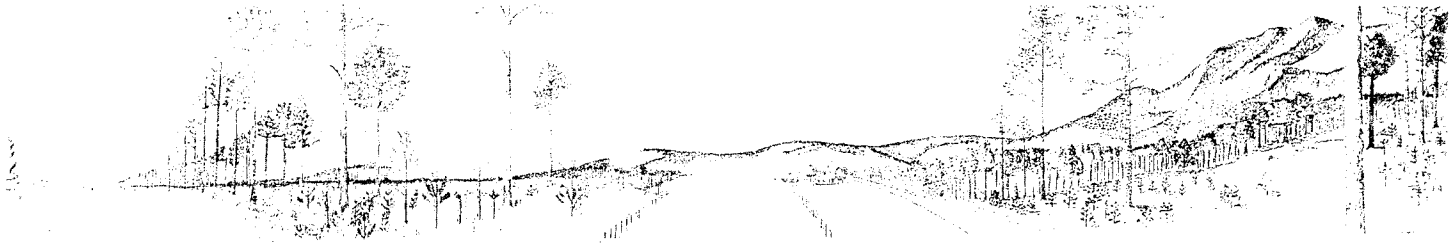

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LATE-SUMMER NESTING SITES OF QUAIL IN SOUTH GEORGIA

Abstract.—An exploratory investigation in south Georgia indicates that quail seem to prefer freshly burned areas and 1-year roughs as late-summer nesting sites. Bluestem grasses were most frequently used as nesting cover and as nest sites, and optimum herbaceous cover appeared to be around 50 percent. Burning enhanced the condition of ground cover by promoting complexes of plant clumps; these provided adequate screening and passageways for the quail.

Because the bobwhite quail *(Colinus virginianus)* is one of the more important species of small game in the southeast, it constitutes an extremely important and valuable recreational resource. Much research has been devoted to the ecology of the bobwhite and much has been learned. Many questions remain unanswered, however, and further research is needed on some of the least understood facets of quail ecology, such as requirements for nesting habitat.

General field observations show that quail utilize a wide variety of nesting sites. Little is known, however, about quail preferences for various types of nesting habitat and about the quantitative and qualitative composition of herbaceous and nonherbaceous vegetation at the nesting site. In a recent exploratory investigation, we attempted to measure and evaluate quail nesting sites by their vegetational characteristics. Some of the results of this investigation are reported here.

METHODS

This study was conducted on the Nilo Plantation in South Georgia's Upper Coastal Plain. The 1,200-acre study area contains cropland, long narrow strips of planted pine rows, open native-pine woodland mixed with scattered hardwoods, abandoned cropland (idle land), and swamps, ponds, and open marshes. For a number of years, the fall quail population on the study area has been estimated at one bird per acre, a high density of quail.

Quail nests were inventoried by systematically searching the study area on foot in August 1967. A total of 76 nests were located and studied. Eight nests were successful; two were abandoned; 25 were destroyed by predators; 41 were empty when found.

From the 76 nests, 48 were randomly selected for detailed analysis of vegetal characteristics at the nest site. The sample included 19 nests in strips of planted pine, 14 in natural, open-pine woodland, 8 along borders of cultivated fields, and 7 in old, idle fields.

Plant height and ground cover (proportion of ground surface under vegetal parts) were visually estimated for each species that occurred on three concentric plots centered at the nest: herbs within a radius of 1.7 feet, shrubs within 3.7 feet, trees within 11.4 feet.

To evaluate nest concealment, we recorded vegetal intercepts for a line projected vertically (90°) from nest center, and for lines projected at 45° above the ground in eight compass directions. Foliage or stems of herbs, shrubs, or trees intercepted by these projected lines were recorded in the appropriate categories.

RESULTS

Apparently, quail prefer to nest in areas having a diversity of vegetation, abrupt changes in

This work was made possible by assistance from the Georgia Forest Research Council. The authors also gratefully acknowledge the assistance of Mr. John Olin, owner of Nilo Plantation, and Mr. Granten Parker, plantation manager, for providing land and other aids used in carrying out this study.

ecological types, and a supply of nesting material. Two-thirds of the nests were found in some type of woodland (table 1), where the greatest number and variety of plants occurred. A large percentage of the nests were located in areas that produced a maximum edge-effect, such as strips of planted pine and borders of cultivated fields.

Table 1.--Approximate percentage of the 1,200-acre study area within each vegetational type and distribution of the 76 quail nests

Vegetational type	Total area	Occurrence of nests
	--- Percent ---	
Native pine woodland	44	33
Idle fields	20	16
Planted pine	16	35
Cropland	10	16
Other[1]	10	0

[1] Swamps, ponds, and open marshes.

Whether the area had been burned and the type of nesting material available were major factors influencing the location of nesting sites. Most nests were constructed of either pine straw or bunch grass, or both; these materials were prominent on roughs. Twenty-three percent of the nests were in 1-year roughs, and 19 percent were in roughs 2 years old or older. Fifty-eight percent of the nests, however, were in areas that had been burned in late March or early April of the same year. These nests were associated with pine trees and were largely constructed of freshly fallen pine straw. Dense grass roughs were not used for nesting except at the edges.

Herbaceous cover around nest sites ranged from 10 to 85 percent; 73 percent of the nests were found in areas where herb cover varied between 21 and 60 percent (fig. 1). Herbaceous

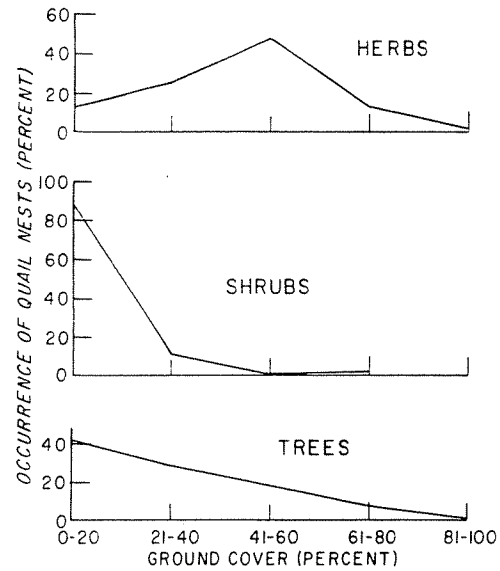

Figure 1.—Occurrence of nests in relation to surrounding ground cover by herbaceous species (within a radius of 1 ft. 8 in.), shrubs (within a radius of 3 ft. 8.7 in.), and trees (within a radius of 11 ft. 4.3 in.).

cover around nest sites in all vegetational types averaged only 48 percent (table 2), while general vegetational surveys indicated that 37-percent cover was a representative average for most of the herbaceous vegetation on the study area in August. The distribution of the August nests indicated that quail used the existing cover disproportionately.

Cover conditions appeared to be desirable wherever plants were growing in medium-sized,

Table 2.--Average cover of herbs, shrubs, and trees around 48 randomly selected quail nests in the various vegetational types

Vegetational type	Occurrence of nests	Herbs		Shrubs		Trees	
		Cover	Height	Cover	Height	Cover	Height
	Percent	Percent	Inches	Percent	Inches	Percent	Feet
Planted pine rows	40	45	22	12	17	42	24
Native pine woodland	29	44	21	16	27	36	21
Cultivated field border	17	43	30	9	11	3	4
Old field	14	62	22	21	19	23	11
Average	25	48	24	14	18	26	15

isolated clumps. This type of herbaceous cover provides adequate passageways for quail movement and good screening for the nest. Burning enhances this condition by maintaining an open network between clumps of plants.

Ninety-eight percent of the nests were found in areas where shrub cover was less than 41 percent (fig. 1). Shrub cover averaged 14 percent over all sites (table 2) and did not exceed 80 percent. In most cases, shrub cover above 60 percent indicated unburned sites.

Ninety percent of the nests were located in areas where tree cover varied between 0 and 60 percent (fig. 1). Tree cover averaged 26 percent over all sites (table 2). In general, tree cover in planted pines and pine woodlands fell between 21 and 60 percent. Cover in excess of 80 percent was unusual.

The height of herbaceous cover around nest sites varied from 7 to 40 inches (fig. 2). Fifty-four percent of the nests were found in vegetation which was 21 to 30 inches tall. The range in height of herbs encountered around the nest sites was not indicative of any selective pattern by quail but, in general, was the average range in height of vegetation on the study area in August. Herbs and shrubs did not exceed 40 inches. A large number of nests were found in locations where shrubs ranged from 11 to 20 inches, conditions typical of the freshly burned areas. Many nests were associated with trees, particularly slash pine (*Pinus elliottii* Engelm.) under 35 feet tall.

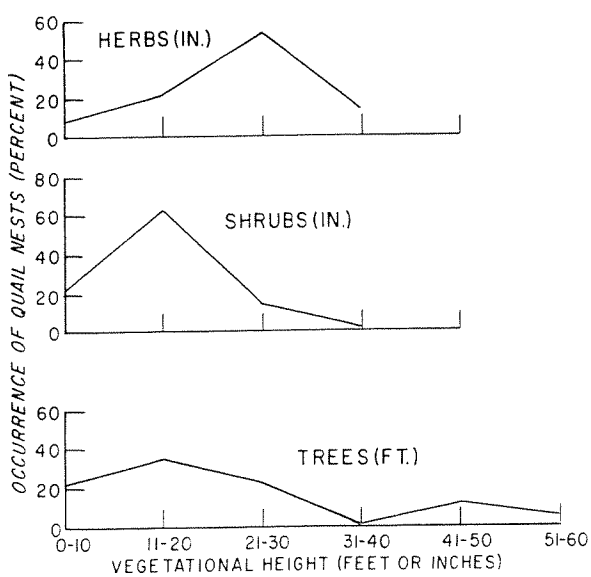

Figure 2.—Occurrence of nests in relation to the height of surrounding herbaceous species (within a radius of 1 ft. 8 in.), shrubs (within a radius of 3 ft. 8.7 in.), and trees (within a radius of 11 ft. 4.3 in.).

Correlations between shrub and herb cover and between herb height and herb cover were investigated. No correlations were evident between these variables.

Broomsedge bluestem (*Andropogon virginicus* L.), blackberry (*Rubus* spp.), and slash pine were the most common plant species around quail nests (table 3). Bare ground (mineral soil) was an important characteristic on 65 percent of the nest sites. Quail seemed to prefer bunch grasses, such as most bluestems (*Andropogon* spp.) and Indiangrass (*Sorghastrum secundum* (Ell.) Nash), for nesting sites. Ninety-eight percent of the nests were located in bluestem clumps, the most important single group of plants. In all cases, the greatest number and variety of plants occurred in woodlands and in strips of planted pine.

Measurements of vegetative cover showed that herbs and trees provided most nests with overhead concealment (table 4). Nests were concealed from the ground by herbs which surrounded and overtopped the nest site. Tree canopies provided additional off-the-ground concealment from flying predators and possibly from the direct rays of the sun. Shrubs in most cases provided only incidental concealment. All nests had less herb and shrub concealment on the entrance side of the nest.

DISCUSSION

These findings indicate that quail seem to prefer certain conditions of herbaceous cover for nest sites. Fresh burns and 1-year roughs were utilized by quail as late-summer nesting sites. Optimum herbaceous cover appeared to be around 50 percent. Bluestem grasses were most frequently utilized as nesting cover and also as nest sites. Burning enhanced the condition of ground cover for nesting quail by promoting a complex of medium-sized, isolated plant clumps which provided optimum screening for the nest and adequate passageways for quail movement.

A wide range of herb heights was tolerated by quail, and no doubt this is a lesser factor in the selection of a nest site. Shrubs and trees appear relatively unimportant, although many nests were found in pine woodlands, apparently because of the pine straw produced there. There were strong indications that quail preferred to nest close to areas with maximum edge-effect. The number of nests located in cultivated field

Table 3.--Herbs, shrubs, and trees around various nesting sites

Species	Occurrence of nests	Ground cover	Vegetational type[1]
	- - - - Percent - - - -		
Herbs			
Andropogon scoparius Michx.	11	30	PP
Andropogon tracyi Nash	23	19	PP, NP
Andropogon virginicus L.	63	31	PP, NP, CF, OF
Andropogon ternarius Michx.	19	23	CF, OF
Panicum spp.	25	2	NP, CF, OF
Sorghastrum secundum (Ell.) Nash	10	10	NP
Chrysopsis spp.	29	14	PP, NP
Gymnopogon spp.	23	3	PP
Cassia spp.	29	3	PP, NP
Lespedeza spp.	21	3	PP, NP
Desmodium spp.	10	1	PP, NP
Eupatorium spp.	31	2	PP, CF
Ambrosia spp.	17	1	NP, CF
Shrubs			
Rubus spp.	69	11	PP, NP, CF, OF
Rhus spp.	33	6	PP, NP
Sassafras albidum (Nutt.) Nees	13	2	NP
Quercus spp.	25	13	PP, NP
Trees			
Pinus elliottii Engelm.	60	37	PP, NP
Quercus spp.	35	23	NP, OF

[1]PP = planted pine rows; NP = open native pine woodland; CF = cultivated field border; OF = old field or idle land.

Table 4.--Distribution of nests with overhead (90°) and surrounding (45°) vegetational concealment

Concealment	Occurrence of nests with concealment of--									
	90°	45°								
		N.	NE.	E.	SE.	S.	SW.	W.	NW.	Avg.
	- Percent -									
Herbs	56	65	81	79	71	58	65	63	63	68
Shrubs	23	25	27	17	17	19	21	19	23	21
Trees	50	48	48	52	48	35	42	48	48	46

borders and narrow rows of planted pine was well above the number of nests found in other vegetal types, although the latter actually comprised a much larger percentage of the study area.

A more comprehensive study, now underway, will examine quail nesting sites throughout the nesting season (May-August) in various vegetational types and in areas with various patterns of land use. Besides providing measures of nest densities, a larger sample of nests should enhance the prospects for substantiating the results of this exploratory study and provide additional information on acceptable nesting habitat for quail.

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