

HABITAT TYPES USED BY THE BOBWHITE
QUAIL AND OTHER WILDLIFE IN
SOUTHWESTERN OKLAHOMA

By

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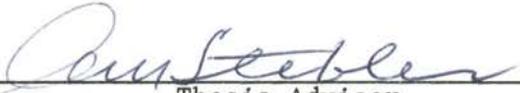
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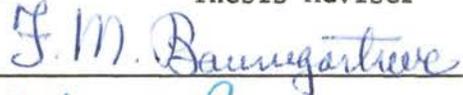
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Thesis Approved:



Thesis Adviser







Dean of the Graduate School

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CHAPTER I

INTRODUCTION

The bobwhite quail is considered the most important game bird in Oklahoma since more sportsmen in this state hunt quail than any other type of game (Duck and Fletcher, ca. 1944). Bobwhites live under a wide variety of environmental conditions over the state because of marked differences between the vegetation, topography, climate, soils, and agricultural practices of the several sections of the state. They are found in every county and occupy virtually all of the available types of habitat.

Various aspects of bobwhite ecology have been studied for some parts of Oklahoma. In north-central Oklahoma, Baumgartner (1945, 1946), DeArment (1950), and Davis (1964), have investigated food and cover use, and in the northwestern part of the state, Davison (1935), and Hanson (1953), have described population movements and cover preferences of the bobwhite. Baumgartner, et al. (1952), Bird and Bird (1931), and Lee (1948), have published data relative to bobwhite food habits in Oklahoma. Although Duck and Fletcher (ca. 1944) made a cursory study of this species for much of the state, there are many sections of Oklahoma for which there is little or no systematic information available concerning bobwhite habitat conditions.

A search of the literature revealed that little is known about bobwhite populations and habitat conditions in southwestern Oklahoma. Similarly, only a small amount of information is available relative to other wildlife

populations in this part of the state. Margaret Nice (1931), refers to twelve different biological expeditions between 1852 and 1931 during which birds and/or mammals were collected or reported from southwestern Oklahoma. E. A. Preble and James Gaut, of the U. S. Bureau of Biological Survey, collected a few mammals from the Wichita Mountains in 1904 (Nice, 1931). In 1938, W. F. Blair spent eight nights trapping mammals in eastern Cotton County, southern Jackson County, and extreme southwestern Harmon County (Blair, 1954). Baumgartner and Baumgartner (no date) have listed nearly all the species of birds which have been recorded in Oklahoma, together with their resident status.

The present study was made in southwestern Oklahoma and principally concerns the bobwhite quail. It provides information relative to cover preference, fluctuation in populations, reproductive success, and other aspects of bobwhite ecology in diverse habitats during different seasons of the year. In addition, the species and the relative densities of the more common birds in the various habitats during both summer and winter were determined and a list of mammals identified during the study was compiled. Field work was done from June 1963 to April 1964.

The study was supported by the Oklahoma Cooperative Wildlife Research Unit¹ and conducted under the direct supervision of Dr. A. M. Stebler and the other members of the graduate advisory committee, Dr. F. M. Baumgartner and Dr. D. E. Bryan. I wish to thank the following hunters for their cooperation during the 1963-64 quail hunting season:

¹Oklahoma Department of Wildlife Conservation, Oklahoma State University, U. S. Fish and Wildlife Service, and Wildlife Management Institute cooperating.

Messrs. Dewayne Noble, Homer Messick, Charles Anderson, Sr., Richard Treadwell, Bill Treadwell, James Head, and J. E. Reeder. Land was made available for the study by Messrs. H. L. Payne, Jack Myers, Paul Bennett, Loyd Dempsey, Clarence Barker, Lonzo Walker, and Lewis Stearns. I am also indebted to Harley W. Reno for his help with the figures and manuscript.

CHAPTER II

GENERAL DESCRIPTION OF SOUTHWESTERN OKLAHOMA

The area studied was located in the southwest corner of Oklahoma, between the North Fork of the Red River and the Wichita Mountains (Fig. 1).

The climate (Bruner, 1931; Blair and Hubbell, 1938; U. S. D. A., 1941), physiography (Curtis and Ham, 1957), and vegetation (Bruner, 1931; Blair and Hubbell, 1938; Clements and Shelford, 1939) of this part of the state have been characterized previously in the literature.

The agriculture of the area is typified by farms which primarily produce field crops - cotton, wheat, and other small grains - with supplementary livestock enterprises, and by ranching operations interspersed throughout the area (Martin, *et al.*, 1964). In Kiowa and Tillman Counties, where this study was centered, there has been a recent trend to use more land for pasture and less for cropland (Table I).

TABLE I

NUMBER OF ACRES OF CROPLAND AND PASTURE IN KIOWA AND TILLMAN COUNTIES, OKLAHOMA, FROM 1940 TO 1959 (U. S. BUR. CENSUS 1946, 52, & 61).

<u>KIOWA COUNTY</u>	<u>1940</u>	<u>1944</u>	<u>1949</u>	<u>1954</u>	<u>1959</u>
Total Cropland	400,496	392,330	385,116	379,128	351,079
Total Pasture	-	226,782	215,738	243,697	249,508
<u>TILLMAN COUNTY</u>					
Total Cropland	415,570	396,411	405,572	393,960	368,258
Total Pasture	-	145,544	148,715	163,748	167,078

CHAPTER III

DESCRIPTION OF STUDY AREAS

Seven study areas in southwestern Oklahoma were used in the present study, all within a 30-mile radius of Snyder (Fig. 1). Ecological situations represented were sandsage-grassland, mesquite-grassland, small granite hills, wooded bottomland, mixedgrass prairie, and unstabilized bottomland.

Areas 1 to 5 were studied from June, 1963 to April, 1964, and Areas 6 and 7 were studied from December, 1963 to April, 1964.

Area 1

Study Area 1 was located six and one-half miles west of Snyder, Oklahoma. It consisted of approximately 70 acres of sandsage (Artemisia filifolia)-grassland interspersed with fallow fields and shelterbelts (Fig. 2). The fallow fields ranged in size from three to ten acres, and were characterized by generally open stands of Amaranthus sp., Eriogonum sp., white prickly poppy (Argemone sp.), annual sunflower (Helianthus sp.), and other annual forbs which averaged from two to four feet in height. Typical shelterbelts in this part of the state are comprised chiefly of osage-orange (Maclura pomifera), Chinese elm (Ulmus parvifolia), and black locust (Robinia pseudo-acacia) trees.

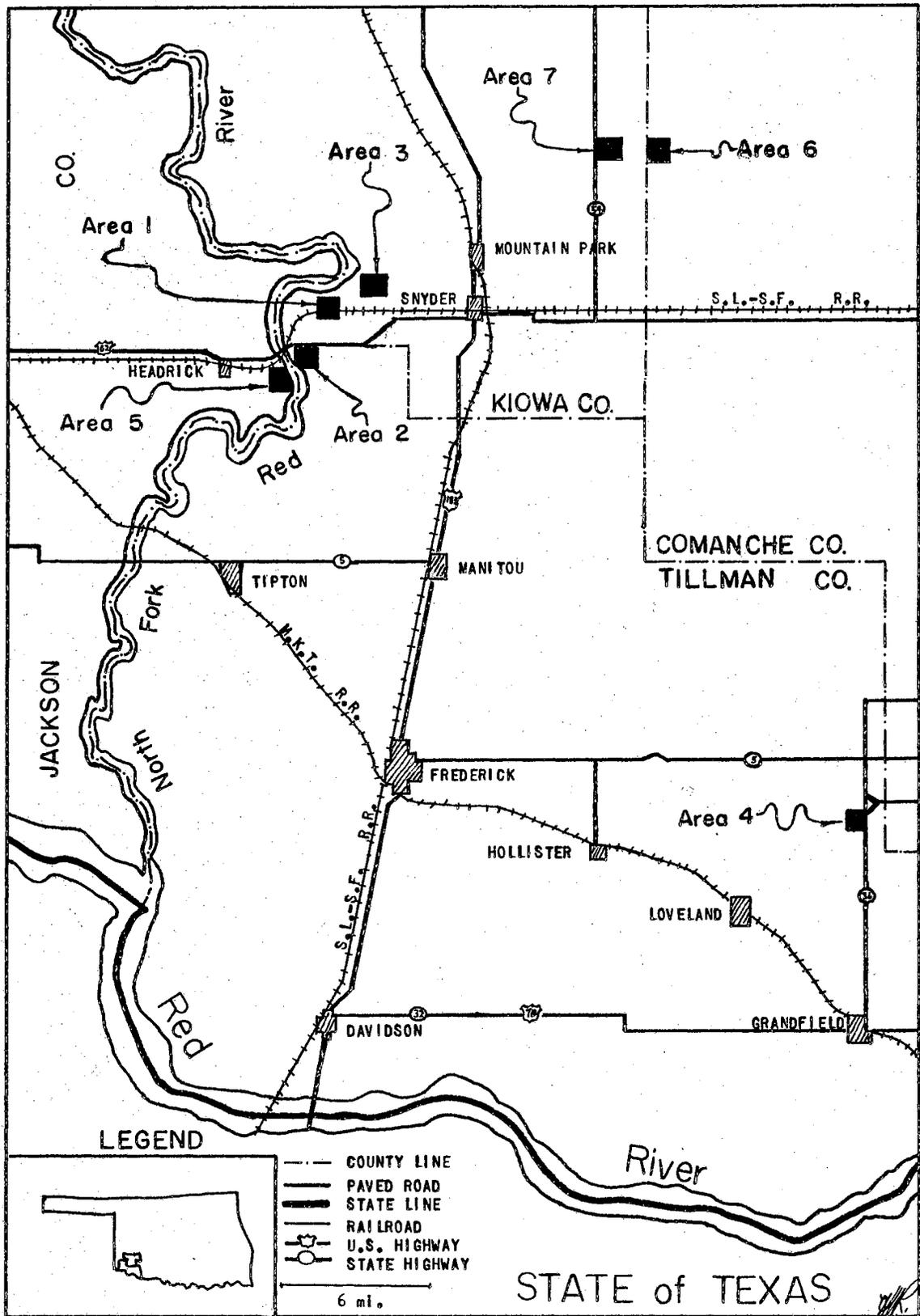


Figure 1. Location map of study areas in southwestern Oklahoma.

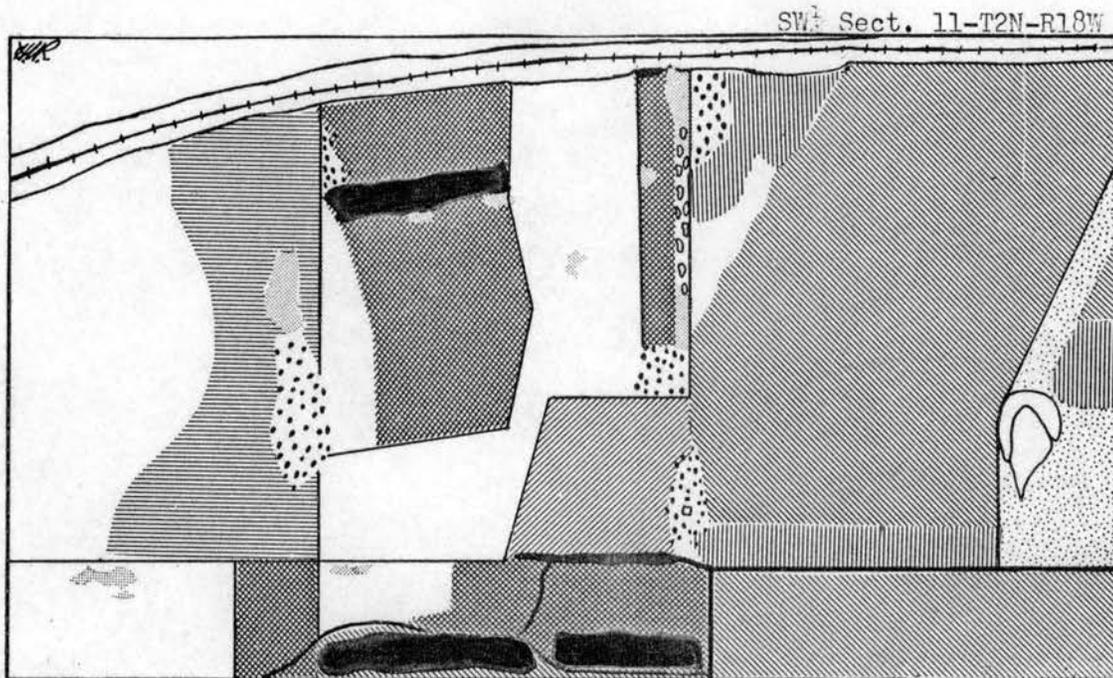


Figure 2. Study Area 1.

- | | | | |
|---|-----------------------|---|-------------|
|  | COTTON |  | TREES |
|  | WHEAT |  | SHELTERBELT |
|  | PLOWED LAND |  | ROAD |
|  | SMALL GRAIN |  | POND |
|  | FALLOW LAND |  | BUILDINGS |
|  | MESQUITE-BUFFALOGRASS |  | SANDHILLS |
|  | SHRUBS (MOSTLY PLUM) | | |

Area 2

This area was also of the sandsage-grassland type. It was located three miles east and one and one-half miles south of Headrick on the east side of the North Fork of Red River. The following ecological situations were present on this 40-acre study area: shelterbelts, sandhills, bottomland timber, and a heavily overgrown fence row (Fig. 3). Thick stands of Tamarix, black willow (Salix nigra), and cottonwood (Populus deltoides) trees along the riverbank constituted the bottomland timber. The fence row was dominated by plum thickets (Prunus sp.) mixed with tumbleweed (Amaranthus graecizans), johnsongrass (Sorghum halepense), and annual forbs, and an extensive thicket of plum mixed with little bluestem (Andropogon scoparius) skirted a small granite knoll in the northeast corner of the study area.

Area 3

Area 3 consisted of a small granite knoll covering about 35 acres and a 30-acre mesquite (Prosopis juliflora) pasture (Fig. 4). It was located four and one-half miles west and one-half mile north of Snyder. Thick stands of sumac (Rhus glabra), hackberry (Celtis sp.), American elm (Ulmus americana), chittamwood (Bumelia lanuginosa), and chinaberry (Sapindus drummondii) trees grew along the base of the knoll.

In the mesquite pasture, buffalograss (Buchloë dactyloides) was the dominant ground cover and clumps of prickly-pear (Opuntia sp.) were common. The pasture was heavily grazed during the course of the study.

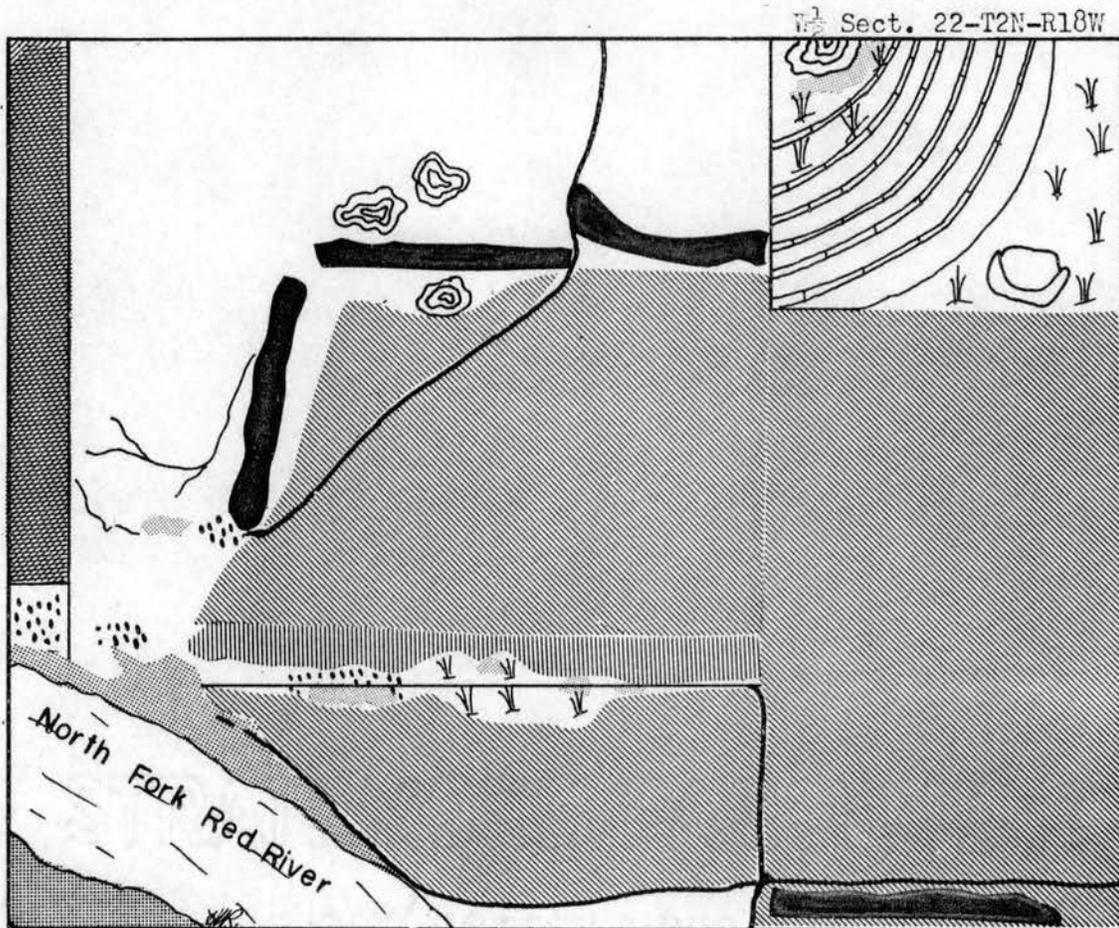
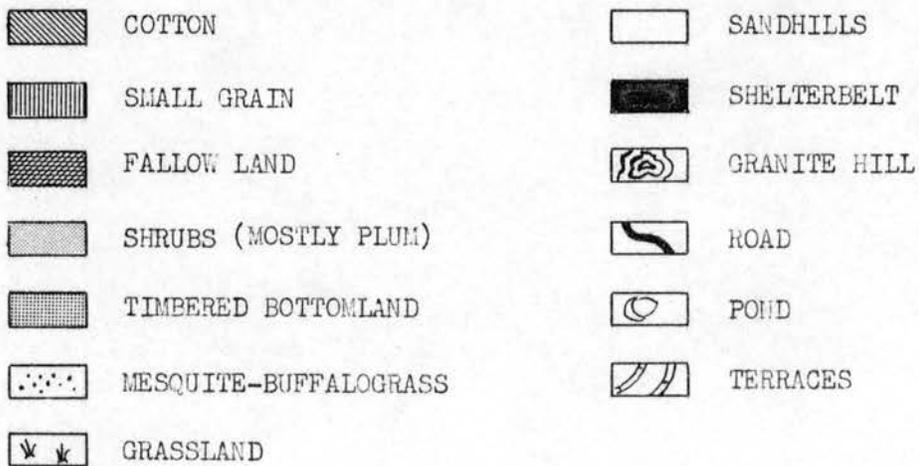


Figure 3. Study Area 2.



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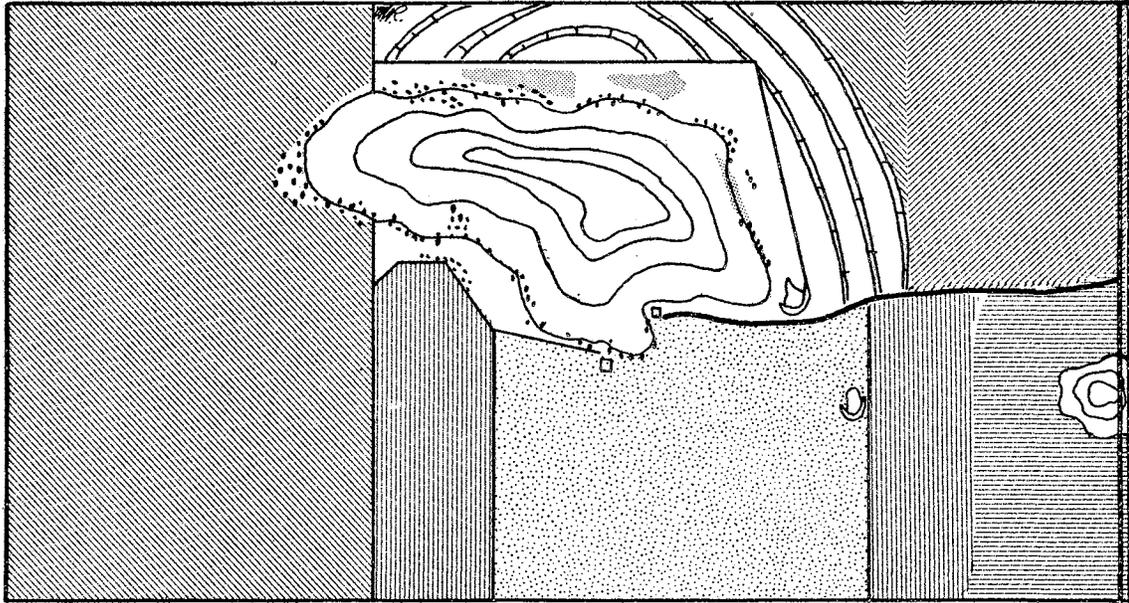
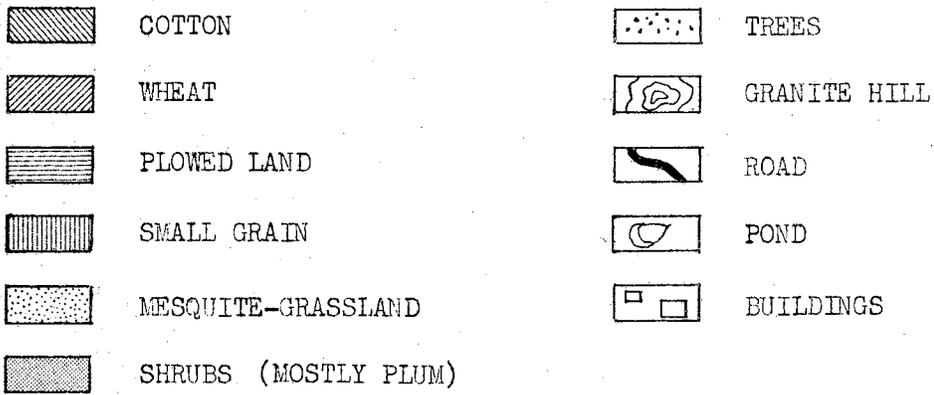


Figure 4. Study Area 3.



Area 4

This study area was located eight miles north of Grandfield, Oklahoma, at the upper end of Brush Creek, a small tributary of Deep Red Creek. It was an unstabilized drainage bottom, and was covered mostly with weeping lovegrass (Eragrostis curvula) and Tamarix. It occupied approximately 27 acres. The wide, shallow streambed ran in a southeasterly direction between two large fields of cotton, and, like most other streams in the region, seldom contained much water. Principal plant species growing along the watercourse included cattail (Typha sp.), bulrush (Scirpus sp.), yellow nutgrass (Cyperus esculentus), smartweed (Polygonum sp.), weeping lovegrass, and Tamarix (Fig. 5).

Area 5

Area 5 was located two miles east and one and one-half miles south of Headrick, on the west side of the North Fork of Red River. It covered some 25 acres and was the smallest of the study areas.

A moderately-grazed field of tall grasses dominated by little bluestem occupied most of the west-central portion of the study area; a few open spots in the grass contained only forbs, notably: Eriogonum, annual sunflower, camphorweed (Heterotheca subaxillaris), and white prickly poppy. A large plum thicket grew in the northeast corner of the field.

In the southwest corner of the study area, a small, dense grove of black locust trees mixed with johnsongrass and skunkbush (Rhus aromatica) projected into a large field of cotton (Fig. 6).

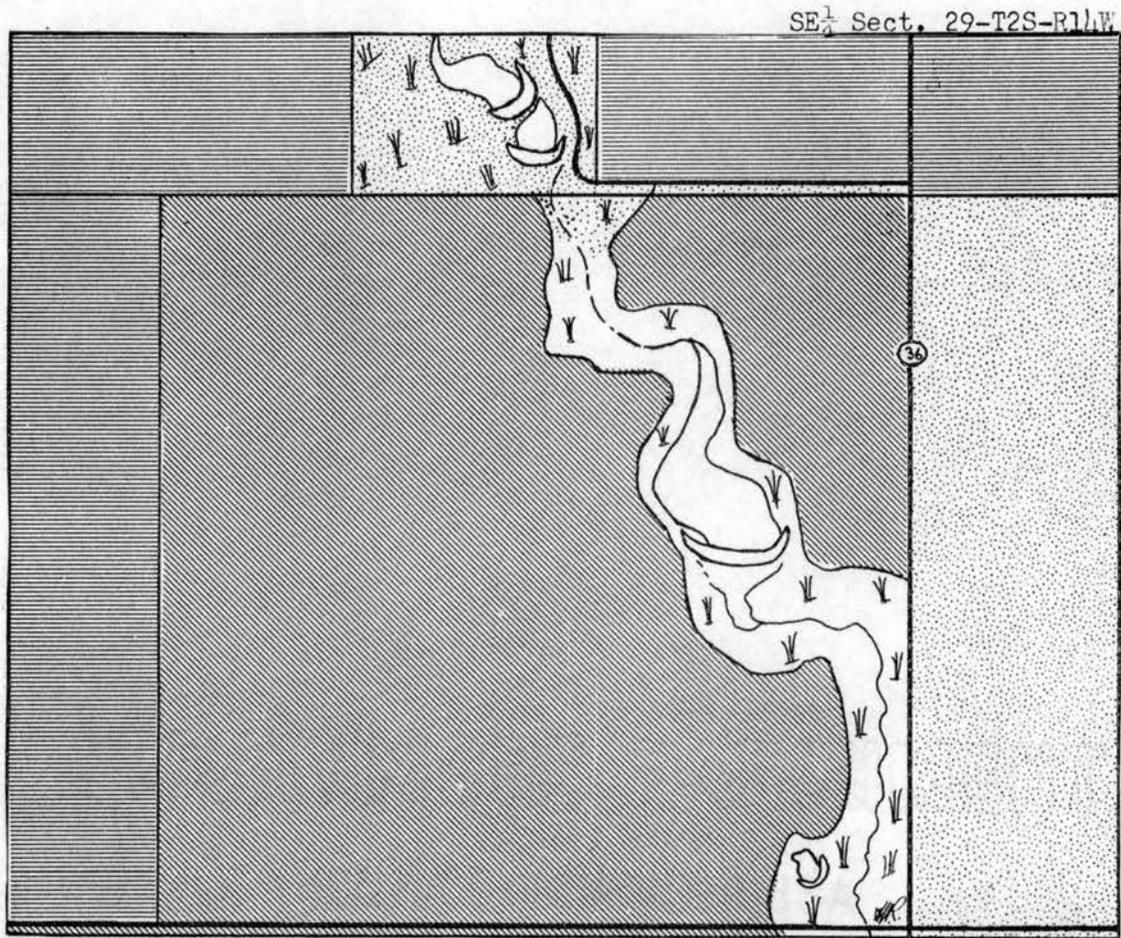
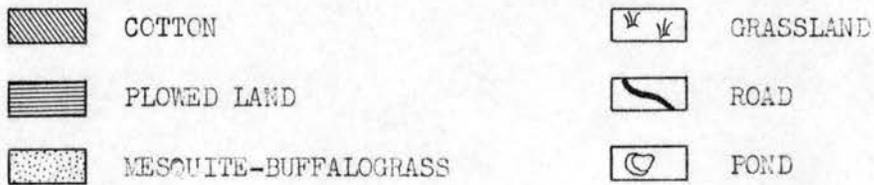


Figure 5. Study Area 4.



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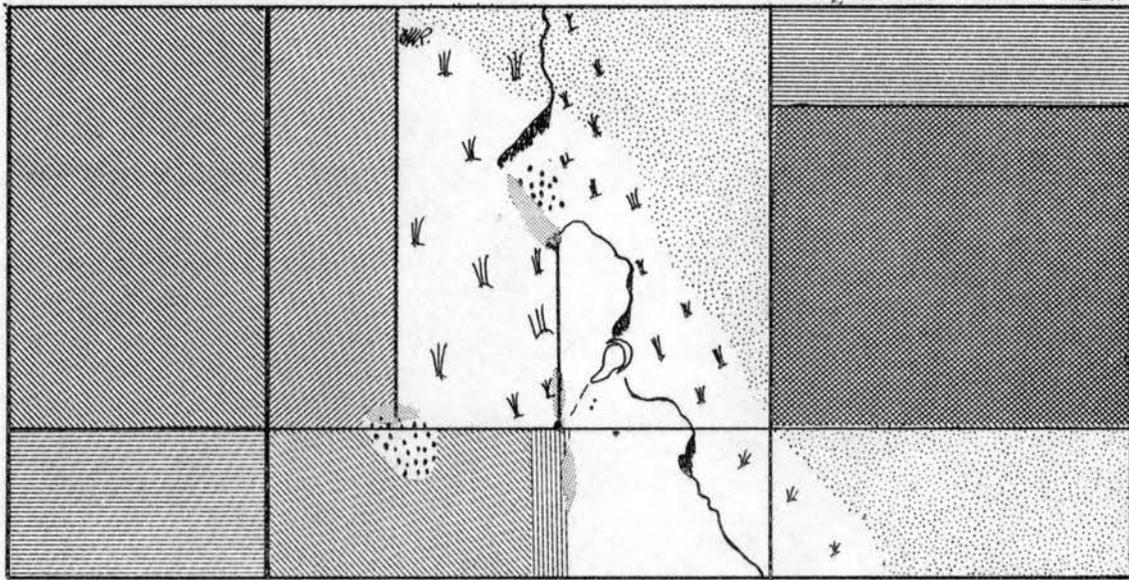


Figure 6. Study Area 5.

- | | | | |
|---|-----------------------|---|----------------------|
|  | COTTON |  | SHRUBS (MOSTLY PLUM) |
|  | WHEAT |  | TREES |
|  | PLOWED LAND |  | GRASSLAND |
|  | SMALL GRAIN |  | SANDHILLS |
|  | FALLOW LAND |  | POND |
|  | MESQUITE-BUFFALOGRASS | | |

Area 6

This area, seven and one-half miles east and four and one-half miles north of Mountain Park, was located at the northwest edge of Comanche County, in the foothills of the Wichita Mountains. It consisted of approximately 50 acres and was characterized by low-lying granite hills rising on either side of a small creek bottom and surrounded by an extensive mesquite pasture (Fig. 7).

Granite boulders, with little bluestem growing among them, covered the hills. Thickets of Forestiera sp., skunkbush, and plum were common on the hillsides, as were thick stands of sumac. The larger ravines between the hills were dominated by black walnut (Juglans nigra), hackberry, chinaberry, sumac, and Forestiera, often mixed with dense tangles of smilax (Smilax bona-nox). Along the creek, the major woody species were: American elm, hackberry, black willow, and buttonbush (Cephalanthus occidentalis). During the study, the mesquite pasture adjacent to this study area was moderately grazed.

Area 7

Timbered bottomland was the principal type of habitat on this area, which was five miles east and five miles north of Mountain Park. It was located along a small tributary of Otter Creek, and occupied some 45 acres. The creekbed followed a southwesterly direction and averaged about 20 yards in width; woody species were essentially the same as described on Area 6. There were several dense groves of chinaberry trees and many brushpiles along the creekbank (Fig. 8).

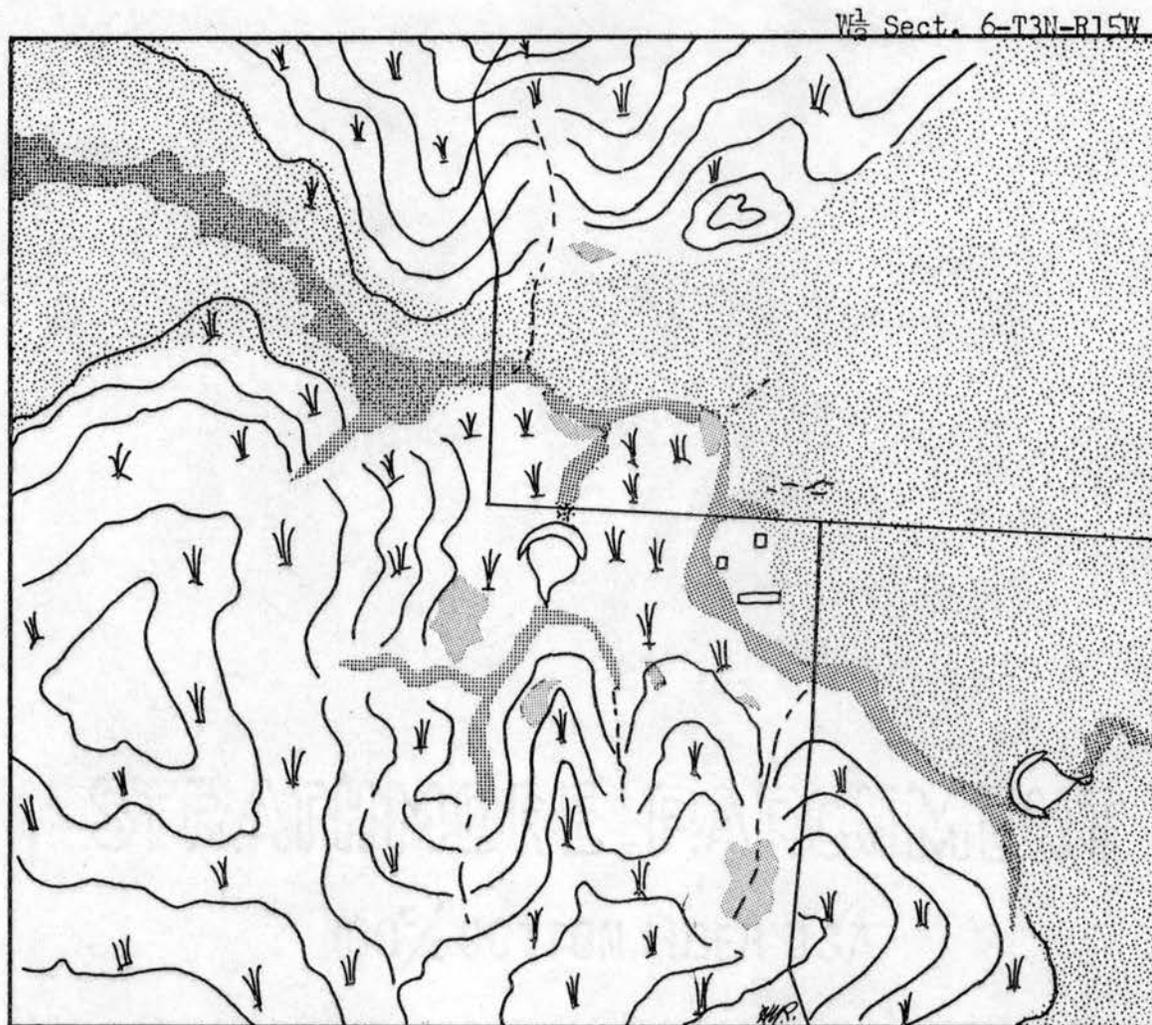
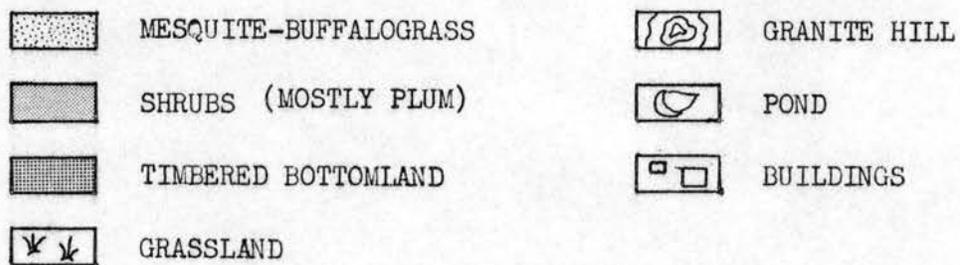


Figure 7. Study Area 6.



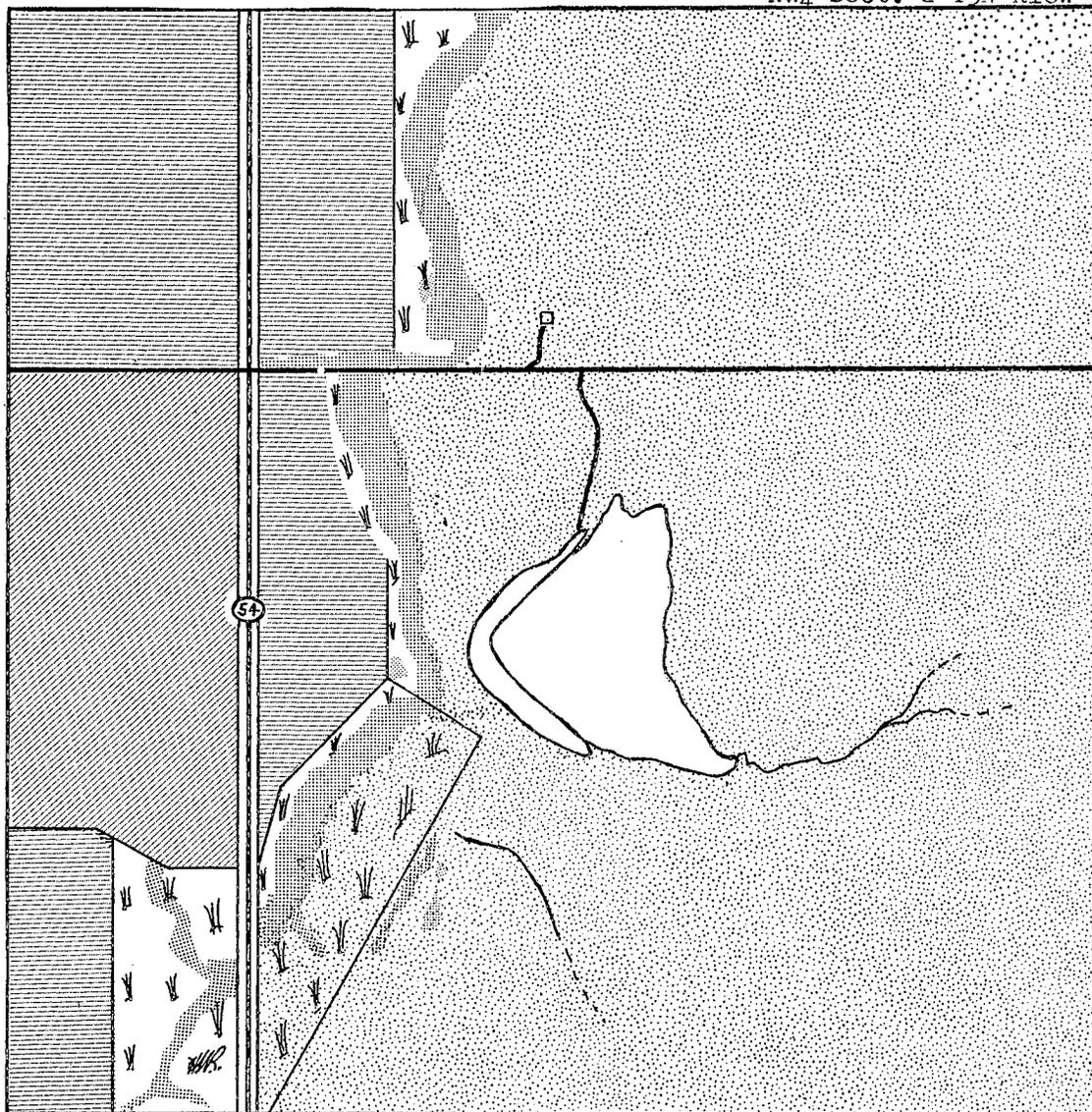
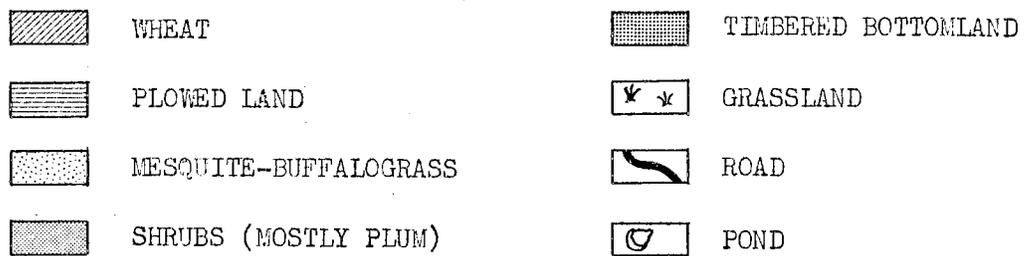
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Figure 8. Study Area 7.



CHAPTER IV

METHODS

Selection of Study Areas

Seven study areas, varying in size from 25 to 70 acres, were selected in different types of habitat in southwestern Oklahoma on the basis of: (1) quantity, quality, and type of wildlife habitat available; (2) numbers of bobwhite quail and other wildlife found on the area; and (3) land-use on, and adjacent to the area.

Census of Study Areas

A census was made on each study area approximately every three weeks, from June to mid-September, 1963, and again from mid-October, 1963, to April, 1964. During the summer and early fall, bobwhites were censused using the method developed by Bennett and Hendrickson (1938). Briefly, the method consisted of using a bird dog to take censuses of bobwhite covey ranges during the early morning hours. The time selected was from 6:00 a.m. to 8:00 a.m., when cool temperatures and dew enabled the dog to work more effectively. After September, the time of the census was changed to mid-day, from 10:30 a.m. to 1:30 p.m., but the method remained essentially the same. The number of bobwhites flushed and the location of the flush were recorded on individual maps of each study area.

At the time each study area was being censused for bobwhites, the number and species of all other birds seen on the area were also recorded. This was done in order to give a rough index to the relative density of the species of birds found in various habitat types during different seasons of the year. A record was also kept of the species of mammals present on each area. Mammals were identified both by sighting and by the presence of distinct signs, such as tracks or diggings.

Identification of Habitat Components

Places used by bobwhites for (a) roosting, (b) escape, and for (c) resting, dusting, and feeding were noted. Roosting places were distinguished by the presence of small heaps of droppings found in open vegetation where the birds were known to roost, or were suspected of roosting. Escape places were those used for refuge by the quail when disturbed. Resting, dusting, and feeding places were determined by the following criteria: (1) places from which the birds were flushed; (2) places where droppings were found scattered or in little heaps similar to a night roost, but with fewer droppings (Errington and Hamerstrom, 1936); or (3) places where dusting spots were found. Separation of these latter types of places was difficult, because the birds were often flushed before they had been set by the dog, and even when they were set, it was hard to determine the activity in which they had been engaged. Dusting places were distinguishable where dusting depressions were found, but many of these places were also used for resting and feeding.

At each place where the activity of the birds could be determined using the above criteria, the general type of vegetation and growth-form, when applicable, were recorded.

CHAPTER V

RESULTS

Types of Habitat Used by Birds Other Than Bobwhites

Seasonal bird census data from each study area are compared in Tables II and III. Information relative to number of species are presented in Table II, and data pertaining to average bird densities are found in Table III.

The average numbers of each species of bird found on the study areas during different seasons are presented in Table IV.

Types of Habitat Used by Mammals

The 25 species of mammals identified in southwestern Oklahoma during the study, and the study areas on which they were found, are presented in Table V.

Types of Habitat Used by Bobwhites

Table VI shows the number of bobwhites examined from the five principal types of habitat in the area of the study during the 1963-64 hunting season.

TABLE II

NUMBERS OF SPECIES OF BIRDS ON THE STUDY AREAS IN
SOUTHWESTERN OKLAHOMA; JUNE, 1963-APRIL, 1964

Area	Acres	Number of Times Censused	Total Number of Species	Number of Species in Different Seasons
1	70	3	38	Summer - 21
		7		Fall-Winter - 28
2	40	3	49	Summer - 24
		7		Fall-Winter - 38
3	65	4	38	Summer - 22
		6		Fall-Winter - 28
4	27	3	38	Summer - 13
		7		Fall-Winter - 29
5	25	3	33	Summer - 13
		7		Fall-Winter - 25
6	50	6	30	Fall-Winter - 30
7	45	5	36	Fall-Winter - 36

TABLE III

AVERAGE NUMBERS OF BIRDS SEEN ON THE STUDY AREAS IN
SOUTHWESTERN OKLAHOMA; JUNE, 1963-APRIL, 1964

Area	Acres	Average Number of Birds Seen per Census	Average Number of Birds per Acre
1	70	Summer - 101.00	1.44
		Fall-Winter - 228.71	3.27
2	40	Summer - 130.00	3.25
		Fall-Winter - 335.43	8.59
3	65	Summer - 115.00	1.77
		Fall-Winter - 112.67	1.73
4	27	Summer - 110.33	4.09
		Fall-Winter - 111.28	4.12
5	25	Summer - 59.67	2.39
		Fall-Winter - 140.67	5.63
6	50	Fall-Winter - 254.83	5.10
7	45	Fall-Winter - 263.20	5.85

TABLE IV

SPECIES AND AVERAGE NUMBERS OF BIRDS FOUND ON THE STUDY AREAS IN
SOUTHWESTERN OKLAHOMA; JUNE, 1963-MARCH, 1964^a

	Summer (June-September)					Fall-Winter (September-March)						
	Area No.					Area No.						
	1	2	3	4	5	1	2	3	4	5	6	7
<u>Permanent Residents</u>												
1. Great Blue Heron ^b	-	-	-	-	-	-	x*	-	x	-	x	-
2. Cooper's Hawk	-	-	-	-	-	-	-	-	-	x	-	-
3. Red-tailed Hawk	x	x	-	-	-	x	x	-	.29	.50	.33	.60
4. Marsh Hawk	-	-	-	-	-	.57	.71	x	.86	.33	x	.40
5. Sparrow Hawk	-	-	-	-	-	-	x	x	-	x	-	x
6. Bobwhite	8.67	8.33	13.00	15.33	18.00	26.57	35.43	17.83	21.29	31.17	37.33	29.80
7. Killdeer	-	-	-	18.33	-	-	-	x	1.00	-	-	1.40
8. Mourning Dove	16.00	20.67	31.00	7.00	18.00	13.14	3.43	15.67	-	12.67	x	10.20
9. Roadrunner	-	-	x	-	-	-	-	x	-	-	-	-
10. Great Horned Owl	-	-	-	-	-	-	-	-	1.00	-	-	.60
11. Burrowing Owl ^c	-	-	-	-	-	-	-	-	-	-	-	-
12. Long-eared Owl	-	-	-	-	-	-	-	-	-	-	.50	-
13. Belted Kingfisher	-	-	-	-	-	-	x	-	-	-	-	-
14. Yellow-shafted Flicker	x	-	-	-	-	1.14	1.71	1.00	.57	.83	1.50	1.20
15. Red-bellied Wood- pecker	1.33	-	-	-	-	.71	.71	-	-	-	.50	x
16. Red-headed Wood- pecker	x	1.00	-	-	1.00	-	-	-	-	-	-	-
17. Downy Woodpecker	x	x	-	-	x	.43	.29	-	-	-	.83	1.20
18. Ladder-backed Wood- pecker	-	-	1.00	-	-	1.00	.57	2.17	-	.33	.67	-
19. Horned Lark	-	-	-	-	-	-	-	-	1.86	-	-	234.00
20. Blue Jay	-	4.00	-	-	-	1.43	1.71	-	-	-	-	-

TABLE IV (Continued)

	Summer (June-September)					Fall-Winter (September-March)						
	Area No.					Area No.						
	1	2	3	4	5	1	2	3	4	5	6	7
<u>Permanent Residents (Continued)</u>												
21. Common Crow	x	2.67	=	-	=	1.14	1.14	2.33	.86	x	.67	4.80
22. Carolina chickadee	=	x	1.00	=	=	1.29	1.43	2.83	=	=	4.67	5.00
23. Bewick's Wren	3.67	1.67	3.00	=	=	1.57	2.43	2.17	=	=	2.33	.40
24. Cañon Wren	=	=	=	=	=	=	=	x	=	=	=	=
25. Mockingbird	7.00	7.67	13.25	=	3.00	.29	.43	x	=	x	=	x
26. Robin	=	=	=	=	=	32.00	27.00	12.00	=	x	31.50	x
27. Eastern Bluebird	=	=	=	=	=	1.86	=	=	=	=	8.50	x
28. Loggerhead Shrike	=	=	x	=	=	-	.29	x	=	x	x	x
29. Starling	=	=	=	=	=	x	x	=	=	=	=	3.20
30. House Sparrow	=	=	=	=	=	2.71	=	5.83	6.14	x	=	x
31. Western Meadowlark	=	x	.50	7.33	x	25.57	33.14	26.17	21.00	17.83	5.00	31.40
32. Redwinged Blackbird	=	=	x	44.33	=	=	=	=	25.43	x	=	32.00
33. Cardinal	6.67	5.67	5.00	=	1.00	2.43	17.86	3.17	=	.83	1.67	4.20
34. American Goldfinch	=	=	=	=	=	x	16.14	x	2.43	19.17	19.17	=
35. Rufous-crowned Sparrow	=	=	=	=	=	=	.43	2.33	=	=	3.33	=
36. Field Sparrow	6.67	2.00	1.50	=	=	22.43	12.71	=	=	x	19.33	x
<u>Summer Residents</u>												
1. Green Heron	=	=	=	x	=	=	=	=	=	=	=	=
2. Turkey Vulture	=	x	x	=	=	=	=	=	=	=	=	=
3. Mississippi Kite	3.00	2.33	=	=	x	=	=	=	=	=	=	=
4. Yellow-billed Cuckoo	3.00	7.67	2.75	=	1.33	=	=	=	=	=	=	=
5. Chimney Swift ^c	=	=	=	=	=	=	=	=	=	=	=	=
6. Eastern Kingbird	=	7.33	=	=	1.67	=	=	=	=	=	=	=
7. Western Kingbird	=	x	=	=	=	=	=	=	=	=	=	=
8. Scissor-tailed Flycatcher	13.00	16.00	9.00	1.67	2.33	=	=	=	=	=	=	=

TABLE IV (Continued)

	Summer (June-September)					Fall-Winter (September-March)						
	Area No.					Area No.						
	1	2	3	4	5	1	2	3	4	5	6	7
<u>Summer Residents (Continued)</u>												
9. Great Crested Fly-catcher	x	-	-	-	3.67							
10. Eastern Phoebe ^C	-	-	-	-	-							
11. Barn Swallow	-	-	x	8.67	-							
12. Cliff Swallow	-	-	-	x	-							
13. Purple Martin	-	-	-	x	-							
14. Brown Thrasher	-	2.00	-	-	-							
15. Orchard Oriole	-	x	-	x	-							
16. Baltimore Oriole	8.13	14.67	x	-	-							
17. Bullock's Oriole ^C	-	-	-	-	-							
18. Common Grackle ^C	-	-	-	-	-							
19. Brown-headed Cowbird	5.00	8.67	4.25	-	-							
20. Painted Bunting	x	-	4.75	-	-							
21. Lark Sparrow	x	x	16.75	4.33	4.33							
22. Chipping Sparrow	x	-	x	-	-							
<u>Winter Residents</u>												
1. Mallard	-	-	-	-	1.71					x	x	
2. Gadwall	-	x	-	-	-					-	-	
3. Pintail	-	-	-	-	x					-	-	x
4. Green-winged Teal	-	-	-	-	x					-	-	-
5. American Widgeon ^C	-	-	-	-	-					-	-	-
6. Canvasback	-	-	-	-	-					-	-	x
7. Common Merganser ^C	-	-	-	-	-					-	-	-
8. Red-shafted Flicker	-	.57	x	-	-					1.33	3.20	
9. Brown Creeper	-	x	x	-	-					-	1.40	
10. Hermit Thrush	-	-	-	-	-					x	-	

TABLE IV (Continued)

	Summer (June-September)					Fall-Winter (September-March)						
	Area No.					Area No.						
	1	2	3	4	5	1	2	3	4	5	6	7
<u>Winter Residents (Continued)</u>												
11. Mountain Bluebird						-	-	-	-	-	4.33	-
12. Golden-crowned Kinglet						-	.43	-	-	-	-	-
13. Ruby-crowned Kinglet						-	x	-	-	-	-	-
14. Brewer's Blackbird						-	-	-	-	-	-	x
15. Purple Finch						-	-	-	-	-	-	1.00
16. Rufous-sided Towhee						.43	.57	-	-	-	-	-
17. Vesper Sparrow						5.00	21.86	-	x	11.17	x	15.80
18. Slate-colored Junco						-	7.71	3.00	-	-	71.17	9.80
19. Tree Sparrow						x	8.14	-	x	7.17	18.00	11.60
20. Harris' Sparrow						50.14	84.71	10.83	5.57	8.67	21.17	48.20
21. White-crowned Sparrow						25.00	39.14	-	4.57	17.00	-	-
22. Fox Sparrow						-	.86	-	-	-	-	-
23. Song Sparrow						7.00	7.43	x	16.57	2.17	1.50	4.20
<u>Migrants</u>												
1. Canada Goose ^c	-	-	-	-	-	-	-	-	-	-	-	-
2. Blue-winged Teal	-	-	-	x	-	-	-	-	-	-	-	-
3. Wood Duck ^c	-	-	-	-	-	-	-	-	-	-	-	-
4. Sandhill Crane	-	-	-	-	-	x	-	x	x	x	x	-
5. Upland Plover	-	-	-	x	-	-	-	-	-	-	-	-
6. Spotted Sandpiper	-	-	-	x	-	-	-	-	-	-	-	-
7. Greater Yellowlegs	-	-	-	x	-	-	-	-	-	-	-	-
8. Lesser Yellowlegs	-	-	-	x	-	-	-	-	-	-	-	-
9. Least Sandpiper	-	-	-	x	-	-	-	-	-	-	-	-
10. Long-billed Dowitcher	-	-	-	x	-	-	-	-	-	-	-	-

-TABLE IV (Continued)

	Summer (June-September)					Fall-Winter (September-March)						
	Area No.					Area No.						
	1	2	3	4	5	1	2	3	4	5	6	7
<u>Migrants (Continued)</u>												
11. Wilson's Phalarope	-	-	-	x	-	-	-	-	-	-	-	-

^aSee Table II for the number of times each area was censused.

^bCommon names taken from A. O. U. Checklist of North American Birds (1957); resident status from Baumgartner and Baumgartner (no date).

^cIndicates that the species was identified outside the study areas.

*A small "x" indicates that the species was encountered on only one occasion.

TABLE V

MAMMALS IDENTIFIED IN SOUTHWESTERN OKLAHOMA;
JUNE, 1963-APRIL, 1964

Species	Study Area						
	1	2	3	4	5	6	7
1. Opossum (<u>Didelphis virginiana</u>)		x		x			x
2. Eastern mole (<u>Scalopus aquaticus</u>)	x	x	x		x		
3. Armadillo (<u>Dasypus novemcinctus</u>)							x
4. Blacktail Jackrabbit (<u>Lepus californicus</u>)		x	x	x			
5. Eastern Cottontail (<u>Sylvilagus floridanus</u>)	x	x	x	x	x	x	x
6. Thirteen-lined ground squirrel (<u>Citellus tri-decemlineatus</u>)	x						
7. Blacktail Prairie dog (<u>Cynomys ludovicianus</u>)*							
8. Eastern Fox squirrel (<u>Sciurus niger</u>)	x	x				x	x
9. Plains pocket gopher (<u>Geomys bursarius</u>)	x	x	x		x		
10. Hispid pocket mouse (<u>Perognathus hispidus</u>)	x	x			x		
11. Ord kangroos rat (<u>Dipodmys ordi</u>)	x	x			x		
12. Beaver (<u>Castor canadensis</u>)		x					
13. White-footed mouse (<u>Peromyscus maniculatus</u>)	x		x				
14. Wood mouse (<u>Peromyscus leucopus</u>)						x	x
15. Cotton rat (<u>Sigmodon hispidus</u>)	x	x	x				
16. House mouse (<u>Mus musculus</u>)		x	x				
17. Coyote (<u>Canis latrans</u>)	x						x
18. Gray fox (<u>Urocyon cineroargenteus</u>)*							
19. Raccoon (<u>Procyon lotor</u>)				x		x	x
20. Mink (<u>Mustela vison</u>)				x			
21. Badger (<u>Taxidea taxus</u>)	x	x			x		
22. Striped skunk (<u>Mephitis mephitis</u>)	x	x	x	x		x	
23. Spotted skunk (<u>Spilogale putorius</u>)*							
24. Bobcat (<u>Lynx rufus</u>)*							
25. Whitetail deer (<u>Odocoileus virginianus</u>)							x

*Identified outside the study areas.

TABLE VI

NUMBERS OF BOBWHITES TAKEN BY HUNTERS FROM DIFFERENT
HABITAT TYPES IN SOUTHWESTERN OKLAHOMA,
NOVEMBER, 1963-JANUARY, 1964

HABITAT TYPE	NO. OF QUAIL TAKEN
Sandsage-grassland	52
Mesquite-buffalograss pasture	39
Granite hills	31
Mixedgrass prairie	27
Wooded bottomland	3
Unknown	29

The different kinds of vegetative cover found on each study area, and the relative frequency with which each was used for escape, resting, dusting, and/or feeding, and roosting are summarized in Tables VII-XVI.

Results of bobwhite censuses made in the summer and during fall and winter are shown in Tables XVII and XVIII, respectively.

TABLE VII

TYPES OF COVER USED BY BOBWHITES FOR ESCAPE ON THE STUDY AREAS
IN SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

Area No.	Observed Number of Times Used for Escape:				
	Trees	Shrubs	Woody debris*	Herbaceous Cover	Other
1	8	3	-	4	-
2	19	3	6	11	1
3	4	9	-	-	-
4	4	-	-	11	-
5	2	4	-	24	2
6	12	-	1	24	-
7	27	-	4	2	-
TOTALS	76	19	11	76	3

*Brush, fallen limbs, etc.

TABLE VIII

TYPES OF COVER USED BY BOBWHITES FOR REST-DUST-FEEDING ON THE STUDY AREAS
IN SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

Area No.	Observed Number of Times Used for Rest-Dust-Feeding:				
	Trees	Shrubs	Woody debris*	Herbaceous Cover	Other
1	22	42	19	16	-
2	10	9	12	12	-
3	3	16	-	-	2
4	5	-	1	11	-
5	7	9	-	19	-
6	15	9	3	11	-
7	15	6	14	2	-
TOTALS	77	91	49	71	2

TABLE IX

TYPES OF COVER USED BY BOBWHITES FOR ROOSTING ON THE STUDY AREAS
IN SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

Area No.	Observed Number of Times Used for Roosting:			
	Shrubs	Woody debris*	Herbaceous Cover	Other
1	4	-	55	-
2	-	-	-	1
3	-	-	-	2
4	-	-	20	-
5	-	-	26	-
6	-	-	2	-
7	3	2	2	-
TOTALS	7	2	105	3

*Brush, fallen limbs, etc.

TABLE X

TYPES OF COVER USED BY BOBWHITES ON THE SANDSAGE-GRASSLAND HABITAT TYPE OF STUDY AREA NO. 1, SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:			
	ESCAPE	REST-DUST	FEED	ROOST
WOODY COVER				
<u>Trees:</u>				
Elm-osage orange-locust shelterbelt	2			
Chinaberry-sandsage	3			
Chinaberry grove	3		1	
Hackberry-skunkbush			11	
Hackberry			2	
Chittamwood			5	
Willow-tumbleweeds			2	
<u>Shrubs:</u>				
Plum thicket-sandsage	3			
Plum thicket			20	3
Skunkbush-sandsage-bluestem			17	1
Skunkbush-willow			4	
<u>Woody debris:</u>				
Brushpile			3	
Fallen limbs-tumbleweeds			12	
Tumbleweeds			4	
HERBACEOUS COVER				
Sandsage-mixed forbs and grasses	3		13	15
Sandsage-bluestem-hackberry	1		2	4
Open mixed forbs (2-3½ ft. tall)				34
Soapweed-prickly-pear				2
TOTALS	15		96	59

TABLE XI

TYPES OF COVER USED BY BOBWHITES ON THE SANDSAGE-GRASSLAND HABITAT TYPE OF STUDY AREA NO. 2, SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:		
	ESCAPE	REST-DUST-FEED	ROOST
WOODY COVER			
<u>Trees:</u>			
Elm-osage orange-locust shelterbelt	6		6
Chittanwood-sandsage	1		1
Tamarix	5		2
Cottonwood-willow-Tamarix	6		
<u>Shrubs:</u>			
Plum thicket-sandsage			2
Plum thicket-bluestem	1		5
Plum thicket-mixed grasses and forbs	1		1
Plum thicket	1		1
<u>Woody debris:</u>			
Brushpile	5		11
Tumbleweeds	1		1
HERBACEOUS COVER			
Sandsage-mixed forbs and grasses	2		1
Cotton	3		
Mixed grasses and forbs	6		8
Bluestem			3
TOTALS	38		42

TABLE XII

TYPES OF COVER USED BY BOBWHITES ON THE GRANITE MOUNTAIN-MESQUITE
PASTURE HABITAT TYPES OF STUDY AREA NO. 3, SOUTHWESTERN
OKLAHOMA, OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:			
	ESCAPE	REST-DUST-FEED	ROOST	
WOODY COVER				
Trees:				
Scrub elm-hackberry-chittamwood skunkbush (base of mtn.)	2	1		
Mesquite-buffalograss pasture	2	2		
Shrubs:				
Plum thicket		3		
Sumac stand	1	6		
Skunkbush-chittamwood-rocks (on mtn. side)	8	7		
OTHER COVER				
Open rocks (at base of mtn.)		1		2
TOTALS	13	20		2

TABLE XIII

TYPES OF COVER USED BY BOBWHITE ON THE UNSTABILIZED DRAINAGE
BOTTOM HABITAT TYPE OF STUDY AREA NO. 4, SOUTHWESTERN
OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:			
	ESCAPE	REST-DUST-FEED	ROOST	
WOODY COVER				
Trees:				
Tamarix-lovegrass	4	4		
HERBACEOUS COVER				
Mixed grasses and forbs	6	7		7
Open mixed grasses				13
Tall weeds (over 4 ft.)	3	3		
TOTALS	13	14		20

TABLE XIV

TYPES OF COVER USED BY BOBWHITES ON THE SAND-SAGE GRASSLAND HABITAT TYPE OF STUDY AREA NO. 5, SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:		
	ESCAPE	REST-DUST-FEED	ROOST
WOODY COVER			
<u>Trees:</u>			
Locust-skunkbush-johnsongrass	2	7	
<u>Shrubs:</u>			
Grape tangle		3	
Plum thicket	4	6	
HERBACEOUS COVER			
Sandsage-mixed grasses and forbs	7	1	
Cotton	2		
Mixed grasses and forbs	5	5	10
Bluestem	5	9	
Open mixed forbs			16
Tall weeds (over ft.)	5	4	
OTHER COVER			
Bare gulley	2		
TOTALS	32	35	26

TABLE XV

TYPES OF COVER USED BY BOBWHITES ON THE GRANITE MOUNTAIN-WOODED BOTTOMLAND HABITAT TYPE OF STUDY AREA NO. 6, SOUTHWESTERN OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:		
	ESCAPE	REST-DUST-FEED	ROOST
WOODY COVER			
<u>Trees:</u>			
Mesquite-mixed grasses and forbs	5	3	
Elm-hackberry-walnut(wooded draw on mtn.)		2	
Elm-willow-buttonbush (along creekbed)	7	10	
<u>Shrubs:</u>			
Plum thicket		9	
<u>Woody debris:</u>			
Brushpile	1	3	
HERBACEOUS COVER			
Bluestem-sumac-rocks(on mtn.side)	16	8	
Mixed grasses and forbs	2	3	
Bluestem	5		2
TOTALS	36	38	2

TABLE XVI

TYPES OF COVER USED BY BOBWHITES ON THE WOODED BOTTOMLAND
 HABITAT TYPE OF STUDY AREA NO. 7, SOUTHWESTERN
 OKLAHOMA; OCTOBER, 1963-APRIL, 1964

KIND OF COVER USED FOR:	Observed Number of Times Used for:		
	ESCAPE	REST-DUST-FEED	ROOST
WOODY COVER			
<u>Trees:</u>			
Chinaberry grove	3	4	
Willow grove	2	1	
Mesquite-mixed grasses and forbs	3	1	
Elm-hackberry (along creekbed)	16	9	
Tops of trees	3		
<u>Shrubs:</u>			
Plum-mixed grasses and forbs		3	3
Buttonbush		3	
<u>Woody debris:</u>			
Fallen trees and limbs	2	2	
Brushpile	2	11	
Leaves and debris		1	2
HERBACEOUS COVER			
Johnsongrass-tumbleweeds	2		
Bluestem		2	2
TOTALS	33	37	7

TABLE XVII

RESULTS OF BOBWHITE CENSUSES ON STUDY AREAS IN
SOUTHWESTERN OKLAHOMA; JUNE-SEPTEMBER, 1963

Area	Acres	Average Number of Quail Per Census*	Acres Per Quail
1	70	8.67	8.07
2	40	8.33	4.80
3	65	13.00	5.00
4	27	15.33	1.76
5	25	18.00	1.39

*Each area was censused three times.

TABLE XVIII

RESULTS OF BOBWHITE CENSUSES ON STUDY AREAS IN SOUTHWESTERN
OKLAHOMA; OCTOBER, 1963-APRIL, 1964

Area	Location	Acres	Number of Times Censused	Average Number of Quail Per Census	Acres Per Quail
1	SW $\frac{1}{4}$ Sect. 11- T2N-R18W	70	7	26.29	2.67
2	W $\frac{1}{2}$ Sect. 22- T2N-R18W	40	6	40.83	1.12
3	NE $\frac{1}{4}$ Sect. 6- T2N-R17W	65	6	17.83	3.65
4	SE $\frac{1}{4}$ Sect. 29- T2S-R14W	27	7	24.43	1.12
5	W $\frac{1}{2}$ Sect. 28- T2N-R18W	25	7	32.00	.78
6	W $\frac{1}{2}$ Sect. 6- T3N-R15W	50	6	34.83	1.44
7	NW $\frac{1}{4}$ Sect. 2- T3N-R16W	45	6	27.17	1.66

CHAPTER VI

DISCUSSION

Types of Habitat Used by Birds Other Than Bobwhites

Throughout the year, more species of birds were seen on Area 2 than on any other study area, probably because it contained several diverse types of habitat interspersed within a relatively small area. Sandsage-grassland, timbered bottomland, shelterbelts, and cropland were all situated on approximately 40 acres (Fig. 3). Although the birds occupied all of these habitat types to some extent, they were most abundant in the shelterbelts, where they had simultaneous access to other environmental types bordering the prolonged edges of the shelterbelts.

The second largest number of species was found on Areas 1, 3, and 4, although each was located in a different type of habitat. Respectively, these types were: sandsage-grassland, granite knoll and mesquite pasture, and marshy drainage bottom. This indicates that most species of birds in southwestern Oklahoma inhabit a variety of habitat types, depending principally on which ones are available.

Summer Populations

During the summer, Areas 1 and 3 had almost as many species of birds as did Area 2 (Table II). Area 1, in addition to being the largest study area, contained several ecological situations, the principal

ones being sandsage-grassland, shelterbelts, and scattered stands of chinaberry and black locust trees (Fig. 2). On Area 1, as on Area 2, more species of birds were seen in the shelterbelts than in the other situations mentioned.

The trees fringing the base of the granite hill on Area 3 provided a haven for many birds in the vicinity because the area was surrounded by cropland (Fig. 4). The cañon wren and rufous-crowned sparrow, however, were seen only on the granite knoll itself, and the lark sparrow, western meadowlark, and ladder-backed woodpecker inhabited only the mesquite pasture.

The only summer residents found on all the study areas were the lark sparrow and scissor-tailed flycatcher, although the yellow-billed cuckoo was observed on all except Area 4. Conversely, a few summer residents inhabited only one or a few of the study areas, e.g., the crested flycatcher on Area 5, the eastern kingbird on Areas 2 and 5, the painted bunting on Areas 1 and 3, and the brown thrasher on Areas 1 and 2.

Bird densities during the summer were highest on Area 4 and lowest on Area 1 (Table III). Area 4 had more birds per acre, not only because of its small size in relation to the other study areas, but also because of its unusual type of habitat. It consisted of a wide drainage bottom covered with lovegrass and located between two fields of cotton (Fig. 5). A pond dam in the middle of this otherwise treeless area backed water a considerable distance, forming a shallow marsh. The marsh was fringed by Tamarix, willows, and cattails, and provided a favorable resting and feeding place for shorebirds and waterfowl. Sixteen of the thirty-eight species identified on this area were seen only in association with the

marsh (Table IV).

In contrast, Area 1 was composed chiefly of sandsage-grassland interspersed with shelterbelts, scattered stands of trees, and small fallow fields. However, these situations were scattered over some 70 acres, as compared to 27 acres on Area 4. For this reason, the number of birds per acre was considerably reduced.

Fall and Winter Populations

Areas 2 and 7 contained the largest variety of birds found on the study areas during the fall and winter. As indicated earlier, several ecological situations characterized Area 2, but it was basically of the sandsage-grassland type. Area 7, however, was located in the timbered bottomland habitat type.

The least number of species seen during fall and winter was on Area 5, primarily because of its small size. It covered only 25 acres, and was the smallest area studied.

Birds were much more abundant during the fall and winter than during the summer. Areas 4 and 5, for instance, had only about half as many species in the summer as they did in the fall and winter. Densities were highest on Area 2, for reasons already mentioned, and lowest on Area 3. The main reasons for the low density of birds on Area 3, as compared to the other study areas, were: (1) it was composed of only two major types of habitat, both of which provided little cover for wildlife, and (2) it covered a larger area than did most of the other study areas.

Winter residents which inhabited all the areas were the song and Harris' sparrows, with the vesper sparrow present on all except Area 3.

Some winter residents were seen on only one study area, e.g., the hermit thrush on Area 5, and the golden-crowned kinglet, ruby-crowned kinglet, and fox sparrow on Area 2.

Permanent Residents and Migrants

Only six permanent residents were found on all seven study areas: the marsh hawk, bobwhite, mourning dove, yellow-shafted flicker, crow, and western meadowlark. Three permanent residents noted on all the areas except Area 4 were the robin, cardinal, and field sparrow. The American goldfinch was seen on all the areas except Area 7. The single permanent resident recorded from only one study area was the belted kingfisher, which was seen along the river near Area 2. Another permanent resident worthy of note was the rufous-crowned sparrow, which was observed only in association with the small granite hills on Areas 2, 3, and 6.

Red-tailed hawks were the most abundant raptors in southwestern Oklahoma, and often were seen circling over the study areas. Sparrow hawks and marsh hawks were also common, but the Cooper's hawk was noted on only two occasions.

Several migrants identified on the marshy drainage bottom of Area 4 were seen on none of the other study areas. Among them were: the blue-winged teal, upland plover, spotted sandpiper, greater yellowlegs, lesser yellowlegs, least sandpiper, long-billed dowitcher, and Wilson's phalarope.

Types of Habitat Used by Mammals

The area studied was located in the southwest part of the Mixed-grass Plains biotic district of Blair and Hubbell (1938), which occupies

most of the western half of Oklahoma. Other than the Mixed-grass Plains district, only the small Wichita district of the Wichita Mountains and the Mesquite Plains district in the extreme southwest corner of the state are found in southwestern Oklahoma. According to Blair (1939), the mammalian fauna of the two smaller districts is largely analogous to that of the mixed-grass plains, from which he recorded 50 species. However, five of these are now extirpated from southwestern Oklahoma, and nine are found only in the edge of the mixed-grass plains. Three species identified during the present study that were not listed by Blair were the armadillo, beaver, and gray fox. From the foregoing, it may be assumed that approximately 40 species of mammals occur within the area studied.

Although no extensive trapping was done, a total of 25 species of mammals were identified during the study (Table V). The prairie dog, gray fox, spotted skunk, and bobcat were identified outside the study areas. One species, the cottontail rabbit, occurred on all the study areas. The striped skunk was found on all the areas except Areas 5 and 7. The badger, kangaroo rat, hispid pocket mouse, plains pocket gopher, and eastern mole were found on all the areas with sandy soil. Several species were found on just one study area: the armadillo and the white-tailed deer on Area 6, the thirteen-lined ground squirrel on Area 1, the beaver on Area 2, and the mink on Area 4. Both Areas 1 and 2 contained the largest number of species (12) and both were of the sand-sage-grassland habitat type. The timbered bottomland type of Area 7 had five species, the smallest number recorded.

Four of the few prairie dog towns remaining in southwestern Oklahoma were inspected during the study. They were all located in buffalograss-

mesquite pastures in southern Kiowa County. Prairie dogs were found in only two of the towns, but each of these occupied about 40 acres and was growing.

Types of Habitat Used by Bobwhites

More bobwhites were found in the sandsage-grassland association during the study than in any of the other major habitat types in southwestern Oklahoma (Table VI). The average fall density for the three study areas in this type, which together occupied a total of 135 acres, was 1.29 acres per bird, compared to 4 acres per quail on 3,815 acres of the same type in Oklahoma during the falls of 1940 and 1941, as determined by Duck and Fletcher (ca. 1944). This difference, as well as the exceptionally high bobwhite densities throughout this study, can be largely accounted for by the fact that the study areas described here were relatively small and were purposely selected in localities known to consistently support large bobwhite populations. These quail were not necessarily confined to the study areas, and no doubt ranged into adjacent territory at times.

Escape Cover

The kind of cover used for refuge by the quail when they were disturbed depended to a large extent on that which was available and readily accessible. Trees and herbaceous cover were each utilized for escape four times as often as any other type of cover (Table VII). Trees growing as bottomland timber were used more often than any other form of tree growth, but shelterbelts and groves were also used when available. Mixed grasses and forbs were used for escape more frequently

than any other type of herbaceous cover. This is in agreement with the findings of Lehmann and Ward (1941), Parmalee (1953), and Davis (1964).

The most important shrub used for refuge was plum, which grew in dense, scattered thickets on every study area except Area 4. These thickets, frequently associated with mixed grasses and/or sandsage, provided excellent escape cover. Scott and Klimstra (1954) found that plum thickets were favorite escape sites of bobwhites in the southeastern states, and Lehmann (1939) refers to them as valuable concealment cover for quail in south-central Texas.

Resting-Dusting-Feeding Cover

This type of cover included places from which quail were flushed, or where small, scattered piles of droppings were found, or where dusting places were located. Shrubs and trees were used for these activities more often than any other type of vegetation, but herbaceous cover was also used to a considerable extent. Woody debris was utilized approximately two-thirds as much as were shrubs and trees. The principal shrubs used were plum and skunkbushes, with plum used more often because of its greater abundance and more widespread distribution. For the same reason, bottomland timber was used twice as much as were groves of trees. The bobwhites utilized mixed grasses and forbs for resting, dusting, and feeding more often than they did any other type of herbaceous vegetation. Brushpiles and fallen limbs were the types of woody debris most often used (Table XVIII). These data are in general agreement with those of Stoddard (1931), Lehmann and Ward (1941), and Davis (1964).

Roosting Cover

Open, erect herbaceous cover was used by bobwhite for roosting almost exclusively. This agrees with Stoddard (1931), Klimstra and Ziccardi (1963), and Davis (1964). Roosting places were found in open stands of mixed forbs three times as often as in mixed grasses, and five times more often than among grasses and forbs growing together. Overgrown fallow fields were favorite roosting sites when available, as were areas of native grassland. Stoddard (1931), Errington and Hamerstrom (1936), Wilson and Vaughn (1944), and Lay (1940) have indicated preferences of the bobwhite for similar roosting cover in other sections of the country. Two fallow fields on Area 1 which were frequently used for roosting were characterized by generally open stands of Eriogonum, Amaranthus, white prickly poppy, sunflower, and other annual forbs averaging from two to four feet in height. In the sand-sage-grassland along the North Fork of Red River, roosting places were often found on the tops or slopes of sandhills in openings among soapweed (Yucca glauca), prickly-pear, and sandsage (Table IX). Klimstra and Ziccardi (1963) found that 68 percent of the roosting headquarters of 36 coveys studied in southern Illinois were on medium or low elevations.

Bobwhite Populations

Summer Populations

During the summer, bobwhite densities were greatest on Area 5, but were high on Area 4 as well (Table XVII). The smaller size of these two areas in relation to the other study areas was the principal reason for these exceptionally high densities. The lowest density was encountered

on Area 1, which, as mentioned before, contained several habitat situations, but they were loosely distributed over almost three times as many acres as those on Areas 4 and 5. Area 5 also contained the largest summer population of quail.

Fall and Winter Populations

As in the summer, quail densities were highest on the mixedgrass-sandsage grassland of Area 5 during fall and winter, which contained an average 0.78 acres for each quail, or 1.3 bobwhites per acre (Table XVIII). The overall average fall and winter density on all seven study areas combined was 1.78 acres per quail. Quail can be classified as "abundant" on areas with one quail to less than two acres (Texas Game, Fish, and Oyster Commission, 1945). Because of their small size and generally favorable bobwhite habitat, five of the seven study areas contained fall and winter populations large enough to fit this definition. In general, however, bobwhites were not "abundant" in the area studied, but were usually numerous in places containing suitable habitat.

The granite knoll and mesquite pasture of Area 3 supported only one covey of quail, and as a result had the lowest quail density and smallest fall and winter population.

Coveys

The number of coveys on each study area ranged from one on Area 3 to five on Areas 2 and 6. Area 2 had the most coveys per unit area with 8 acres per covey, and Area 3 contained the fewest with 65 acres per covey. Areas 4, 5, and 6 also contained large bobwhite populations by having 9, 8.33, and 10 acres per covey, respectively. The average

number of acres per covey for all study areas combined, which totaled 322 acres, was 20.88.

From October, 1963 to April, 1964, the number of birds per covey ranged from 6 to 19, and the average size of the 22 coveys studied, which contained 280 birds altogether, was 12.7. Some of the coveys were exposed to hunting, so this average is minimum. Stoddard (1931) reported an average size of 12.7 birds per covey in 1925 and 14.6 in 1926 for 78 coveys in the southeastern states. Wilson and Vaughn (1944) reported observations in Maryland from October to January on 18 coveys which averaged 11.7 birds. This figure is a minimum, because some of these coveys had been exposed to hunting. Lehmann (1946b), during a study in southwestern Texas, found that 22 coveys, consisting of 284 quail, averaged 12.9 birds. His figures coincide closely with those of the present study.

Intense whistling, signaling the beginning of the breeding season and the start of covey break-ups, was first heard on March 24 on Area 6. It was noted again March 25 on Area 7 and March 26 near Area 2.

On March 25, a loosely-scattered covey composed of four singles, a group of four, and another group of six birds was flushed on Area 7. A covey of 13 birds, intact except for three singles, was flushed from Area 1 the next day. On March 27, a covey on Area 5 was entirely disbanded into five pairs and two singles, and scattered over an area of several hundred square feet. These observations suggest that the spring break-up of bobwhite coveys in southwestern Oklahoma probably begins about the last week in March. Lehmann (1946a) stated that coveys in southwestern Texas also break up at about this time. Stanford (1952) indicated that the breeding season in Missouri begins from late March

to late April. Parmalee (1953) heard the first whistling of male bobwhites in east-central Texas in 1950 on April 1, and Stoddard (1931) states that in the southeastern states, the first whistles usually are heard in the first week of April. In Kansas, Robinson (1957) first noted whistling on April 3, 1952 and on March 23, 1953.

Sex and Age Ratios

Although the sex ratio of 160 bobwhites examined during the 1963-64 hunting season was 49 cocks to 51 hens, a preponderance of males is reported in the literature repeatedly. Stoddard (1931) found that of nearly 20,000 quail examined, the ratio was 53 cocks to 47 hens. Leopold (1933) compiled sex ratios of 4,184 bobwhites, and his figures agree with those of Stoddard almost exactly. The slightly larger number of females in the present study is attributable to the small size of the sample.

The ratios of young birds (aged less than one year, Steele, 1950) to adults was 67 to 33. Leopold (1945) stated that in southern Missouri, young birds actually make up from 75 to 80 percent of the autumn populations, but that reproductive success in turn doubtless varies with local conditions of rainfall and temperature during successive nesting seasons. Robinson (1957) found a fall and winter young-adult ratio of 72 to 28 in south-central Kansas. In 1963, a spring flood, followed by one of the driest summers in several years in southwestern Oklahoma, may have affected nesting success adversely, as indicated by the low ratio of young to adult birds in the present study. However, quail were generally considered to be plentiful by most hunters questioned.

CHAPTER VII

SUMMARY

1. The objectives of this study were: 1) to obtain information relative to habitat type preferences, population fluctuations, reproductive success, and other aspects of bobwhite ecology in different types of habitat in southwestern Oklahoma during different seasons of the year; 2) to determine relative abundance of different species of birds in the various habitat types during the year; and 3) to identify the common mammals found in this part of the state.

2. Types of vegetative cover used by bobwhites were divided into three categories: (1) escape cover, (2) resting, dusting, and feeding cover, and (3) roosting cover. Trees and herbaceous cover were each used for escape four times as often as any other type of cover. Shrubs and trees were used for resting, dusting, and feeding more often than any other type of vegetation, although herbaceous cover was also frequently used. Open, erect herbaceous vegetation was used almost exclusively for roosting.

3. The five major types of habitat present in the area studied included sandsage-grassland, mixedgrass prairie, shortgrass-mesquite pasture, small granite hills, and timbered bottomland. Of these, sandsage-grassland was found to support the largest bobwhite populations and the highest quail densities throughout the year.

4. Twenty-two coveys, containing a total of 280 quail, and distributed over 322 acres of various types of habitat, were studied. The average number of acres per covey was 20.88, and the average covey size was 12.7 birds.

5. In 1964, the spring break-up of coveys in southwestern Oklahoma began about the last week in March. First whistling was heard March 24, and the first completely disbanded covey was noted on March 27.

6. The sex ratio of 160 bobwhites examined during the 1963-64 hunting season was 49 cocks to 51 hens. The age ratio was 67 young to 33 adult birds, which suggested a poor nesting season during 1963. However, quail were generally considered plentiful by most hunters.

7. Ninety-two species of birds were identified in southwestern Oklahoma during the study. Throughout the year, more species were found in sandsage-grassland than in any other type of habitat. This type also supported the greatest number of birds per acre during the fall and winter, but bird densities during the summer were highest on the timbered bottomland habitat type. Birds were much more abundant in the fall and winter than during the summer.

8. Twenty-five species of mammals were identified in southwestern Oklahoma from the Mixed-grass Plains and Wichita Mountains biotic districts of Blair and Hubbell (1938). Three of these, the armadillo, beaver, and gray fox, were not recorded from these districts by Blair in 1939. (Blair, 1939).

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