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HABITAT UTILIZATION BY BOBWHITE QUAIL DURING WINTER

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Abstract:

This study was conducted on a 214-acre area of the Ames Plantation, Fayette County, Tennessee. Information on habitat utilization by bobwhite quail (Colinus virginianus) during winter was obtained by telemetering quail during January - March, 1970. The ranges of five coveys averaged 16.7 acres. Coveys spent little time in cultivated fields although this type of cover constituted much of the home ranges of 4 coveys. Cedar woods, hardwood forests, and old fields were used in proportion to their abundance for diurnal protective cover by the quail population, but presence of honeysuckle (Lonicera japonica) or other dense understory cover generally increased the attractiveness of a wooded area for quail. Honeysuckle was also the preferred ground cover for roosts.

The characteristic habitat or vegetative type most important to the bobwhite during winter varies widely among portions of its range in North America. The specific vegetative types quail utilize most frequently in a particular region reflect both their immediate needs for coping with environmental problems and the variety of vegetative types available to them. Typically, certain features of habitat exert significant influence on diurnal patterns of quail movement during winter. This is evidenced by the bobwhite's tendency to spend disproportionate amounts of its time in certain areas. Bobwhites in south-central Kansas, an area characterized by open herbaceous cover, show a strong inclination to establish "headquarters" in patches of brushy or woody cover when available (9). In Wisconsin, hedgerow of specified dimensions is the significant feature determining the quality of winter habitat for quail (5), and in

Missouri fencerow cover is important to the carrying capacity of farmland (8). In southern Illinois, however, bobwhite population densities show no significant correlation to total amounts of edge (including fencerows), but the number of coveys in fall is strongly correlated with the amount of specified types of edge, e.g., edge between cultivated fields and brushy pastures (4).

We made the present study to identify cover types or habitat features that are most important to bobwhites in west Tennessee. We analyzed the extent to which quail utilize various cover types and habitat features during winter, and we described characteristics of covey ranges and reactions of quail to habitat alterations within covey ranges.

The Study Area

The study area is located on the Ames Plantation, an 18,600-acre tract in Fayette and Hardeman Counties, Tennessee. Quail behavior was studied intensively on a 214-acre plot within a 2,100-acre unit intensively managed for bobwhites.

Soil materials in the plot consist of a 3-ft layer of loess overlying coastal plains material composed mostly of sand. Loring and Calloway soil series characterize the area (11). Drainage ranges from moderately good to restricted; topography is smooth. Elevation is about 600 ft (3). Several intermittent streams cut deeply into the underlying sand and meander away from the study area.

The climate is humid and temperate. A long growing season, averaging 209 days, and high annual rainfall, averaging 51.6 inches, favor such vegetational growth. Mean seasonal temperatures range from 42 F in winter to 78 F in summer.

Varied habitats exist on the study area. A red cedar (Juniperus virginiana) grove with an understory of broomsedge (Andropogon virginicus) occupies 33 acres in the southern portion of the area. North of these cedars lies a series of soybean (Glycine max) and cotton (Gossypium hirsutum) fields ranging in size from 1.2 to 40 acres. Idle ground and brushy cover patches encircle each field. Two strips of hardwoods run north and south through the 100-acre central portion of the study area. One strip halves the area while the other edges the western border.

The northern portion of the study area consists of 41 acres of idle land interspersed with hardwood stands consisting mostly of sapling and pole-sized oaks (Quercus spp.), sweetgum (Liquidambar styraciflua), and hickories (Carya spp.). Hardwood understories range from open to dense. Honeysuckle (Lonicera japonica) and blackberry (Rubus sp.) characterize dense understories.

In addition to agricultural usage, the study area is managed for quail by prescribed burning and maintaining cover strips. Twice annually, during December and March, the quail population is censused. The December census, immediately prior to this study, revealed a density of 1 quail per 2 acres. The March census, at the termination of the study, indicated the population had declined to 1 quail per 2.4 acres.

Methods and Materials

Quail were live-trapped on the study area to obtain birds for marking. Eight funnel traps, made of 0.5 inch nylon mesh sewn to steel-rod frames were used to capture quail. Traps were placed at the edges of merging cover types in areas frequented by quail. Traps were set early each morning and examined late in the morning and evening. Trapping continued for a maximum of 3 weeks at each site. Quail were aged, sexed, and banded; some were fitted with transmitters as described below.

The heaviest bird captured from each covey was harnessed with a transmitter. A second quail was retained, providing a second chance to telemeter a covey should the first transmitter fail to perform satisfactorily.

The telemetry system consisted of a battery-operated receiver, a directional, hand-held antenna, and 9 transmitters, each equipped with a 10-inch whip antenna. Transmitters emitted a continuous signal on frequencies ranging from 150.830 Mc. to 151.070 Mc. RM-625 Mallory batteries equipped with soldering tabs powered the transmitters. Weight of an assembled unit was 14 g. Brander and Cochran (2) concluded that transmitters on birds should constitute no more than 4% of body weight. The transmitter assembly used in this study averaged nearly 10% of body weight, but did not noticeably impair quail flight if properly balanced over the wings. Coveys containing telemetered quail were flushed 35 times; at each flush the telemetered bird flew with the covey. The trailing antenna dragging through vegetation, however, may have posed a problem to the telemetered bird.

Coveys containing telemetered birds were located at 2-hour intervals diurnally. Transmitter signals were detected by systematically searching covey ranges with the receiver. The bird was approached to within 30 to 70 yards, as indicated by signal intensity, and then circled to obtain bearings on the position of the covey.

Results and Discussion

Eleven telemetered quail provided data on 5 covey ranges for periods ranging from 8 to 27 days (Table 1 and Fig. 1-5). The home ranges of these 5 coveys, determined by 69 to 134 radio telemetry locations, averaged 16.7 acres. Home-range size on our study area was smaller than reported elsewhere. Bartholomew (1) estimated home ranges of 4 coveys in southern Illinois to average 38 acres, ranging from 30 to 46 acres. His data, like ours, were obtained by radio telemetry during the winter, and represented comparable periods of observation. Roseberry (10) tracked 3 coveys in heavy snow for about 6 weeks and reported that their average home range included 23.7 acres. Using mean dimensions reported by Lehman (7) we computed a mean home range of about 23 acres each for 10 coveys he studied during winter in Texas.

Utilization of Cover Types

The proportion of time a covey spent in each cover type during daylight hours was measured by the proportion of occasions it was located

by telemetry in each type. These data were then compared with the proportion of the covey's home range occupied by each cover type to determine whether or not cover types were used randomly (Table 2). Chi-square tests of goodness of fit for single classification frequency distribution were used for statistical determinations.

Four of the 5 coveys showed nonrandom use of cover types in their home ranges. Coveys 1, 3, and 5 occupied ranges containing large percentages of cultivated land. Use of this cover type, however, was decidedly nonrandom. While an average of 31.5% of the ranges of these 3 coveys was in cultivated land, only 4.3% of 328 telemetry locations were in this cover type. Bartholomew's (1) observations on time bobwhites spent in cornfields corroborated ours.

A cornfield in the range of Covey 3 was the only cultivated field in which quail were located frequently (Fig. 3). Cornstalks and weeds remained standing in this field providing concealment for the covey. Protective cover was absent from other cultivated fields. Despite the limited amount of time spent there, however, cultivated land is obviously important to bobwhites. All coveys studied had ranges which included portions of a cornfield or soybean field, and these 2 cultivated grains composed the most important food of quail on the study area during winter (Eubanks, personal communication).

Covey 2 deviated from a pattern of random utilization of its range although its range included little cultivated land. The majority of this deviation resulted from the covey's heavy utilization of a small, densely vegetated, marshy area. The covey's use of this marsh was 6 times greater than random use would indicate.

The use of cover types by Covey 4 was random. This covey's range included only a small portion of cultivated land and contained no unique habitat type such as the marsh described previously.

Three vegetative types constituted the majority of uncultivated lands in the covey ranges studied; cedar woods, hardwoods, and old fields. The combined use of these three vegetative types by the 5 coveys was random ($X^2 = 0.7922$). However, 3 of the coveys showed preferential use for 1 or more of these types (Table 2). A major factor influencing use of the 2 forest types by coveys was the character of its understory vegetation. The presence of honeysuckle or other dense understory vegetation generally increased the attractiveness of a wooded area for quail.

Activity Centers

Within covey ranges, activity centers of about 50 sq yards or less were used intensively (Fig. 1-5). Each of the 5 ranges had 2 of these centers, arbitrarily defined as places where the covey was found 10 or more times during the study. With 1 exception, each was characterized by honeysuckle understory in a forested area adjacent to a grain or weed field. Honeysuckle is a very common understory species on our study area and many such sites were available.

Examination of flush data obtained during the population census further illustrated the usefulness of honeysuckle to quail during winter. Nearly 30% of 946 covey flushes were from sites at which the vine was a significant feature. Typically, these flush locations were patches of honeysuckle near an edge between a forest and a field. These data, while not strictly comparable to data obtained by telemetry, signify that honeysuckle plays an important role in providing protection to coveys during the winter period.

Roost-Site Selection

Of 107 roosts located by radio telemetry, 63 were in honeysuckle. Brushy and herbaceous vegetation were frequently interspersed in the honeysuckle patches selected for roosts. The extent to which honeysuckle was favored for roosting varied between coveys (Table 3). Of 37 roosts selected by coveys 1 and 5, 34 were in honeysuckle. Covey 4 selected only 3 of 21 roosts in honeysuckle.

Twelve roost sites were located under low-hanging cedar boughs. Eleven roost sites each were in mixed herbaceous vegetation and in blackberry briar patches. Ten roost sites were in broomsedge. The characteristic use of honeysuckle for roosting contrasted with roosting behavior of quail in other areas. Murray (8) indicated that luxuriant growths of Korean lespedeza (Lespedeza stipulacea) were favored for winter roosts in Missouri farmlands. In southern Illinois, in an agricultural region roughly similar to our study area, quail characteristically selected broomsedge for roosting (1,6). However, during a lengthy period of heavy snow cover in that same region, Roseberry (10) observed a shifting of roosting and loafing sites from open to woody cover, especially to clumps of Japanese honeysuckle.

The rather striking differences in roost-site selection by quail occupying generally similar environments indicates clearly the need for information on specific cover requirements and preferences of local quail populations if they are to be managed effectively.

Response of coveys to habitat alteration

Baiting or trapping within covey ranges did not noticeably influence movements of quail. Coveys utilized bait sites in passing but did not linger near bait.

Modification of areas 0.25 acre or larger, however, precipitated some changes in range utilization. Two covey ranges encompassed a cedar woods in which some mature trees were cut out during the study period. The coveys noticeably increased their use of this part of their ranges by feeding on ground disturbed by the tree cutting and taking refuge in the cedar tops left in the area. In another instance, several horses were stabled for a brief period in a covey's range. This covey quickly developed a new center of activity in this area, feeding in the soybean straw used as bedding for the horses. In both cases, quail recognized and responded rapidly to favorable changes in their habitat.

Summary

We observed the following characteristics of cover-type selection by quail on our study area:

1. The proportionate use of major cover types by a covey reflected certain characteristic features of its range. Coveys occupying ranges composed of significant amounts of cultivated land deviated from random usage of cover types, showing disproportionately heavy use of uncultivated portions of their ranges.

2. Within the uncultivated segment of a covey's range, utilization of major cover types, summed for all coveys, was random. Individual coveys, however, were strongly influenced by special vegetative features. Honeysuckle, for example, figured prominently in selection of daytime activity centers and night roosts. It also appeared to provide important escape or protective cover, as observed during population censuses.

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Table 1. Home Ranges of Five Coveys During Winter as Determined by Radiotelemetry

Covey number	Number of telemetered quail employed	Period over which telemetry data was obtained	Number of days during which telemetry locations were made	Number of monitored locations	Covey range size in acres
1	2	Feb. 9 - Feb. 16	8	69	13.8
2	3	Jan. 28 - Mar. 17	27	94	10.0
3	1	Feb. 17 - Mar. 17	27	125	15.9
4	4	Jan. 14 - Feb. 18	25	109	14.6
5	1	Feb. 19 - Mar. 17	25	134	28.9
Average			23	106	16.7

Table 3. Ground Cover of 107 Roost Sites Selected by Five Radiotelemetered Coveys During Winter, 1970, Ames Plantation, Tennessee

	Covey number					
	1	2	3	4	5	Total
Honeysuckle	10	16	10	3	24	63
Broomsedge	-	1	6	1	2	10
Low-hanging cedar bough	-	5	7	-	-	12
Blackberry	-	-	4	7	-	11
Mixed herbaceous vegetation	1	-	-	10	-	11
Total	11	22	27	21	26	107

Table 2. Comparative Availability and Use of Vegetation Types by Five Coveys During January-March, 1970.

Covey number	Vegetative types in covey range	Acres of vegetative type in covey range	Percent of range composed of vegetative type	Percent of telemetry location in vegetative type	Number of telemetry locations in vegetative type	Chi-square comparison of relative use of all habitat types	Chi-square comparison of relative use of cedar, hardwood, & herbaceous habitat types
1	Cedar	.6	4.6	17.4	12	120.8834*	15.1081*
	Cultivated	8.2	59.1	4.4	3		
	Hardwood	3.6	26.1	39.1	27		
	Herbaceous	1.4	10.2	39.1	27		
2	Cedar	4.6	44.6	36.2	34	60.7629*	25.4622*
	Cultivated	.5	4.6	2.1	2		
	Hardwood	2.4	23.1	38.3	36		
	Herbaceous	2.5	24.6	6.4	6		
	Marsh	.3	3.1	17.0	16		
3	Cedar	.8	2.8	8.0	10	34.9732*	9.7422*
	Cultivated	7.8	26.9	8.0	10		
	Hardwood	15.8	54.5	60.0	75		
	Herbaceous	4.6	16.8	24.0	30		
4	Cedar	1.1	7.6	3.7	4	2.5743 NS	0.6781 NS
	Cultivated	.2	1.4	.9	1		
	Hardwood	4.3	29.4	32.1	35		
	Herbaceous	9.0	62.0	63.3	69		
5	Cedar	7.7	48.1	56.0	75	23.7060*	.6781 NS
	Cultivated	2.5	15.6	.8	1		
	Hardwood	1.4	8.6	9.0	12		
	Herbaceous	4.4	27.5	34.3	46		

*Use of habitat types was not random at the 0.05 level of probability, indicating a preference by coveys for certain habitat types.

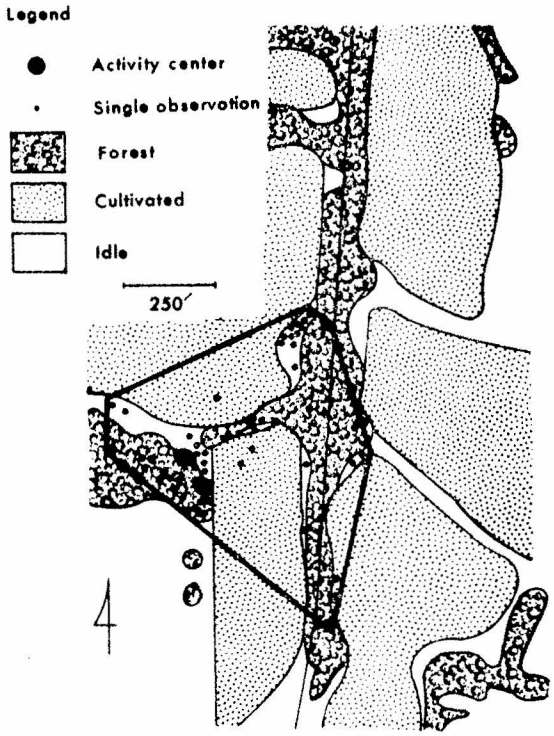

Fig. 1. Home range of covey 1, February 9–16, 69 locations.

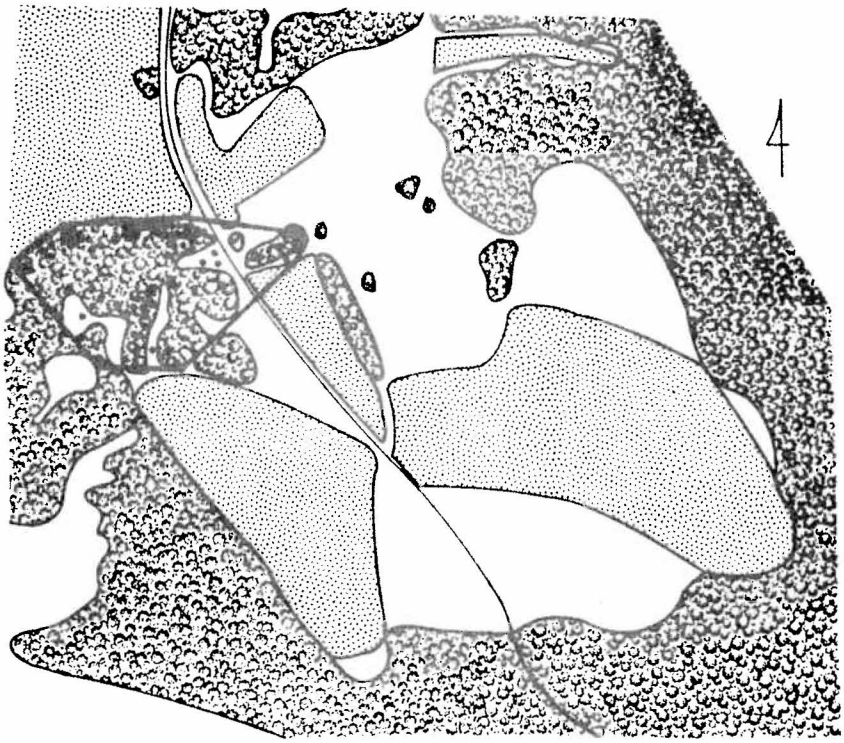

Fig. 2. Home range of covey 2, January 28 – March 17, 94 locations.

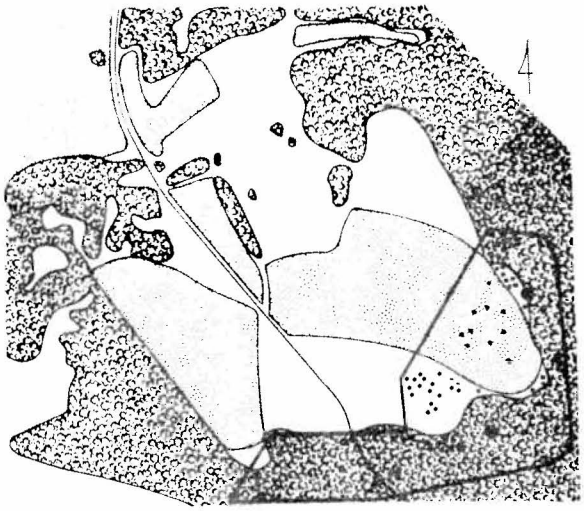

Fig. 3. Home range of covey 3, February 17 — March 17, 125 locations.

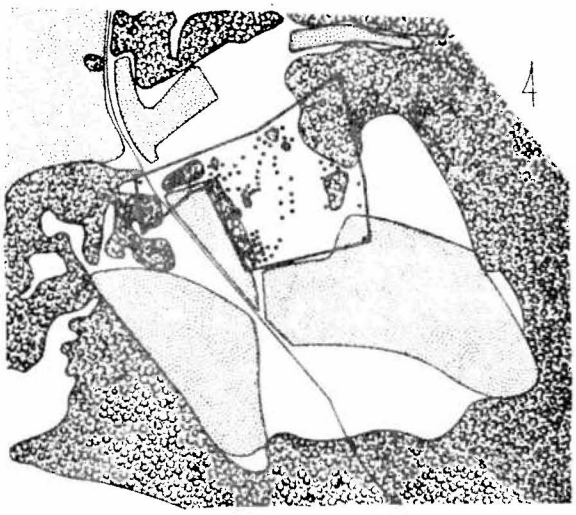

Fig. 4. Home range of covey 4, January 14 — February 18, 109 locations.

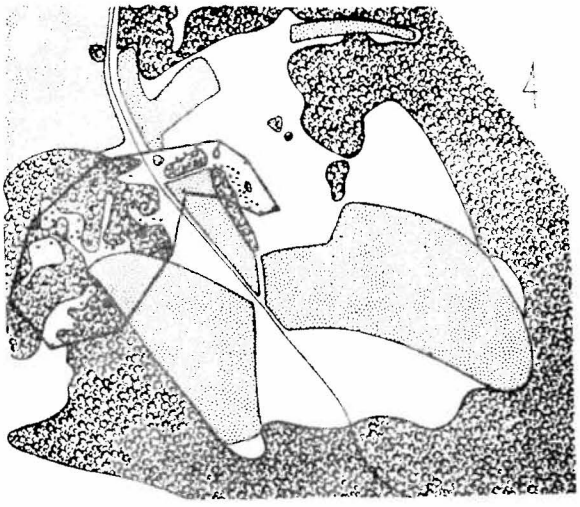

Fig. 5. Home range of covey 5, February 19 — March 17, 134 locations.