamerstrom et al. (1957) have pointed out the need for grassland areas for nesting and brood rearing. The broods of the greater prairie chicken were usually found in the edaphically controlled short and mid grass vegetation, old fields going back to native vegetation, or in the cultivated pastures. Lesser prairie chicken broods, on the contrary were found in either shrub or half-shrub coverts with a high proportion of forbs. Broods are usually found along the edges of shorter vegetation, which was often in a sub-climax stage of succession, while the nests found during the present investigation were found in the tallest and densest vegetation occurring on the area.

Cultivated land was very important to the greater prairie chicken. Sorghum fields, for example, received, with few exceptions, intense use during winter by all the birds known to be present in an area. Cultivated pastures of Bermuda grass interplanted with Korean lespedeza were used throughout the year. These were used with particular intensity during the summer and fall. Over-planted to wheat and rye, the cultivated pastures provided feeding areas throughout the winter months. Their use of severely disturbed lands, limited to only four birds, suggested a few of these birds could exist on the study area during the winter months independent of cultivated land. Bennitt (1939) also pointed out that the greater prairie chicken in Missouri is associated with cultivated lands. He stated that "occupied areas have this in common, - lower land values and corn productivity; higher percent of land in sorghum, annual legumes, timothy and clover; and

other grasses." Thus it seems that the cultivated areas play an integeral part in maintaining greater prairie chicken numbers.

The lesser prairie chicken, on the contrary, seemed to get along well without using cultivated lands. Yet intense use was made of sorghum fields when these were present and accessible to the birds. Most of the birds on the lesser prairie chicken study area, however, did not make use of crop lands; as they were found on range lands at all times. Food use by these birds also showed that sorghum was used only by those birds located nearest to the sorghum fields. Even birds using sorghum fields did not exclusively feed on sorghum to the extent the greaters did. Cultivated land, therefore, does not appear to have the importance to lesser prairie chickens that it does to greater chickens.

Soils and the resultant plant distributional patterns affect prairie chicken use considerably. Lesser prairie chickens used the tight, clay loam soils for feeding and booming, and the loose sandy soils with their associated half-shrub and shrub communities for resting, dusting and also for feeding. Broods also were found usually on the loose soils covered with shrub and half-shrub vegetation. Elevation seemed to effect some use patterns, particularly night roosts, day resting, and courtship sites. These were usually located on slight elevations, or at least in areas where visibility was largely unobstructed.

The shallow, droughty soils of the greater prairie chicken study area and the associated short and mid grasses were used by the greater prairie chicken for booming and feeding. Resting greater chickens

usually selected contact zones between the tall grass and the short and mid grass areas. The deep soils, with the tall grasses, were used by the birds for night roosts and nesting. Broods were generally found in disturbed situations.

Habitat Summary. If we take the two species considered in this investigation and apply the known data to their habitats, the following outline of habitat use may be related to habitat management.

For the lesser prairie chicken:

1. The food resources used vary, but were made up primarily of insects. These form the bulk of the foods used during the late spring, summer and fall. Fruits of the skunkbush sumac become important during the summer to birds in areas where these plants abound. Skunkbush sumac was also important during the winter months, when their buds formed the principal food during periods of heavy snow fall. Green leafy vegetation was found to be the primary food during the winter and early spring, being replaced in early spring by larval insects in the half-shrub vegetation. During the season of the heaviest insect use, the summer, the greatest number of insects was produced in the plant associations with the highest number of forbs.
2. Resting birds used as their principal cover the dwarf half-shrub life-form. Vegetation used for this purpose averaged taller in height than that used for other purposes within the same plant communities. The birds ordinarily selected a hill top or ridge for resting, from which visibility was unobscured. During summer,

some use was made of shrubby vegetation for resting, possibly to take advantage of the heavier shade provided.

3. For night roosting, vegetation of a medium height was selected, usually of the half-shrub or the mid grass type. This bird used low cover with even shorter vegetation selected as the actual roosting site. Night roosts were almost always on elevations overlooking as much area as possible.

4. Courtship areas were always located in short vegetation, usually on a ridge or other elevated area. The vegetation in only two instances consisted of something other than short grasses. In these, brushy species were present. Compared to the surrounding vegetation these were low in height.

5. Insufficient data were available concerning nesting habits of the lesser prairie chicken. From the limited data obtained, it is assumed that these birds, like the greater chicken, also make use of heavy cover not distant from the booming area.

6. Abundant forbs were present in the plant associations used for brood ranges. The forbs were usually associated with disturbed areas within the shrub and half-shrub vegetation. These associations possessed the highest availability of insects, an important food of the young birds.

For the greater prairie chicken:

1. Food resources used also were varied, but the birds apparently chose those coverts which provided plentiful quantities of seeds. Sorghum was the deitary staple of the winter period. Summer foods

leaned heavily toward green leafy vegetation, and to a lesser degree toward the insects which are extremely plentiful at this time.

2. When resting, these birds tend to use a taller vegetation than when feeding. Sites providing good visibility presumably were preferred in their selection of resting cover. The edges of tall and mid grasses and tall and mid forbs were much favored for resting sites.

3. For roosting at night, tall grasses were selected of about the same height and density as those selected for day resting. The roosting bird ordinarily did not select the edge of a covert. Rather it selected a location within the tall grass where the vegetation was significantly shorter than the over-all cover. During the summer period this selectivity did not occur, and the birds at this time used areas of rather even physiognomy. Areas of low plant physiognomy in tall grass cover often resulted from cattle grazing. This influence, as is to be expected, was greater after the summer growing season was completed.

4. Courtship areas were always within vegetation of short stature, located usually on a ridge or a situation slightly higher than the surrounding country side. Occasionally the birds selected for this purpose areas that been mowed and heavily grazed the previous summer. Two booming grounds were known to have been moved into mowed areas for this reason and several other movements probably were related to this influence.

5. Nesting areas were always located in the tallest cover in the vicinity of the booming grounds. Since all nests found during this study were within a half mile of the booming ground, suitable nesting cover near these is presumed to be essential. All nests found during this study also were close to cultivated pastures or old field areas. Possibly so the brood will not have to move far to the food sources. Another interesting observation was the fact that all nests found were located within one-quarter mile of a watering place. This may have been coincidence and, therefore, needs further testing in a less well watered area.

6. Broods seem to require an area of weedy vegetation, one high in forbs. This need is associated with the high production of insects in this type of vegetation and the fact the young birds subsist primarily on insects during the first weeks after hatching. This vegetal type is preferred for resting as well as for feeding by the young birds.

of the ranchers' grazing program. Overplanting these areas to winter wheat or rye creates additional feeding sites during the winter.

2. Sorghum fields for providing winter food. The principal food item of the greater prairie chicken during the winter months in those areas studied, is sorghum. The location of sorghum fields can be very important. They should be as far from trees as possible so that sparrow and starling flocks do not clean them before the prairie chickens begin to use them. Relatively large fields located some distance from other cultivated fields are presumably most useful. Usually birds near cultivated areas fare quite well on waste grains and shocked sorghum.

3. Spring burning should not be done on prairie chicken nesting areas. Fire is often used by ranchers to reduce grass litter from the previous years growth and hence to encourage grazing on these areas by exposing the green growing plants. These areas of heavy grass and litter are ideal nesting situations for prairie chickens if food, water, and booming grounds are available. If burning in the nesting areas must be done, it should be carried out before March 31, so that direct losses of nests and adult females can be held to a minimum.

4. Mowing of display grounds. This may be practiced to enhance areas where few or no short grass areas are available to the

birds. Where plowed fields, cultivated pastures, heavily grazed areas, or native short grasses are available to the birds, this practice is unnecessary.

5. Fencing small areas near cultivated pastures could be recommended to increase the area of nesting cover. This would be necessary only where pastures are intensively grazed.

Habitat Management for the Sand Sagebrush Portion of Lesser Prairie Chicken Range in Oklahoma.

The findings of this report indicate that very little can be done in the way of direct habitat management of lesser prairie chicken range, except to retain rangelands in good condition for their use. A base has been provided, however, to show what the birds use during the course of a calendar year. The following suggestions are made to prompt leads to pursue for future investigation with actual experimentation in habitat management.

1. A feeding situation analogous to the cultivated pasture in the range of the greater prairie chicken needs to be developed for the lesser prairie chicken. This would have to be high in percentage of forbs, preferably legumes, and with a low grass cover for the protection of the birds. These might be scattered through the management area. Overplanting to wheat or rye might be successful in adding additional winter foods.

2. Another suggestion would be fencing certain areas so that an increase in nesting cover can be encouraged. These areas

should be located near active booming grounds. If the problems of implementing Suggestion No. 1 were surmounted, these two suggestions might work very well in combination.

3. Mowing certain booming areas, which truly are threatened by brush invasion, might enhance their value to the birds. This practice might even be used to create new booming grounds on areas deficient in short grass cover. If attempted, a ridge overlooking considerable area should be chosen for mowing.

from the standpoint of habitat unit with definitive boundaries as has been done by Emlen (1956) and Elton and Miller, (1954). Features outside of the bounded area which are used, or unused features within the area, give the wrong impression of what makes up the habitat of an animal. When the approach is from the point of view of what that animal actually uses, a description more definitively helpful can be developed.

The animal species may choose a different habitat component for each of its life activities. These components have been termed centers of activity by Elton and Miller (1954). Obviously resources to satisfy nutritional needs are necessary. Another necessity is cover of the proper physiognomy for reproduction. If special courtship areas are necessary, these must be present within easy flight distance of the nesting area. Special conditions for nesting may be mandatory for the perpetuation of species, and again these may need to be close to the brood coverts if these differ from the rest of the area. Resting places must be available for both day and night use. If these uses require different vegetal types, then these two different habitat components must be present. Each activity center may be identified by plant life-form, plant height, plant cover, plant dispersion, or by interaction with other animal members of the community, such as the presence or absence of insects used for food. A particular component then can be seen to be comprised of a particular assemblage of parts or elements.

Many investigators have pointed out that higher vertebrates, particularly birds, seem to respond to features related to the physiognomy of the vegetation (Elton and Miller, 1954; Emlen, 1956;

MacArthur, 1958; Miller, 1942; and Svärdson, 1949). The use of a systematic classification of the physiognomy of the habitat used by the animal species should be an effective approach to habitat evaluation. A system of plant life-form classification appears to offer a helpful base upon which to develop a habitat description.

The Du Reitz (1931) life-form system was found to be the most useful, because of its clearness and simplicity. Although Du Reitz used a complicated terminology, it is far superior, for the purposes of habitat evaluation, to the systems of Raunkiaer (1934), Drude (1890), or Rübel (1930). The height division points of this system are perhaps the most useful available for the use of animal ecologists. Du Reitz's life-form criteria are easily understood and easily differentiated in contrast to those of Raunkiaer (1934), which are based on the height of the perrenating bud, the physiologically based life-forms of Drude (1890) or the simplified perrenating bud system of Rübel (1930). The more recent systems of Küchler (1949) and of Dansereau (1951 are difficult to handle when changing from one life-form to another. The reason being that height relationships change from life-form to life-form while Du Reitz retains the same height classes through each category.

Floral comparisons of two habitat units can be made through the use of the Sørensen Index of Floral Similarity. This system provides a criterion for the separation of the communities on a common basis by comparing the species content of the two plant communities. Hanson and Dahl (1957) used it successfully to separate grassland communities in Colorado. It has the disadvantage, however, of not considering the

abundance of the species within the community. This index has been used for the first time in this report for the purpose of comparing the habitats of two closely related animal species. With additional work, it could be employed to compare the separate habitat use features with one another.

Height of the vegetation already has been used to differentiate the habitats of birds (Lack, 1933). Although height is recognized by him as not the only feature of the environment which conditions habitat selection, for most species considered by him height of vegetation figured prominently. This feature was also found to be of importance for the prairie chickens. When their courtship areas are considered, for example, one finds the heights average 5 cm lower for the lesser prairie chicken than for the greater. This was, however, the only distinction observed interspecifically on the basis of height of vegetation alone. Intraspecifically, height was extremely important. Courtship grounds were composed of very short grasses, providing a turf-like area; resting areas usually were associated with a medium to tall vegetation; night roosting sites were similar to the resting situations in general over-all height conditions; and nesting sites were among the tallest plants available to the birds, exclusive of trees which were not used.

Plant dispersion or the sociological arrangement of the plant species can be an extremely important facet in the selection of a particular plant community by an animal species. An instance of importance of this feature may be seen in Table 14. A consistant difference may be noted in that the greater prairie chickens used

continuous vegetation to a greater degree than the lesser prairie chicken did and conversely that the scattered and bunched vegetation are used to a measurably greater degree by the lesser.

The comparative approach to the study of an animal's habitat is not uncommon, though usually it is limited to study and comparison of sympatric species (MacArthur, 1958; McCabe and Blanchard, 1950; Moreau, 1948; and Wirtz and Pearson, 1960). For the comparison of allopatric groups, a common denominator is needed to dissect and describe habitat. Seiskari and Koskimies (1956) have effectively used feeding habits and winter roosting habits to differentiate two races of capercaillie, each living in different areas.

The graphic presentation shown in Figure 9 is an example of the degree of habitat definity that can be identified for the different activities of a single species. This chart shows height of average cover for a particular use, the life-form as well as the general appearance as a symbolic representation. It also shows seasonal differences in the same activities through the calander year. In a very general way, it gives an idea of the proportion of use a habitat feature (element) received from the birds. A descriptive presentation such as this would not be possible without considering it from the point of view of actual bird use.

The method described above has proven effective for describing the habitats of greater and lesser prairie chickens in Oklahoma. A great deal of additional testing is necessary to find out whether these criteria used for describing prairie chicken habitat are consistant throughout the range of these species. Major differences in plant taxa

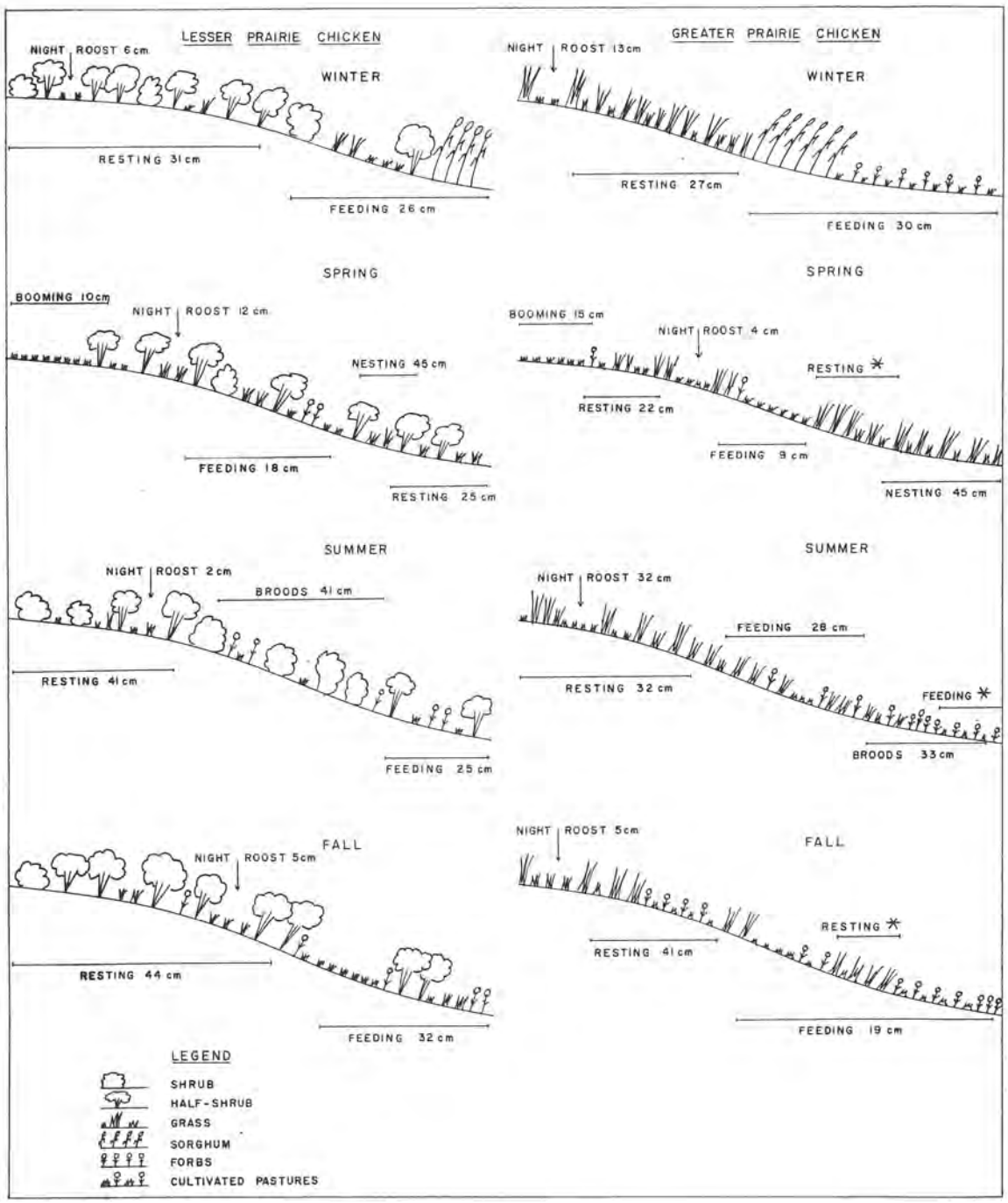

Fig. 9. Life-form use portrayed symbolically emphasizing the seasonal use for the vital activities of the prairie chicken. Asterisk represents height measurements given for the same activity previously in the same drawing.

can be expected to occur in the northern portion of their range when compared to the southern portion. Plant life-form use by the birds should be relatively constant throughout the range, however, and thus form an effective means of habitat description.

The methodology upon which this report is based represents a compounding of the methods of the plant and animal ecologist. The combination of plant life-form, floral comparison, plant height, and plant dispersion makes up a more definitive habitat description than was formerly available. Consideration of habitat from the standpoint of use for all of the vital activities rather than approaching it by describing a bounded habitat unit, allows a more complete identification of the animal habitat.

SUMMARY

1. This study was undertaken to extend knowledge of the essential components of the habitats of the lesser and of the greater prairie chickens on a comparative basis. The habitat of an animal is here considered to be the place in which it lives and carries out all its life functions.
2. Study areas for each species were selected on typical Oklahoma ranges. The greater prairie chicken study area was the K. S. Adams Ranch in Osage County. That for the lesser prairie chicken was the Maple Ranch and a portion of the Lloyd Barby Ranch in Beaver County. Half month study periods were spent on each study area during the period June 1959 to September 1959 and February 1960 to September 1961.
3. Hythergraphic presentation of the climatic features of temperature and precipitation showed very little overlap in climatic influences affecting the study areas of the two birds.
4. During the study period no change other than the usual short-term fluctuation was noted in the prairie chicken populations of the two study areas.
5. Phenologic changes occur in the plant species used by the prairie chicken. Bird use of particular habitat features changes as a result. Leaf and seed production were two phenomenon importantly influencing the oird's use of environmental resources.

6. Winter habitat use by the lesser and by the greater prairie chickens differed in many respects. Lessers did not frequent cultivated crop and pasture lands for feeding to any extent like the greaters. The lesser used the half-shrubs for resting, whereas the greater used mid grasses for the same purpose. The night roosts of both were in short vegetation within areas of vegetation of medium height.

7. Spring habitat use by the two species of prairie chicken was more complex than during any other season of the year. Foods of the lesser prairie chicken were primarily insects, though the seeds of winter annuals also were important. The greaters fed mainly on sorghum and the foliage of early green vegetation. Resting lesser prairie chickens used the half-shrub life-form, while greaters used, for the most part, the tall grass life-form. Night roosts used by both species during the spring were similar to those used in winter. The prairie chickens' courtship areas were located on hills or ridges in the short grass life-form. Nesting sites of the greater were found in pasture corners more lightly grazed than most of the area. Here the tall grasses reached their greatest height and density. The lesser prairie chickens' nesting site is not as well known as that for the greater, but apparently was situated in the taller grasses and half-shrubs.

8. The summer habitat of these two birds differed considerably from that of the other seasons of the year. Insects were the food of greatest use to the lessers, but the greaters used green leafy materials for the most part. Seeds were used by both prairie

chickens, but more heavily by the greater. For resting during the summer the lesser prairie chicken used the half-shrub and shrub life-forms. Resting greater prairie chickens selected a variety of covers, but mid grasses were selected by many for this purpose. Lessers chose for resting half-shrubs and shrubs. Lesser prairie chickens followed the night roost patterns of the previously discussed seasons, that of selecting pockets of short vegetation within a taller vegetation. Greater prairie chickens used vegetation of a uniform height for night roosting.

9. Fall habitat use by the prairie chickens was similar to that during the other seasons of the year. Lesser prairie chickens consumed large quantities of insect materials, while the greaters made extensive use on the seeds of the late summer perennials for their foods. Half-shrubs were the life-form used for resting by lessers while the resting situation of the greaters showed no consistant life-form. Night roosts of both birds were again found in vegetation of short stature within the taller vegetation.

10. An integrated methodology for the identification and description of an animal species' habitat has been developed. An important point of this method was the consideration of habitat in the terms of actual animal use rather than measuring unused areas just because they fall within the boundaries of an animal's home range or those of a particular plant association. Measurement of vegetation used by the birds was made in terms of life-form, height, floral similarity, and plant dispersion. Recognition of

the phenology of the plants as well as seasonal variation in animal activities was an important consideration.

11. The habitat of a species population is of a very complex structure. The term grassland habitat is not sufficiently definitive for the purposes of the land manager concerned with prairie chicken management. As a general overlook of the habitat of the two species, they might be described as follows: lesser prairie chickens - small units of short grass prairie mixed with large units of shrub or half-shrub vegetation. Greater prairie chicken - small units of short or mid grasses mixed with large units of tall grasses. Height and arrangements of these units have been symbolically represented in Figure 9.

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APPENDIX A

Table 1. January food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1961.

Food Items	Half - shrub Sample Size 82				Shrub Sample Size 20			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	3.6	.06						
Chrysomelidae								
Eumolpinae	36.5	.73			55.0	1.10		
Curculionidae								
Otiorhynchinae	3.6	.04			5.0	.05		
Carabidae	1.2	.01						
Orthoptera	6.1	.08						
Acrididae	28.0	.58			5.0	.10		
Cyrtacanthacridinae	6.1	.37						
Acridinae	1.2	.06						
Immature Insects	4.8	2.67			30.0	1.00		
Plants								
Festuca octoflora (L)	70.0	3.73	74.0	18.4	80.0	6.55	63.8	29.0
" " (S)	1.2	.02						
Sorghum	25.6	2.57						
Eriogonum annuum (L)	54.9	3.87	39.3	42.2	75.0	5.81	46.9	39.8
" " (S)	19.5	.27			40.0	.75		
Artemisia filifolia (L)	32.9	1.03	5.3	31.2	35.0	1.10	6.9	32.6
Viola kitaibeliana (L)	45.1	1.73	21.3	35.5	40.0	1.60	26.2	29.5
Evax prolifera (L)	12.2	.75	44.7	6.7	10.0	.15	18.5	8.2
Sporobolus cryptandrus (L)	6.1	.14						
" " (S)	29.3	.35			50.0	.70		
Cryptantha minima (S)	6.1	.08	63.3	2.2	5.0	.05	38.2	3.1
Bouteloua gracilis (L)	1.2	.96						
Cyperus schweinitzii (S)	1.2	.02						
Grass	6.1	.15			5.0	.15		
Plantago purshii (L)	6.1	.24	43.3	3.4				
Cirsium undulatum (S)	2.4	.02						
Gaillardia pulchella (S)	1.2	.02						
Gutierrezia sarothrae (L)	7.3	.26	3.3	7.1	5.0	.10	14.0	4.3
Euphorbia fendleri (S)	4.9	.14						
Monarda punctata (S)	6.1	.07			15.0	.25		
" " (L)	1.2	.04						
Gilia longiflora (L)	6.1	.25						
Croton texensis (S)	2.4	.04			5.0	.15		
Hordium pusillum (S)	1.2	.01						
Amaranthus graecizans (S)					5.0	.05		
Chloris verticillata (S)					5.0	.05		
Panicum capillare (S)					5.0	.05		

(L) = Leaf
(S) = Seed

Table 11. February food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1961.

Food Items	Half-shrub Sample Size 15				Shrub Sample Size 87			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	6.7	.06			1.1	.03		
Chrysomelidae								
Eumolpinae	13.3	.26			9.2	.26		
Orthoptera					1.1	.01		
Acrididae	6.7	.13			2.3	.05		
Cyrtacanthacridinae	6.7	.33						
Immature insects	13.3	2.40			31.0	2.20		
Plants								
Evax prolifera (L)	33.3	2.20	44.7	18.4	66.7	7.12	18.5	54.4
Rhus aromatica (S)	6.7	.13			17.2	4.28		
" " (bud)	26.7	3.66			14.9	6.34		
Eriogonum annuum (L)	26.7	.53	39.3	16.2	41.4	1.74	46.9	22.0
" " (S)					5.7	.08		
Festuca octoflora (L)	20.0	.60	74.0	5.2	40.2	1.95	63.8	14.6
Sporobolus cryptandrus (L)					2.3	.05		
" " (S)	20.0	.46			8.0	.09		
Monarda punctata (S)					9.2	.09		
Amaranthus graecizans (S)	6.7	.06			3.4	.10		
Buchloe dactyloides (L)					1.1	.03		
Draba reptans (L)	13.3	1.40			4.6	.13		
Cyperus schweinitzii (S)					3.4	.03		
Viola kitaibeliana (L)					34.5	1.54	26.2	25.5
Croton texensis (S)	13.3	.13			4.6	.09		
Paspalum ciliatifolium (S)					4.6	.06		
Artemisia filifolia (L)	20.0	1.00	5.3	18.9	31.0	1.10	6.9	28.9
Grass					11.5	.64		
Sorghum					8.0	1.21		
Cryptantha minima (L)					3.4	.11		
" " (S)					8.0	.09		
Bouteloua gracilis (L)	6.7	.13			2.3	.11		
Gutierrezia sarothrae (L)					10.3	.29	8.5	9.4
Bouteloua curtipendula (L)					1.1	.03		
Gossypianthus (S)					1.1	.05		
Euphorbia fendleri (S)	6.7	.20			1.1	.05		
Ambrosia psilostachya (L)					1.1	.02		
Plantago purshii (L)	6.7	.46			1.1	.04		
Cirsium undulatum (S)					1.1	.02		
Allium sp. (S)					1.1	.01		
Chloris verticillata (S)					1.1	.01		
Descurainia pinnata (S)	6.7	.13						
Haplopappus spinulosis (S)	6.7	.06						

Table III. March food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1961.

Food Items	Half-shrub Sample Size 26				Shrub Sample Size 70			
	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index
Insects								
Coleoptera					10.0	.24		
Cicindelidae	7.7	.30						
Chrysomelidae								
Eumolpinae	11.5	.50	12	10.1	14.3	.40	12	12.6
Carabidae					1.4	.07		
Scarabaeidae								
Melolonthinae					2.3	.11		
Curculionidae								
Otiorhynchinae	7.7	1.07			21.4	1.25		
Orthoptera	11.5	.34			8.6	.22		
Acrididae	7.7	.23						
Cyrtacanthacridinae	7.7	.46	12	6.8				
Immature insects	76.9	12.69	38	47.7	40.0	4.14	38	24.8
Plants								
Festuca octoflora (L)	73.1	3.42	81.5	9.1	61.4	2.42	71.7	17.4
Evax prolifera (L)	46.2	3.50	41.7	26.9	35.7	5.44	14.2	30.6
Artemisia filifolia (L)	19.2	.57	13.3	16.6	20.0	.45	17.2	16.6
Viola kitaibeliana (L)	23.1	.61	10.0	20.8	20.0	.92	38.8	12.2
Eriogonum annuum (L)	19.2	.38	25.8	14.2	14.3	.47	46.9	7.6
" " (S)	7.7	.07			2.9	.11		
Sporobolus cryptandrus (S)	11.5	.19	21.7	9.0	5.7	.05	42.1	3.3
Gutierrezia sarothrae (L)	7.7	.30	7.5	7.1	20.0	.61	5.0	19.0
Oenothera serrulata (L)	3.8	.19			2.8	.09		
Ambrosia psilostachya (S)	7.7	.15			1.4	.01		
Gaillardia pulchella (S)	3.8	.03						
Cryptantha minima (S)	11.5	.15	46.6	6.1	4.3	.10		
" " (L)					1.4	.02		
Bouteloua gracilis (L)	7.7	.26	0.8	7.6	4.3	.20		
Grass	7.7	.38			5.7	.27		
Paspalum ciliatifolium (S)	3.8	.03						
" " (L)					1.4	.07		
Descurainia pinnata (S)	3.8	.07						
Monarda punctata (S)	3.8	.03			5.7	.27		
Rhus aromatica (S)					21.4	1.88		
" " (Bud)					30.0	7.28	2.1	29.4
Sorghum					4.3	1.00		
Euphorbia sp. (S)					1.4	.02		
Euphorbia fendleri (S)					1.4	.04		
Geranium carolinianum (L)					2.9	.24		
Buchloa dactyloides (S)					4.3	.15		
" " (L)					1.4	.02		
Croton texensis (S)					4.3	.08		
Cyperus schweinitzii (S)					1.4	.02		
Draba reptans (L)					8.6	.22		
Amaranthus graecizans (S)					1.4	.02		
Celtis occidentalis (S)					1.4	.02		
Gilia longiflora (L)					1.4	.07		

Table IV. April food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1960 and 1961.

Food Items	Half-shrub Sample Size 30				Shrub Sample Size 69			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	10.0	.30			11.6	.34		
Chrysomelidae								
Eumolpinae	36.7	1.33	12	32.3	11.6	.37	12	10.2
Galerucinae					1.4	.01		
Scarabaeidae								
Cetoniinae					1.4	.02		
Curculionidae								
Otiorhynchinae	16.7	1.71			30.4	2.05		
Tenebrionidae	3.3	.06			1.4	.04		
Carabidae					10.1	.66		
Orthoptera					2.9	.05		
Gryllidae					1.4	.04		
Blattidae					1.4	.02		
Hemiptera								
Nabidae					1.4	.04		
Pentatomidae	16.7	1.53			13.0	.49		
Hymenoptera								
Formicidae					1.4	.02		
Immature insects	36.7	6.30	38	22.7	13.0	.63	38	8.1
Plants								
Evax prolifera (L)	76.7	9.76	41.7	44.7	58.0	6.23	14.2	49.4
Festuca octoflora (L)	60.0	2.66	87.5	7.5	69.6	3.05	71.7	19.7
Rhus aromatica (S)					2.9	.15		
" " (Bud)	3.3	2.00			10.1	.31	2.1	9.9
Oenothera serrulata (L)	3.3	.10			1.4	.04		
Sporobolus cryptandrus (S)	3.3	.03			1.4	.01		
" " (L)	6.7	.13	21.7	5.2	10.1	.37	42.1	5.8
Eriogonum annuum (S)	3.3	.03						
Sorghum vulgare (S)	3.3	.66			1.4	.02		
Draba repens (L)	3.3	.06						
Plantago purshii (L)	6.7	.26	52.5	3.2	15.9	.59	45.4	8.7
Hordeum pusillum (L)	3.3	.10			11.6	.21	10.4	10.4
Viola kitaibeliana (L)	3.3	.10			11.6	.39	38.8	7.1
Buchloe dactyloides (L)	16.7	.63	19.2	13.5	1.4	.05		
Grass	16.7	.60			15.9	1.10		
Bouteloua gracilis (L)	3.3	.10			4.3	.19		
Monarda punctata (L)					1.4	.04		
Geranium carolinianum (L)					2.9	.05		
Evolvulus nuttallianus (L)					2.9	.11		
Tradescantia occidentalis (L)					2.9	.08		
Euphorbia fendleri (S)					4.3	.15		
Artemisia filifolia (S)					7.2	.11	17.9	5.9

Table V. May food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1960 and 1961.

Food Items	Half-shrub Sample Size 96				Shrub Sample Size 60			
	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index
Insects								
Coleoptera	13.9	.25			3.3	.58		
Chrysomelidae	5.6	.11						
Camptosomatinae	5.6	.11			1.7	.03		
Galerucinae	2.8	.02			6.7	.16		
Eumolpinae	19.4	4.27	12	17.1	35.0	4.01	12	30.8
Halticinae	2.8	.11						
Cleridae	16.7	.51			16.7	.43		
Scarabaeidae								
Melolonthinae	13.9	.83						
Aphodiinae	2.8	T			5.0	.10		
Buprestidae	2.8	.02						
Curculionidae								
Otiorhynchinae	13.9	.38			10.0	.20		
Coccinellidae					1.7	.01		
Malachiidae					1.7	.03		
Orthoptera	2.8	.02			1.7	.16		
Hemiptera								
Pentatomidae	11.1	.36			6.7	.23		
Corimelaenidae	2.8	.05			8.3	.45		
Homoptera								
Cicadellidae	2.8	.08						
Hymenoptera								
Formicidae					1.7	.01		
Immature Insects	19.4	.56	38	12.0	8.3	.20	38	5.1
Pupae	2.8	.08			1.7	.01		
Arachnida					1.7	T		
Plants								
Silene antirrhina (S)	63.9	7.50			40.0	3.28		
Lepidium oblongum (S)	47.2	1.52	11.7	41.7	16.7	1.08	4.6	15.9
Festuca octoflora (L)	27.8	.52	87.5	3.5	33.3	.95	71.7	9.4
" " (S)	27.8	.47			11.7	.08		
Sporobolus cryptandrus (L)	22.2	.97	21.7	16.4	16.7	.56	42.1	9.7
Buchloe dactyloides (L)	22.2	.83	19.2	17.9	15.0	.35	3.3	14.5
Hordeum pusillum (S)	19.4	.77	20.0	15.5	8.3	.31	10.4	7.4
" " (L)	8.3	.41						
Plantago sp. (L)	8.3	.69	52.5	3.9	16.7	1.10	45.4	9.1
Gilia longiflora (L)	5.6	.16	1.6	5.5	1.7	.05	5.0	1.4
Draba reptans	2.8	T			1.7	.03		
Grass	5.6	.56			11.7	.73		
Bouteloua gracilis (L)	5.6	.22	.8	5.6	5.0	.15		
Descurainia pinnata (L)	2.8	T			3.3	.01		
Artemisia filifolia (S)	2.8	.05			1.7	.01		
" " (L)					1.7	.03		
Physalis sp. (S)					1.7	T		
Gaillardia pulchella (L)					3.3	.46		
Agropyron Smithii (S)					1.7	T		
Euphorbia missurica (S)					1.7	T		
Paspalum ciliatifolium (L)					1.7	.05		
" " (S)					3.3	.20		
Chloris verticillata (S)					1.7	.01		
Viola kitaibeliana (S)					1.7	.01		
" " (L)					1.7	.01		
Tradescantia occidentalis (L)					3.3	.13		
Cryptantha minima (L)					1.7	.08		
Monarda punctata (S)					1.7	.03		
Rhus aromatica (S)					1.7	.01		

Table VI. June food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1959, 1960, and 1961.

Food Items	Half-shrub Sample Size 47				Shrub Sample Size 49			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insecta								
Coleoptera	27.7	1.04			4.1	.16		
Chrysomelidae	12.8	.38						
Eumolpinae	31.9	1.21	10.5	28.6	14.3	.28	10.5	12.8
Chrysomelinae	8.5	.17						
Camptosomatinae	4.3	.04	5.3	4.1	4.1	.16	5.3	3.9
Halticinae	2.1	T			4.1	.12	5.3	3.9
Scarabaeidae								
Melolonthinae	53.2	1.93			55.1	8.04		
Coprinae					2.0	.34		
Curculionidae								
Curculioninae	2.1	.10	5.3	2.0	2.0	.04	5.3	1.9
Otiorhynchinae	4.3	.10	5.3	4.1	63.3	2.18	5.3	59.9
Cicindelidae	2.1	.08						
Carabidae					16.3	2.87	2.6	14.2
Mordellidae					10.2	.57	2.6	9.9
Cleridae					2.0	.02		
Hemiptera								
Pentatomidae	12.8	1.29	7.9	11.8	2.0	.20	7.9	1.8
Orthoptera	72.3	9.63			55.1	6.55		
Acrididae								
Cyrtacanthacridinae	6.4	.95	63.2	2.4	10.2	.63	63.2	6.5
Oedipodinae	2.1	.53	2.6	2.0				
Mantidae					2.0	.10		
Immature Insecta	2.1	.14	21.1	1.7	4.1	.32	21.1	3.2
Plants								
Rhus aromatica (Bud)					2.0	.06		
" " (S)	31.9	4.76			83.7	24.83	19.5	67.4
" " (L)					2.0	.10		
Silene antirrhina (S)	36.2	1.85			28.6	1.67	1.0	28.1
Tradescantia occidentalis (L)	8.5	.72	.6	8.5	16.3	.65		
Physalis (S)	2.1	T			2.0	.04		
Chloris verticillata (S)	2.1	.04						
Lepidium oblongum (S)	4.3	.06						
Hoffmanseggia jamesii (S)	2.1	.10						
Eragrostis trichodes (S)	2.1	T						
Grass	23.4	.63			38.8	1.32		
Agropyron smithii (S)	2.1	.04						
Hordeum pusillum (S)	4.3	.04						
Sporobolus cryptandrus (S)	4.3	.04						
" " (L)					2.0	.04		
Iva ciliata (S)	4.3	.17						
Festuca octoflora (L)	4.3	.06	1.8	4.2	6.1	.06	1.7	6.0
" " (S)	4.3	T						
Buchloe dactyloides (S)	2.1	.10			2.0	.06		
Cyperus schweinitzii (S)	2.1	T						
Convolvulus arvensis (S)	2.1	.02						
Croton texensis (S)	2.1	.02						
Bouteloua gracilis (L)	4.3	.10			4.1	.10		
Viola kitaibeliana (L)	2.1	.02						
Cryptantha minima (S)	2.1	T						
Lithospermum incisum (S)					2.0	.10		
Artemisia filifolia (L)					2.0	.06		

Table VII. July food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1959, 1960, and 1961.

Food Items	Half-shrub Sample Size 26				Shrub Sample Size 52			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	23.1	1.26			15.4	.23		
Chrysomelidae					1.9	.05		
Eumolpinae	80.8	1.76	10.5	72.3	32.7	.82	10.5	29.3
Cassidinae	3.8	T						
Halticinae					3.8	.03	5.3	3.6
Galerucinae					1.9	T	2.6	1.7
Cicindelidae	3.8	T						
Tenebrionidae	7.7	2.11			1.9	.09		
Carabidae					1.9	T	2.6	1.7
Mordellidae					1.9	T	2.6	1.7
Scarabaeidae					1.9	T		
Melolonthinae	3.8	T			13.5	.71		
Curculionidae								
Otiorhynchinae	7.7	.07	5.3	7.3	28.8	.71	5.3	27.3
Diptera								
Asilidae	3.8	.11			1.9	.19		
Hymenoptera								
Formicidae					1.9	.01		
Hemiptera								
Pentatomidae	3.8	.96	7.9	3.5				
Orthoptera	69.2	6.61			57.7	7.50		
Acrididae								
Cyrtacanthacridinae	3.8	.07	63.2	1.4	30.8	5.00	63.2	19.5
Gryllidae								
Oecanthinae					3.8	.05	5.3	3.6
Plants								
Rhus aromatica (L)					3.8	T		
" " (S)	38.5	8.11			67.3	22.19	19.5	54.2
Tradescantia occidentalis (L)	19.2	1.38	.6	18.1	28.8	2.19	1.7	28.3
Physalis sp. (S)	3.8	.38			3.8	T		
Festuca octoflora (S)	7.7	T	1.8	7.6	1.9	T		
Grass	23.1	.92			11.5	.44		
Gaillardia pulchella (L)	3.8	.11						
Silene antirrhina (S)	7.7	.07			5.8	.03		
Cyperus schweinitzii (S)	3.8	.03						
Paspalum ciliatifolium (S)					5.8	.15	11.2	5.2
Ambrosia psilostachya (L)					1.9	.19		
Hoffmanseggia jamesii (S)					1.9	.13		
Lithospermum incisum (S)					5.8	.23		
Bouteloua gracilis (L)					1.9	.05		
Stillingia sylvatica (S)					1.9	.28		
Leptoloma cognatum (S)					1.9	.05		

Table VIII. August food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1959, 1960, and 1961.

Food Items	Half-shrub Sample Size 6				Shrub Sample Size 66			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	33.3	.83			4.5	.07		
Chrysomelidae								
Eumolpinae	66.7	4.00			31.8	.48	10.5	28.4
Halticinae	16.7	.16			1.5	T	5.3	1.4
Galerucinae					3.0	.01	2.6	2.9
Carabidae					1.5	.03	2.6	1.5
Tenebrionidae					3.0	.60		
Scarabaeidae					1.5	T		
Coprinae					3.0	.10		
Curculionidae								
Otiorhynchinae					22.7	.31	5.3	21.5
Curculioninae					1.5	.03	5.3	1.4
Mordellidae					1.5	T	2.6	1.5
Hemiptera								
Nabidae	16.7	.50			1.5	.01		
Hymenoptera								
Formicidae					1.5	T		
Orthoptera	66.7	5.50			53.0	10.42		
Acrididae					1.5	.07		
Cyrtacanthacridinae	50.0	5.00			43.9	9.43	63.2	16.2
Oedipodinae					1.5	.15	2.6	1.5
Acridinae					3.0	1.36	13.2	2.6
Blattidae					3.0	T		
Diptera					1.5	.10		
Pupae					1.5	.07		
Plants								
Rhus aromatica (S)	33.3	1.33			37.9	8.10	19.5	30.5
" " (L)					3.0	.03		
Grass	16.7	.66			12.1	.62		
Panicum capillare (S)	16.7	.33			3.0	.15		
Paspalum ciliatifolium (S)	16.7	.33			1.5	.01	11.2	1.3
Artemisia filifolia (L)	16.7	.16			1.5	T		
Tradescantia occidentalis (L)	16.7	2.33			15.1	1.22	1.7	13.3
Sporobolus cryptandrus (L)	16.7	.50			3.0	.01		
" " (S)	16.7	T						
Bouteloua gracilis (L)					4.5	.16		
Ambrosia psilostachya (L)					4.5	T		
Cyperus schweinitzii (S)					4.5	.01		
Chenopodium album (S)					1.5	T		
Psoralea tenuiflora (S)					1.5	.01		
Physalis sp. (S)					1.5	T		
Buchloe dactyloides (S)					1.5	.06		
Eragrostis trichodes (S)					1.5	.01		
Silene antirrhina (S)					1.5	T		
Gravel					1.5	.15		

Table IX. September food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1960.

Food Items	Half-shrub Sample Size 44				Shrub Sample Size 46			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	18.2	.39			8.7	2.19		
Chrysomelidae								
Eumolpinae	22.7	.43			23.9	.43		
Galerucinae	56.8	2.13	28.6	40.6	67.4	2.82	28.6	48.1
Cerambycidae								
Lepturinae					2.2	.04		
Carabidae	4.5	1.59						
Scarabaeidae								
Melolonthinae	2.3	.11			2.2	1.63		
Curculionidae								
Otiorhynchinae	15.9	1.72			39.1	.93		
Buprestidae					4.3	.21		
Hemiptera								
Pentatomidae					2.2	.06	50.0	1.1
Hymenoptera								
Formicidae								
Myrmicinae					2.2	.02		
Orthoptera	47.7	4.90			58.7	5.76		
Acrididae								
Acridinae	2.3	.04						
Cyrtacanthacridinae	59.1	4.27	.7	58.7	41.3	3.10		
Pupae	4.5	.09			2.2	.12		
Plants								
Cyperus schweinitzii (S)	43.2	1.27	6.2	40.5	65.2	2.21	8.1	59.9
Grass	13.6	.64			17.4	.69		
Cassia fasciculata (L)	6.8	.15			6.5	.47	1.0	6.4
Descurainia pinnata (S)	6.8	.02			6.5	.06		
Rhus aromatica (S)	2.3	.06			6.5	.08		
Plantago purshii (S)	4.5	.06	33.8	3.0	6.5	.06	11.4	5.8
Croton Texensis (S)	2.3	.06						
Sporobolus cryptandrus (L)	2.3	.06			2.2	.08		
Amaranthus graecizans (S)	4.5	.02						
Gutierrezia sarothrae	4.5	.29						
Festuca octoflora (S)	2.3	.02			2.2	T		
Buchlow dactyloides (L)	2.3	.09						
Tradescantia occidentalis (L)	2.3	.04			4.3	.10		
Bouteloua curtipendula (S)					2.2	.04		
Cryptantha minima (S)					2.2	.10		
Haplopappaus spinulosis (S)					2.2	.08		
Prunus angustifolia (S)					2.2	.43		

Table X. October food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1960.

Food Items	Half-shrub Sample Size 50				Shrub Sample Size 48			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	14.0	.52						
Chrysomelidae								
Eumolpinae	42.0	1.12			45.8	1.12		
Galerucinae	54.0	1.42	28.6	38.6	52.1	3.77	28.6	37.2
Scarabaeidae								
Coprinae	2.0	.30						
Carabidae	22.6	.90			25.0	.70		
Curculionidae								
Otiorhynchinae	16.0	.68			18.8	.97		
Hemiptera								
Pentatomidae	30.0	.70	50.0	15.0	25.0	3.62	50.0	12.5
Nabidae					2.1	.10		
Orthoptera	94.0	11.26			68.8	7.87		
Acrididae								
Cyrtacanthacridinae	6.0	.22	17.9	4.9	22.9	2.54	17.9	18.8
Oedipodinae	2.0	.20						
Pupae					4.2	.12		
Plants								
Cyperus schweinitzii (S)	74.0	3.52	6.2	72.4	68.8	3.18	8.1	63.2
Grass	28.0	.82			8.3	.35		
Sporobolus cryptandrus (L)	4.0	.08			6.3	.20	44.3	3.5
Helianthus annuus (S)	2.0	.02			4.2	.10		
Bouteloua gracilis (L)	2.0	.04			2.1	.04		
Ambrosia psilostachya (S)	22.0	1.44	19.2	17.8	20.8	1.66	15.2	17.6
Monarda punctata (L)	14.0	.68						
Cryptantha minima (L)	2.0	.02						
Rhus aromatica (S)	4.0	.10			4.2	.12		
Plantago sp. (L)	4.0	.10						
Croton texensis (S)					4.2	.18		
Festuca octoflora (L)					8.3	.12	23.3	6.4
Tradescantia occidentalis (L)					2.1	.14		
Buchloe dactyloides (L)					2.1	.14		
Oenothera serrulata (L)					2.1	.06		
Physalis sp. (S)					2.1	.04		
Euphorbia sp. (S)					4.2	.08		
Gravel	2.0	.20						

Table XI. November food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1959 and 1960.

Food Items	Half-shrub Sample Size 41				Shrub Sample Size 42			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	9.8	.41			2.4	.04		
Chrysomelidae								
Eumolpinae	31.7	1.14			66.7	1.90		
Carabidae	12.2	.24			16.7	.64		
Tenebrionidae					2.4	.23		
Hymenoptera	9.8	.26			4.8	.09		
Hemiptera								
Pentatomidae	2.4	.04	50.0	1.2	7.1	.69	50.0	3.6
Orthoptera	26.8	1.53			47.6	3.73		
Acrididae	14.6	.68			9.5	.42		
Cyrtacanthacridinae	34.2	1.92	17.9	28.1	33.3	2.00	17.9	27.3
Pupae	2.4	.09						
Larvae	12.2	.43	64.3	4.4				
Plants								
Festuca octoflora (L)	75.6	5.92	38.5	46.5	26.2	1.52	23.3	20.1
Cyperus schweinitzii (S)	26.8	1.48	6.2	25.1	35.7	2.42	8.1	32.8
" " (L)					2.4	.09		
Ambrosia psilostachya (S)	9.8	1.09	19.2	7.9	14.3	.80	15.2	12.1
Bouteloua gracilis (L)	24.4	.95			4.8	.30		
Leptoloma cognatum (S)	9.8	.97			2.4	.02		
Artemisia filifolia (L)	29.3	.80	13.8	25.3	9.5	.59	25.7	7.1
Evax prolifera (L)	2.4	.07						
Sporobolus cryptandrus (L)	7.3	.24	36.9	4.6	14.3	.57	44.3	8.0
" " (S)	2.4	.02			7.1	.04		
Grass	29.3	1.73			35.7	3.97		
Viola kitaibeliana (L)	4.9	.04			7.1	.19	9.5	6.4
" " (S)	14.6	.24	.8	14.5				
Tradescantia occidentalis (L)	2.4	.24						
Plantago sp. (L)	9.8	.48	33.8	6.5	7.1	.21		
Plantago purshii (S)	2.4	.04			4.8	.09		
Gutierrezia sarothrae (Flower)	26.8	.56	21.5	21.0	2.4	.04		
Draba reptans (L)	4.9	.19						
Helianthus annuus (S)	2.4	.12						
Sorghum vulgare (S)	22.0	1.34						
Geranium carolinianum (L)	4.9	.21						
Hordeum pusillum (L)	4.9	.19						
Eriogonum annuum (L)	9.8	.31			2.4	.23		
" " (S)	14.6	.29	27.7	10.6	11.9	.21	29.0	8.5
Paspalum ciliatifolium (L)	2.4	.24						
Grindelia squarrosa (S)	2.4	.04						
Heterotheca latifolia (S)	4.9	.21						
Cryptantha minima (S)					4.8	.14		
Croton texensis (S)					4.8	.09		
Rhus aromatica (S)					2.4	.11		
Monarda punctata (L)					4.8	.11		
" " (S)					2.4	.04		
Gilia longiflora (L)					2.4	.09		
Descurainia pinnata (L)					2.4	.04		
Buchloe dactyloides (L)	4.9	T						
Chloris verticillata (L)	2.4	T						
Aster ericoides (L)	2.4	T						
Haplopappus spinulosis (S)	2.4	T						

Table XII. December food use by lesser prairie chickens, Maple Ranch, Beaver County, Oklahoma 1960.

Food Items	Half-shrub Sample Size 45				Shrub Sample Size 61			
	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index
Insects								
Coleoptera	6.7	.07						
Chrysomelidae								
Eumolpinae	11.1	.13			27.9	.70		
Galerucinae					1.6	.03		
Carabidae	8.9	.11			1.6	.04		
Curculionidae								
Otiorhynchinae	4.4	.08						
Orthoptera	26.7	1.06			6.6	.13		
Acrididae	15.6	.48			29.5	.88		
Cyrtacanthacridinae	22.2	2.35			14.8	.63		
Hymenoptera								
Ichneumonidae	17.8	.42			9.8	.13		
Immature insects	31.1	2.73			13.1	.60		
Plants								
Festuca octoflora (L)	64.4	2.86	74.8	17.4	29.5	1.09	63.8	10.7
Sorghum vulgare (S)	15.6	6.75						
Eriogonum annuum (L)	33.3	2.71	39.3	20.2	16.4	1.08	46.9	8.7
" " (S)	6.7	.11			8.2	.14		
Gutierrezia sarothrae (L)	31.1	1.77	3.3	30.1	86.9	3.93	8.5	79.5
Artemisia filifolia (L)	35.6	1.62	5.3	33.7	52.5	3.98	6.9	48.9
" " (S)	2.2	.02			9.8	.18		
Plantago sp. (L)	22.2	1.60	43.3	12.6	3.3	.09	43.1	1.9
Plantago purshii (S)	2.2	.02						
Sporobolus cryptandrus (L)	6.7	.08			9.8	.21		
" " (S)	6.7	.08			4.9	.08		
Monarda punctata (S)	2.2	.04			1.6	.01		
Cryptantha minima (L)	4.4	.08	63.3	1.6	3.3	.06	39.2	2.0
" " (S)	2.2	.04			3.3	.03		
Gilia longiflora (L)	2.2	.17			3.3	.16		
Viola kitaibeliana (L)	8.9	.35	21.3	7.0	19.7	.77	26.2	14.5
" " (S)	4.4	.04						
Euphorbia fendleri (S)	4.4	.17			3.3	.14		
Ambrosia psilostachya (S)	6.7	.07			18.0	.54		
Grass	11.1	.62			21.3	1.08		
Amaranthus graecizans (S)	4.4	.07			3.3	.03		
Geranium carolinianum (L)	2.2	.07						
Oenothera serrulata (L)	2.2	.23	1.3	2.2				
Bouteloua gracilis (L)	4.4	.16			6.6	.18		
Paspalum ciliatifolium (L)	2.2	.07						
Fvax prolifera (L)					1.6	.04	18.3	1.3
Croton texensis (S)					3.3	.04		
Euphorbia sp. (S)					9.8	.24		
Calamovilfa gigantea (S)					3.3	.06		
Aster ericoides (L)					3.3	.06		
Rhus aromatica (S)					1.6	.03		
" " (Bud)					9.8	.26		
Bouteloua curtipendula (L)					1.6	.16		
Draba reptans (L)					1.6	.04		
Cyperus schweinitzii (S)					1.6	.01		
Hordeum pusillum (S)					1.6	.03		

APPENDIX B

Table XIII. January food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma, 1961.

Food Items	Native Prairie Sample Size 52				Cultivated Pastures Sample Size 35				Old Field Sample Size 3	
	Per-cent Occ.	Per cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.
Insects										
Orthoptera	7.7	.23			11.4	.34			100.0	7.33
Acrididae	7.7	.29			14.3	.60				
Cyrtacanthacridinae	1.9	.09								
Plants										
Sorghum vulgare (S)	86.5	33.23			31.4	17.85				
Bromus japonicus (L)	69.2	8.55	73.1	18.6	45.7	7.62	74.0	11.9	33.3	1.33
Lespedeza stipulacea (L)	17.3	3.34			25.7	1.65	12.0	22.6		
" (S)	7.7	.19			45.7	4.11				
Grass	34.6	3.98			37.1	3.74			33.3	1.66
Physalis sp. (S)	17.3	1.01			22.9	1.88			66.7	6.66
Oxalis stricta (L)	11.5	.59	10.0	10.4	8.6	.51	5.0	8.2		
Oxalis stricta (S)									66.7	2.00
Panicum capillare (S)	1.9	.01								
Chloris verticillata (S)	1.9	.01								
Corn (S)	1.9	.09			5.7	.28				
Elymus canadensis (S)	3.8	.13								
Symphoricarpos orbiculatus (S)	1.9	.05			2.9	.06			33.3	1.00
Digitaria sanguinalis (S)	9.6	.15			5.7	.06				
Amaranthus retroflexus (S)	1.9	.01								
Ambrosia psilostachya (S)	5.8	.15			2.9	.08				
Buchloe dactyloides (L)	1.9	.05								
Viola kitaibeliana (L)					2.9	.17	66.0	.98	33.3	1.33
Bidens frondosa (S)					2.9	.02				
Cynodon dactylon (S)					2.9	.06				
Helianthus annuus (S)					5.7	.14				
Melilotus officinalis (S)					14.3	.42				
Ruellia humilis (L)					2.9	.14				
Oxalis violacea (L)					2.9	.14				
Rumex crispus (S)									66.7	.66
Panicum sp. (S)									66.7	1.00
Gravel	1.9	.19			2.9	.14				

(S) = Seeds
(L) = Leaf

Table XIV. February food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1961.

Food Items	Native Prairie Sample Size 35				Cultivated Pastures Sample Size 52			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera								
Carabidae	5.7	.20						
Orthoptera	11.4	.45			34.6	1.75		
Acrididae	37.1	1.45			15.4	.50		
Cyrtacanthacridinae	8.6	.42			3.8	.32		
Immature insects					1.9	.06		
Plants								
Sorghum vulgare (S)	54.3	20.25			78.8	21.90		
Lespedeza stipulacea (L)	17.1	7.80			5.8	.48	12.0	5.1
" " (S)	2.9	.14			28.8	4.34		
Bromus japonicus (L)	25.7	1.17	73.1	6.9	15.4	1.05	74.0	4.0
Sorghum halepense (S)	2.9	.42						
Digitaria sanguinalis (S)	5.7	.05			5.8	.06		
Sporobolus cryptandrus (L)	2.9	.02						
Grass	45.7	5.51			55.8	4.34		
Viola kitaibeliana (L)	11.4	.42	24.6	8.6	3.8	.09	66.0	1.3
Festuca octoflora (L)	2.9	.14			1.9	.03		
Achillea lanulosa (L)	2.9	.02						
Panicum capillare (S)	8.6	.08			1.9	.01		
Cyperus sp. (L)	2.9	.11						
Symphoricarpos orbiculatus (S)	5.7	.17						
Panicum dichotomiflorum (S)	2.9	.02						
Solanum carolinense (S)	5.7	.11			11.5	.76		
Physalis sp (S)	5.7	.14			21.2	.69		
Panicum virgatum (S)	2.9	.08			1.9	.01		
Ambrosia psilostachya (S)	2.9	.02						
Bouteloua curtipendula (L)	2.9	.08						
Crotom capitatus (S)	5.7	.11						
Sporobolus asper (S)					1.9	.01		
Hordeum pusillum (L)					1.9	.07		
Buchloe dactyloides (L)					1.9	.09		
" " (S)					1.9	.03		
Melilotus officinalis (S)					11.5	.46		
Gravel					1.9	.19		

Table XV. March food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1960 and 1961.

Food Items	Native Prairie Sample Size 77				Cultivated Pastures Sample Size 22			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	3.9	.12			13.6	.45		
Chrysomelidae								
Eumolpinae	9.1	.36			18.2	.59		
Galerucinae					4.5	.04		
Carabidae	2.6	.05						
Orthoptera	29.9	1.22						
Acrididae	10.4	.37			9.1	.31		
Immature Insects	1.3	.02						
Plants								
Sorghum vulgare (S)	16.9	10.77			18.2	6.13		
Grass	72.7	6.70			50.0	5.36		
Hypoxis hirsuta (L)	40.3	3.38	28.3	28.9	31.8	1.45		
Bromus japonicus (L)	31.2	2.38	47.0	16.5	77.3	11.72	41.3	45.4
Baptisia sp (S)	10.4	1.70	1.0	10.3				
Viola kitaibeliana (L)	10.4	.70	9.0	9.5				
Ambrosia psilostachya (S)	7.8	.29	57.7	3.3				
Lespedeza stipulacea (L)	7.8	.61			27.3	1.68		
" " (S)	2.6	.09			50.0	2.00	73.8	13.1
Plantago rugelii (L)	1.3	.06			9.1	.40	37.5	5.7
Achillea lanulosa (L)	1.3	.02						
Plantago purshii (L)	3.9	.23						
Festuca octoflora (L)	6.5	.11	3.0	6.3				
Geranium carolinianum (L)	2.6	.09						
Digitaria sanguinalis (S)	1.3	.01						
Juncus interior (L)	3.9	.20			4.5	.18		
Cyperus sp. (L)	2.6	.05			4.5	.09		
Physalis sp. (S)	10.4	.35			18.2	.54		
Oxalis stricta (L)	1.3	.03						
Melilotus officinalis (S)	1.3	.02			31.8	.90	1.3	31.4
Panicum sp. (S)	1.3	.01						
Solanum carolinense (S)	1.3	.01			4.5	.18		
Hordeum pusillum (L)	2.6	.19						
Sporobolus asper (S)	1.3	.01						
Corn	3.9	.11						
Wheat	2.6	.15						
Cynodon dactylon (S)					4.5	.04		

Table XVI. April food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1960 and 1961.

Food Items	Native Prairie Sample Size 95				Cultivated Pastures Sample Size 3			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	11.6	.25						
Chrysomelidae								
Eumolpinae	27.4	.96			33.3	1.33		
Halticinae	1.1	.02						
Galerucinae					33.3	.33		
Coccinellidae	1.1	.02	5.3	1.0				
Homoptera	2.1	.01						
Cicadellidae	2.1	.04						
Hemiptera	1.1	.03						
Orthoptera	1.1	.02						
Acrididae	1.1	.02						
Immature Insects	1.1	.01						
Plants								
Eleocharis sp.	32.6	4.44						
Grass	43.2	3.71			66.7	2.66		
Juncus interior (L)	21.1	.92	33.0	14.1				
Viola kitaibeliana (L)	14.7	.49	9.0	13.4				
Hypoxis hirsuta (L)	28.4	1.47	28.3	20.4				
Bromus japonicus (L)	37.9	2.53	47.0	20.1	33.3	3.33		
" " (S)	1.1	.02						
Bouteloua gracilis (L)	8.4	.29	16.0	7.1				
Nemastylis geminiflora (L)	2.1	.51						
Plantago purshii (L)	4.2	.18						
Achillea lanulosa (L)	5.3	.14	17.3	4.4				
Polygonum aviculare (L)	1.1	.03						
Baptesia sp (S)	1.1	T						
Verbena simplex (L)	1.1	T						
Callirhoe involucrata (L)	3.2	.28						
Draba cuneifolia (L)	1.1	.03						
Buchloe dactyloides (L)	4.2	.12						
Ambrosia psilostachya (L)	9.5	.41	57.7	4.0	33.3	1.66		
Plantago rugelii (L)	6.3	.29	14.0	5.4				
Lespedeza stipulacea (L)	4.2	.62			66.7	21.66		
Paspalum ciliatifolium (L)	2.1	.09						
" " (S)	1.1	.02						
Cyperus sp. (L)	15.8	.81	54.0	7.3				
Ruellia humilis (L)	3.2	.15						
Erigeron strigosus (L)	1.1	.03						
Festuca octoflora (L)	8.4	.23	3.0	8.1				
Sporobolus cryptandrus (L)	1.1	.06						
Symphoricarpos orbiculatus (S)	1.1	.02						
Aster ericoides (L)	1.1	.05						
Carex sp. (S)	14.7	.60	54.0	6.8				
Cerastium sp (S)	3.2	.05						
Euphorbia serpens (S)	1.1	.01						
Echinochloa crusgalli (S)	1.1	.01						
Rumex crispus (S)	1.1	.01						
Krigia occidentalis (L)					33.3	5.00		
Cynodon dactylon (L)					33.3	.66		

Table XVII. May food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1960 and 1961.

Food Items	Native Prairie Sample Size 66				Old Fields Sample Size 4			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	9.1	.18						
Chrysomelidae					25.0	1.25		
Eumolpinae	50.0	1.59			25.0	1.50		
Galerucinae	21.2	.54						
Cassidinae	1.5	.03						
Halticinae					25.0	.50		
Scarabaeidae								
Cetoniinae	30.3	1.28			75.0	7.50		
Coccinellidae	1.5	.10	5.3	1.4				
Hemiptera	4.5	.09			25.0	.25		
Pentatomidae	3.0	.09						
Immature insects	1.5	.03						
Plants								
Eleocharis sp.	45.5	5.93						
Carex sp. (S)	59.1	6.77	54.0	27.2				
Grass	97.0	10.68						
Hypoxis hirsuta	3.0	.19	28.3	2.2				
Croton capitatus (S)	1.5	.03						
Krigia occidentalis (S)	16.7	1.10			100	8.75		
Polygonum sp. (S)	12.1	.30						
Galium aparine (S)	15.2	.50						
Bromus japonicus (L)	12.1	1.04	47.0	6.4				
" " (S)	1.5	.07						
Cerastium sp. (S)	16.7	.36						
Ambrosia psilostachya (L)	4.5	.33	57.7	1.9				
" " (S)	1.5	.22						
Convolvulus arvensis (S)	18.2	1.31						
Amaranthus graecizans (S)	4.5	.04						
Hordeum pusillum (S)	7.6	.21	2.0	7.5				
Cyperus sp. (L)	1.5	.04			25.0	1.25		
Aristida oligantha (L)	1.5	.04						
Juncus interior (L)	3.0	.07						
Plantago rugelii (L)	1.5	.04						
" " (S)	7.6	.27	14.0	6.5	25.0	1.00		
Sorghum halepense (S)	1.5	.01						
Oxalis stricta (S)	1.5	.06						
Draba reptans (L)	1.5	.07						
Euphorbia serpens (S)	1.5	.01						
Aster ericoides (L)	1.5	.04						
Buchloe dactyloides (L)	1.5	.06						
Sporobolus asper (L)	1.5	.04			25.0	.75		
Polygonum convolvulus (S)					25.0	1.75		
Festuca octoflora (L)					25.0	.75		
Lepidium virginianum (S)					25.0	.25		

Table XVIII. June food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma, 1959, 1960, and 1961.

Food Items	Native Prairies Sample Size 36				Cultivated Pastures Sample Size 23				Old Field Sample Size 4	
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.
Insects										
Coleoptera	16.7	.72			13.0	1.04			25.0	.50
Chrysomelidae										
Galerucinae	13.9	.38	44.4	7.7	8.7	.26	44.4	4.8		
Halticinae	8.3	.30	13.3	7.2	4.3	.21	13.3	3.7	25.0	.50
Eumolpinae	41.7	1.22			69.6	3.00			50.0	3.50
Camptosomatinae	2.8	.11	4.4	2.7	4.3	.13	4.8	4.1		
Coccinellidae									25.0	.50
Curculionidae										
Curculioninae	13.9	.59	6.7	13.0	13.0	.17	6.7	12.1		
Otiorhynchinae	55.6	2.44			4.3	.08			25.0	1.00
Scarabaeidae	2.8	.02			8.7	.26				
Melolonthinae	13.9	.92			8.7	.43			25.0	5.00
Aphodiinae					8.7	.52				
Carabidae	11.1	.27	6.7	10.4	8.7	.60	6.7	8.1		
Mordellidae	2.8	.02	2.2	2.7	4.3	.04	2.2	4.2		
Hemiptera	11.1	1.11			8.7	.26				
Pentatomidae	2.6	.05	4.4	2.5	8.7	.17	4.4	8.3		
Neuroptera					4.3	.21				
Hymenoptera										
Formicidae					4.3	.08				
Orthoptera					8.7	.30				
Plants										
Plantago rugelii (S)	41.7	7.08	1.8	41.4						
Solidago sp. (L)	33.3	4.38	1.1	32.9	4.3	.34	25.0	3.2	25.0	6.25
Lespedeza stipulacea (L)	11.1	5.00	1.1	10.9	56.5	28.26	82.9	9.7		
Krigia occidentalis	61.1	2.50			39.1	1.34			25.0	.25
Galium Aparine (S)	66.7	1.94	1.1	66.0	4.3	.04				
Oxalis stricta (S)	50.0	1.11	17.9	41.0	30.4	.73	.7	30.2		
Specularia leptocarpa (S)	8.3	.19	1.8	8.2						
Silene antirrhina (S)	36.1	.86			47.8	1.13			50.0	1.00
Carex sp. (S)	13 9	.77	18.9	11.3						
Grass	58.3	3.00			17.4	.73				
Wheat	2.8	.13								
Gutierrezia dracunculoides (S)	2.8	.05								
Juncus interior (S)	5.6	.13	16.4	4.7						
Bromus japonicus (S)	2.8	.05							25.0	.75
Paspalum ciliatifolium (S)	2.8	.08								
Buchloa dactyloides (L)	5.6	.13								
Lepidium virginianum (S)	30.6	.80	1.4	30.2	8.7	.13	12.1	7.6	25.0	.25
Physalis sp. (S)	2.8	.05			4.3	.08	12.1	3.8		
Polygonum sp. (S)	8.3	.13								
Euphorbia missurica (S)	2.8	.02								
Sabatia campestris (L)					4.3	1.08			25.0	3.75
Lepidium densiflorum (S)					8.7	.08				
Polygonum convolvulus (S)					8.7	.95				
Cassia fasciculata (L)					4.3	.65			50.0	15.00
Carex annectens (S)					4.3	.13				

Table XIX. July food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1959, 1960, and 1961.

Food Items	Native Prairie Sample Size 22				Cultivated Pastures Sample Size 11			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	4.5	.04			18.2	.90		
Chrysomelidae								
Halticinae	13.6	.46	13.3	11.8				
Galerucinae	36.4	1.40	44.4	20.2	36.4	.72	44.4	20.2
Eumolpinae	40.9	2.13			54.5	.90		
Malachiidae	4.5	.09			9.1	.09		
Carabidae	9.1	.36	6.7	8.5				
Curculionidae	9.1	.31			9.1	.09		
Curculioninae	13.6	.31	6.7	12.7				
Otiorhynchinae	36.4	1.04			18.2	.45		
Coccinellidae	9.1	.18	4.4	8.5	9.1	.09	4.4	8.7
Homoptera	18.2	.40						
Cicadellidae	4.5	.13	17.8	3.7				
Hymenoptera								
Tiphiidae	4.5	.68			27.3	.81		
Formicidae	4.5	.04						
Orthoptera	40.9	3.54			36.4	1.18		
Acrididae	4.5	.04						
Cyrtacanthacridinae	9.1	.36	28.9	6.5				
Acridinae	9.1	.36	4.4	8.7				
Hemiptera								
Reduviidae	4.5	.18	4.4	4.3				
Pentatomidae					9.1	.27	4.4	8.7
Plants								
Sabatia campestris (L)	54.5	15.77						
Linum sulcatum (S)	36.4	1.31	1.8	35.7				
Tripsacum dactyloides (S)	4.5	.09						
Grass	22.7	.86			9.1	.90		
Corn	4.5	.22						
Physalis sp. (S)	18.2	.81						
Polygonum convolvulus (S)	13.6	.50			9.1	.18		
Solidago (L)	9.1	1.36	1.1	9.0				
Cassia fasciculata (L)	4.5	.13						
Panicum capillare (S)	4.5	.04						
Oxalis stricta (S)	4.5	.09						
Bromus japonicus (S)	4.5	.13			9.1	.63		
Lespedeza stipulacea (L)					90.9	53.63	82.9	15.5
Silene antirrhina (S)					9.1	.27		
Lepidium virginianum (S)					9.1	.09	12.1	8.0
Cynodon dactylon (L)					27.3	.90	42.9	15.5
Rumex crispus (S)					9.1	.63		

Table XX. August food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1959, 1960, 1961.

Food Items	Native Prairie Sample Size 43				Cultivated Pastures Sample Size 60			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	16.3	.39			16.7	.23		
Chrysomelidae								
Eumolpinae	27.9	1.02			18.3	.45		
Galerucinae	27.9	1.02	44.4	15.5	81.7	2.41	44.4	45.4
Halticinae					5.0	.16	.2	5.0
Scolytidae	2.3	.02						
Meloidae	2.3	.04						
Coccinellidae	4.7	.04	4.4	4.5	1.7	.01	4.4	1.6
Curculionidae								
Otiorhynchinae	11.6	.32			3.3	.06		
Carabidae	4.7	.16	6.7	4.4	5.0	.08	6.7	4.7
Cleridae					1.7	.03		
Orthoptera	34.9	2.20			3.3	.10		
Acrididae	20.9	2.13			6.7	.28		
Cyrtacanthacridinae	2.3	.04	28.9	1.6				
Hymenoptera	2.3	.02			1.7	.03		
Formicidae	2.3	.13						
Formicinae	2.3	.16						
Halictidae					1.7	.03		
Ephemeroptera					3.3	.03		
Odonata	4.7	.02						
Hemiptera	4.7	.13						
Pentatomidae	2.3	.13	4.4	2.2				
Anthocoridae	2.3	.02						
Scutelleridae	11.6	.25	6.7	10.8				
Homoptera					3.3	.05		
Cicadellidae					11.7	.18	17.8	9.6
Immature insects	4.7	.09			1.7	.01		
Plants								
Sabatia campestris (L)	11.6	2.67						
Polygonum sp. (S)	7.0	.11						
Grass	25.6	1.34			5.0	.23		
Aster ericoides (L)	2.3	.06						
Solidago sp. (L)	41.9	15.16	1.1	41.4				
Cynodon dactylon (S)	4.7	.11			13.3	.73	42.9	7.6
Desmanthus illinoensis (S)	7.0	.37						
Penstemon cobaea (S)	18.6	2.44						
Linum sulcatum (S)	9.3	.23	1.8	9.1	1.7	.02		
Panicum capillare (S)	4.7	.04						
Oxalis stricta (L)	2.3	.04						
" " (S)	7.0	.09	17.9	5.7	41.7	1.05	.7	41.4
Juncus interior (S)	4.7	.46						
Ruellia humilis (L)	2.3	.81						
Lespedeza stipulacea (L)	4.7	.34	1.1	4.6	98.3	53.43	82.9	16.8
Croton capitatus (S)	2.3	.11						
Bromus japonicus (S)	4.7	.13			6.7	.16		
Paspalum ciliatifolium (S)	9.3	.09	3.0	9.0				
Cassia fasciculata (S)	4.7	.32						
Elymus virginicus (S)	2.3	.11						
Elymus canadensis (S)	2.3	.04			16.7	1.16	1.4	16.5
Euphorbia serpens (S)	2.3	.02						
Poa pratensis (S)	2.3	.02						
Polygonum convolvulus (S)					26.7	.81		
Plantago purshii (S)					1.7	.01		
Physalis sp (S)					15.0	.33	12.1	13.2
Melilotus alba (S)					3.3	.06		
Cerastium sp (S)					5.0	.11		
Leptoloma cognatum (S)					1.7	.01		
Gravel	2.3	.04						

Table XXI. September food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma, 1959, and 1960.

Food Items	Native Prairies Sample Size 14				Cultivated Pastures Sample Size 45				Old Field Sample Size 6	
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.
Insects										
Coleoptera	7.14	.07			15.6	.40			50.0	1.66
Chrysomelidae										
Eumolpinae	50.0	1.07			6.7	.11				
Galerucinae	42.9	2.14	22.9	33.1	57.8	2.11	22.9	44.6	50.0	2.68
Cassidinae	7.1	.14			2.2	.02			16.7	.33
Carabidae										
Hemiptera					6.7	.15				
Pentatomidae	7.1	.14	14.3	6.1					16.7	.33
Hymenoptera										
Halictidae					4.4	.11				
Tiphiidae									16.9	.16
Orthoptera	14.3	.50			12.8	.84				
Acrididae	35.7	2.00							16.7	1.00
Acridinae	7.1	.71	2.9						16.7	1.66
Cyrtacanthacridinae	21.4	1.71	8.6	20.8						
Gryllidae										
Gryllinae	14.3	.50							33.3	3.16
Larvae					2.2	.06				
Plants										
Sabatia campestris (L)	42.9	8.50							16.7	2.50
Solidago sp. (L)	42.9	7.50			4.4	.66			66.6	15.00
Linum Sulcatum (S)	28.6	2.07								
Penstemon cobaea (S)	35.7	2.50			4.4	.20			50.0	2.16
Ruellia humilis (L)	14.3	.92	5.9	13.5						
Oxalis stricta (S)	7.1	.07	1.8	7.0	13.3	.15	10.0	11.97		
Ambrosia psilostachya (S)	35.7	1.21	69.4	10.9	8.9	1.48	27.1	6.5		
Bromus japonicus (S)	7.1	.14								
Aster ericoides (L)	7.1	.14								
Cassia fasciculata (L)	7.1	.71								
Ratibida columnifera (S)	7.1	2.14								
Grass	7.1	.85			11.1	.37				
Panicum virgatum (S)	7.1	.07								
Sorghum vulgare (S)					2.2	.02				
Lespedeza stipulacea (L)					95.6	67.55	48.8	49.0	16.7	3.33
" " (S)					20.0	.82				
Cynodon dactylon (L)					6.7	.17				
Amaranthus retroflexus (S)					8.9	.11				
Panicum capillare (S)					11.1	.17				
Physalis sp. (S)					20.0	1.17	7.1	18.6	16.7	.16

Table XXII. October food use by greater prairie chickens, K. S. Adams Ranch, Osage County Oklahoma 1960.

Food Items	Native Prairie Sample Size 65				Cultivated Pastures Sample Size 14			
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index
Insects								
Coleoptera	1.5	.07			7.1	.14		
Chrysomelidae								
Eumolpinae	6.2	.13						
Galerucinae	1.5	.01	22.9	1.2	50.0	1.35	22.9	38.6
Carabidae	13.8	.49	2.9	13.4				
Hemiptera	1.5	.04						
Scutelleridae	4.6	.09	2.9	4.3				
Pentatomidae	1.5	.23	14.3	1.3				
Orthoptera	55.4	7.72			35.7	1.50		
Acrididae	9.2	1.20			35.7	1.85		
Acridinae	1.5	.15	2.9	1.4				
Cyrtacanthacridinae	30.8	3.15	8.6	28.2	7.1	.36	8.6	6.5
Conocephalinae	13.8	.95						
Gryllidae								
Gryllinae	1.5	.04						
Tettigoniidae								
Oecanthinae	7.7	.89	11.4	6.8				
Homoptera								
Membracidae					7.1	.07		
Plants								
Ambrosia psilostachya (S)	100.0	51.76	69.4	30.6	85.7	31.28	27.1	62.5
" " (L)					7.1	.21		
Symphoricarpos orbiculatus (S)	1.5	.01	.6	1.5				
Penstemon cobaea (S)	10.8	.40						
Grass	6.2	.18						
Croton capitatus (S)	1.5	.03						
Solanum carolinense (S)	4.6	.23			7.1	.07		
Elymus canadensis (S)	1.5	.03						
Panicum capillare (S)	1.5	.01			7.1	.07		
Ambrosia artemisiifolia (S)	1.5	.23						
Bromus japonicus (S)	3.1	.07			7.1	.07		
Helianthus annuus (S)	4.6	.69			7.1	.35	1.8	7.0
Lespedeza stipulacea (L)					64.3	13.14	48.8	32.9
" " (S)					57.1	3.07		
Oxalis stricta (S)					7.1	.07		
Cynodon dactylon (L)					7.1	.71		
Sporobolus asper (S)					7.1	.07		
Desmanthus illinoensis (S)					7.1	.14		

Table XXIII. November food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma 1960.

Food Items	Native Prairie Sample Size 22				Cultivated Pastures Sample Size 64			
	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index	Per-cent Occ.	Per-cent Vol.	Avail-ability	Food Index
Insects								
Coleoptera					12.5	.45		
Chrysomelidae								
Galerucinae					1.6	.03	22.9	1.2
Carabidae					3.1	.09	2.9	3.0
Scarabaeidae								
Copiphorinae	4.5	1.40						
Orthoptera	90.9	24.09			10.9	.92		
Acrididae	9.1	2.27			21.9	1.76		
Cyrtacanthacridinae	13.6	1.40	8.6	8.6	6.3	.65	8.6	5.8
Conocephalinae	4.5	.68						
Acridinae	4.5	1.36	2.9	4.4				
Plants								
Ambrosia psilostachya (S)	77.3	14.50	69.4	23.7	53.1	14.20	27.1	38.7
" " (L)	4.5	.13			1.6	.03		
Lespedeza stipulacea (S)	13.6	.86			29.7	2.37	48.8	15.2
" " (L)	4.5	.22			10.9	.48		
Ambrosia artemisiifolia (S)	4.5	.13						
Grass	31.8	1.55			12.5	2.03		
Bromus japonicus (L)	4.5	.04			7.8	.39		
Croton capitatus (S)	4.5	.13						
Sorghastrum nutans (S)	4.5	.09						
Corn	9.1	1.13						
Symphoricarpos orbiculatus (S)	13.6	.40	.6	12.5	3.1	.03		
Plantago purshii (L)					3.1	.09		
Rumex crispus (S)					1.6	.01		
Oxalis stricta (L)					3.1	.20		
" " (S)					1.6	.03		
Physalis sp. (S)					1.6	.01		
Cynodon dactylon (L)					6.3	.18		
" " (S)					1.6	.03		
Sorghum vulgare (S)					10.9	.98		
Helianthus annuus (S)					20.3	3.59	1.8	19.9
Wheat (L)&(S)					37.5	4.48	11.8	33.1
Solanum carolinense (S)					3.1	.07		
Sabatia campestris (L)					1.6	.03		
Cassia fasciculata (L)					1.6	.06		
Viola kitaibeliana (L)					6.3	.45	19.4	5.1
Panicum capillare (S)					1.6	.01		
Hordeum pusillum (L)					3.1	.17		
Gravel					1.6	.02		

Table XXIV. December food use by greater prairie chickens, K. S. Adams Ranch, Osage County, Oklahoma, 1961.

Food items	Native Prairie Sample Size 13				Cultivated Pastures Sample Size 83				Old Field Sample Size 5	
	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent Vol.	Availability	Food Index	Percent Occ.	Percent vol.
Insects										
Coleoptera					1.2	.03				
Chrysomelidae										
Galerucinae					1.2	.02				
Carabidae					2.4	.03				
Orthoptera					8.4	.27			80.0	2.80
Acrididae	15.4	.46			39.8	1.69				
Cyrtacanth-acridinae	7.7	.23			18.1	1.16				
Larvae					1.2	.02				
Plants										
Lespedeza stipulacea (L)	69.2	7.84			49.4	3.18	12.0	43.5		
" " (S)					10.8	.62				
Sorghum	38.5	1.46			41.0	10.78				
Grass	23.1	5.00			53.0	7.91			20.0	3.00
Corn	30.8	4.84			14.5	1.78				
Melilotus officinalis (S)	30.8	.61			12.0	.45				
Solanum carolinense (S)	7.7	.76			16.9	.60				
Wheat					37.3	4.95	40.0	22.4		
Symphoricarpos orbiculatus (S)					4.8	.93				
Echinochloa crusgalli (S)					3.6	.08				
Buchloe dactyloides (S)					2.4	.20				
Helianthus annuus (S)					2.4	.08				
Melilotus Alba (S)					2.4	.04				
Panicum capillare (S)					2.4	.02				
Oxalis stricta (L)					1.2	.04	5.0	1.1		
Ambrosia psilostachya (S)					4.8	.15			40.0	2.00
" " (L)					2.4	.20				
Physalis					7.2	.18			60.0	2.80
Carex annectens (S)					4.8	.08				
Croton capitatus (S)					1.2	T				
Digitaria sanguinalis (S)					2.4	.04				
Bromus japonicus (L)					8.4	.85	74.0	2.2	20.0	5.00
" " (S)					2.4	.04				
Elymus virginicus (S)					1.2	.02				
Viola kitaibeliana (L)									60.0	31.00

APPENDIX C

A List of Scientific and Common

Plant Names Appearing in this Report[1]

Scientific Name	Common Name
Achillea lanulosa Nutt.	Western Yarrow
Agropyron smithii Rydb.	Western Wheatgrass
Agrostis hyemalis (Walt.) BSP.	Hairgrass
Allium canadense L.	Wild Garlic
Alopecurus carolinianus Walt.	Foxtail Grass
Amaranthus graecizans L.	Tumbleweed
Amaranthus retroflexus L.	Pigweed
Ambrosia artemisiifolia L.	Ragweed
Ambrosia psilostachya DC.	Western Ragweed
Andropogon gerardi Vitman	Big Bluestem
Andropogon hallii Hack	Sand Bluestem
Andropogon saccharoides Sw.	Silver Beardgrass
Andropogon scoparius Michx.	Little Bluestem
Aristida oligantha Michx.	Prairie Three-awn
Aristida purpurea Nutt.	Purple Three-awn
Artemisia filifolia Torr.	Sand Sagebrush
Asclepias viridis Walt.	Spider Milkweed
Astragalus crassicarpus Nutt.	Ground Plum
Aster ericoides L.	Heath Aster

[1] Scientific names were taken from the key by Waterfall (1960).

Scientific Name	Common Name
Baptisia sp.	False Indigo
Bidens frondosa L.	Beggarticks
Bouteloua curtipendula (Michx.) Torr.	Sideoats Grama
Bouteloua gracilis (Willd.) Lag.	Blue Grama
Bouteloua hirsuta Lag.	Hairy Grama
Bromus japonicus Thunb.	Japanese Brome
Bromus mollis L.	Soft Chess
Buchloe dactyloides (Nutt.) Engelm.	Buffalo Grass
Calamovilfa gigantea (Nutt.) Scribn. & Merr.	Big Sandreed
Callirhoe involucrata (Nutt.) Gray	Poppymallow
Camassia scilloides (Raf.) Cory	Blue Camas
Carex annectens Bickn.	Sedge
Cassia fasciculata Michx.	Partridge Pea
Celtis occidentalis Pursh	Hackberry
Cenchrus pauciflorus Benth.	Sandbur
Cerastium sp.	Chickweed
Chenopodium album L.	Lamb's-quarters
Chloris verticillata Nutt.	Windmill Grass
Chrysopsis villosa (Pursh) Nutt.	Golden Aster
Cirsium undulatum (Nutt.) Spreng.	Thistle
Convolvulus arvensis L.	Bindweed
Conyza canadensis (L.) Cronq.	Horseweed
Croton capitatus Michx.	Croton
Croton texensis (Klotzsch) Muell. Arg.	Texas Croton
Cryptantha minima Rydb.	Cryptantha

Scientific Name	Common Name
Cynodon dactylon (L.) Pers.	Bermuda Grass
Cyperus schweinitzii Torr.	Flatsedge
Digitaria sanguinalis (L.) Scop.	Crabgrass
Descurainia pinnata (Walt.) Britt.	Tansy Mustard
Desmanthus illinoensis (Michx.) MacM.	Prairie Mimosa
Draba reptans Fern.	Whitlowgrass
Draba cuneifolia Nutt.	Wedge-leaved whitlowgrass
Echinacea angustifolia DC.	Black Sampson
Echinacea pallida Nutt.	Purple Coneflower
Echinochloa crusgalli (L.) Beauv.	Barnyard Grass
Eleocharis sp.	Spikerush
Elymus canadensis L.	Wild Rye
Elymus virginicus L.	Virginia Wild Rye
Eragrostis megastachya (Loel.) Link.	Stinkgrass
Eragrostis curtipedicellata Buckl.	Short-stalked Lovegrass
Eragrostis oxylepis (Torr.) Torr.	Clustered Lovegrass
Eragrostis sessilispica Buckl.	Tumble Lovegrass
Eragrostis spectabilis (Pursh) Steud.	Purple Lovegrass
Eragrostis trichodes (Nutt.) Nash	Sand Lovegrass
Erigeron bellidiastrum Nutt.	Fleabane
Erigeron strigosus Muhl.	Fleabane
Eriogonum annuum Nutt.	Annual Eriogonum
Euphorbia fendleri T. & G.	Fendler's Spurge
Euphorbia serpens H. B. K.	Spurge
Euphorbia missurica Raf.	Missouri Spurge

Scientific Name	Common Name
Evax prolifera Nutt.	Big-headed Evax
Evolvulus nuttallianus R. & S.	Evolvulus
Festuca octoflora Walt.	Six-week Fescue
Gaillardia pulchella Foug.	Blanket Flower
Galium aparine L.	Bedstraw
Geranium carolinianum L.	Cranesbill
Gilia longiflora (Torr.) Don	Gilia
Gossypianthus sp.	Wild Cotton
Grindelia squarrosa (Pursh) Dunal	Gumweed
Gutierrezia dracunculoides (D.C.) Blake	Broomweed
Gutierrezia sarothrae (Pursh) Britton & Rusby	Broom Snakeweed
Haplopappus spinulosis (Pursh) D.C.	Cut-leaved Haplopappus
Helianthus annuus L.	Sunflower
Heterotheca latifolia Buckl.	Heterotheca
Hoffmanseggia jamesii T. & G.	James' Hoffmanseggia
Hordeum pusillum Nutt.	Little Barley
Hypoxis hirsuta (L.) Coville	Yellow Stargrass
Ipomoea leptophylla Torr.	Bush Morning-glory
Iva ciliata Willd.	Marsh Elder
Juncus interior Wieg.	Interior Rush
Koeleria macrantha (Lebed.) Spreng.	Junegrass
Krigia occidentalis Nutt.	Dwarf Dandelion
Lepidium densiflorum Schrad.	Peppergrass
Lepidium oblongum Small	Peppergrass
Lepidium virginianum L.	Peppergrass

Scientific Name	Common Name
Leptoloma cognatum (Schultes) Chase	Fall Witchgrass
Lespedeza stipulacea Maxim.	Korean Lespedeza
Liatris punctata Hook.	Blazing Star
Linum sulcatum Riddell	Yellow Flax
Lithospermum incisum Lehm.	Narrow-leaved Puccoon
Mamillaria sp.	Nipple Cactus
Melilotus alba Desv.	White Sweetclover
Melilotus officinalis (L.) Lam.	Yellow Sweetclover
Monarda punctata L.	Horse Mint
Nemastylis geminiflora Nutt.	Northern Nemastylis
Oenothera serrulata Nutt.	Half-shrub Evening Primrose
Opuntia macrorhiza Engelm.	Prickly Pear
Oxalis stricta L.	Yellow Wood Sorrel
Oxalis violacea L.	Wood Sorrel
Panicum dichotomiflorum Michx.	Fall Panicum
Panicum capillare L.	Witchgrass
Panicum oligosanthes var. scribnerianum (Nash) Fern.	Scribner Panicum
Panicum virgatum L.	Switchgrass
Paspalum ciliatifolium Michx.	Sand Paspalum
Penstemon cobaea Nutt.	Beardtongue
Physalis sp.	Ground Cherry
Plantago purshii R. & S.	Salt-and-Pepper Plant
Plantago rugelii Dcne.	Rugel's Plantain
Poa annua L.	Annual Bluegrass

Scientific Name	Common Name
Poa arachnifera Torr.	Texas Bluegrass
Poa pratensis L.	Kentucky Bluegrass
Polygonum aviculare L.	Knotweed
Polygonum convolvulus L.	Climbing Buckwheat
Populus deltoides Marsh.	Cotton wood
Prunus angustifolia Marsh.	Sand Plum
Psoralea tenuiflora Pursh	Wild Alfalfa
Ratibida columnifera (Nutt.) W. & S.	Prairie Coneflower
Rhus aromatica Ait.	Skunkbush Sumac
Ruellia humilis Nutt.	Ruellia
Rumex altissimus Wood	Pale Dock
Rumex crispus L.	Curly Dock
Sabatia campestris Nutt.	Prairie Gentian
Schrankia uncinata Willd.	Catclaw Sensitive Brier
Silene antirrhina L.	Sleepy Catchfly
Sisyrinchium campestre Bickn.	Blue-eyed Grass
Solanum carolinense L.	Horse Nettle
Solanum rostratum Dunal	Buffalobur
Solidago rigida L.	Goldenrod
Sorghastrum nutans (L.) Nash	Indian Grass
Sorghum halepense (L.) Pers.	Johnson Grass
Sorghum vulgare Pers.	Sorghum
Specularia leptocarpa (Nutt.) Gray	Venus'-looking Glass
Sporobolus asper (Michx.) Kunth	Dropseed
Sporobolus cryptandrus (Torr.) Gray	Sand Dropseed

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Stillingia sylvatica L.	Queens Delight
Symphoricarpos orbiculatus Moench	Wolfberry
Triplasis purpurea (Walt.) Chapm.	Sandgrass
Tripsacum dactyloides L.	Gamagrass
Triticum aestivum L.	Wheat
Tradescantia occidentalis (Britt.) Smyth	Spiderwort
Ulmus Americana L.	American Elm
Verbena simplex Vent.	Verbena
Vernonia baldwinii Torr.	Ironweed
Viola kitaibeliana var. *rafinesquii* (Greene) Fern.	Johnny-jump-up
Yucca glauca Nutt.	Soapweed

VITA

Robert Earl Jones

Candidate for the Degree of

Doctor of Philosophy

Thesis: A COMPARATIVE STUDY OF THE HABITATS OF THE LESSER AND GREATER PRAIRIE CHICKEN IN OKLAHOMA

Major Field: Zoology

Biographical:

Personal Data: Born at Jamestown, North Dakota, August 24, 1933, the son of Robert L. and Erma Pratt Jones.

Education: Attended grade school at Medina and Bottineau, North Dakota; graduated from Bottineau High School in 1951; received Associate of Arts, 1953, and Associate of Science in Forestry, 1954, from North Dakota School of forestry; received Bachelor of Science in Forestry from the University of Idaho in June, 1956; received the Master of Science in Forestry from the University of Idaho; completed requirements for the Doctor of Philosophy degree in May 1963.

Professional experience: Four summers experience with the U. S. Forest Service; one summer as Student assistant Biologist, Ruby Lake National Wildlife Refuge; one summer as Research Assistant, ruffed grouse project, for the University of Idaho. Member of Ecological Society of America, American Ornithological Union, American Society of Mammalogists, Cooper Ornithological Society, Wildlife Society, Southwestern Association of Naturalists, Northwest Scientific Association, Oklahoma Academy of Science, Ecological Society Section of Animal Behavior and Sociobiology, Phi Theta Kappa, Xi Sigma Pi, Phi Sigma, and Sigma Xi (Associate).