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Relationship of Postburn Intervals to the Incidence and Success of Bobwhite Nesting in Southwest Georgia

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RELATIONSHIP OF POSTBURN INTERVALS TO THE INCIDENCE AND SUCCESS OF BOBWHITE NESTING IN SOUTHWEST GEORGIA

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Abstract:

Data relating to the interval between the last prescribed burn and current nesting attempts were collected from 842 nests known to have contained eggs during the 1969-71 nesting seasons on a 1,262-acre area in southwest Georgia. The yearly habitat acreage per nest averaged 11.4 acres on areas burned during the current spring, 1.4 acres on areas 1 yr postburn, 2.3 acres on areas 2 yr postburn, and 1.8 acres on areas more than 2 yr postburn. One successful nest occurred per 32.0 acres on burned areas, 9.2 acres on areas 1 yr postburn, 14.5 acres on areas 2 yr postburn, and 38.0 acres on areas more than 2 yr postburn.

Initiation dates were known for 385 of the 842 nests. The occurrence of nests on burned areas was low prior to June 16. Nests on burned areas increased after June 15 (1 nest/30.1 acres/year) but the incidence was still lower than that on unburned areas (1 nest/11.1 acres/year). Data indicate that areas burned during the current spring are used by quail for nesting, but that maintenance of suitable cover conditions 1 and 2 yr postburn is the greatest benefit to nesting derived from prescribed burning.

Prescribed burning has long been used in managing land for bobwhite quail (Colinus virginianus). During the past few years, a number of studies have been conducted on prescribed burning done to maintain cover and food supplies important to quail (1,2,5,7,8,10,11,13,14).

Predictable changes in nesting effort and success, and in the seasonal timing of these in relation to changes in vegetational succession caused by prescribed burning, are also important in formulating sound quail habitat management programs. However, only a limited amount of data are available on the effect of prescribed burning on nest-site selection, initiation dates of nesting, and nesting success. Dimmick (3), in reporting on the influence of controlled burning on bobwhite nesting patterns in Tennessee, stated that there was no significant difference between nesting success or peak periods of nest construction on burned and unburned areas. He did find that unburned areas were utilized earlier in the nesting season than were burned areas. Eighty percent of the Tennessee nests were in unburned habitat and 21% in burned habitat. Stoddard (12) reported that in the Thomasville, Georgia - Tallahassee, Florida area 89% of the nests were in growth of the preceding season and only 8% on ground burned over during the preceding winter. Rosene (9) noted that over 80% of the nests he located were in unburned cover. Klimstra and Scott (6) found in Illinois that dead vegetation from only the previous or current year was used in virtually all nest construction. It was indicated that burning on their study area would have an undesirable effect on quail nesting.

The objective of this study was to determine the relative incidence of bobwhite nests and evaluate the chronological distribution of nests and nesting success in relation to postburn intervals after prescribed burns during 1969-1971 in southwest Georgia.

Special recognition is due to Mr. John M. Olin, owner of Nilo Plantation, for providing both financial assistance, through the Georgia Game and Fish Commission, and the area upon which the study was conducted.

Mr. Gratten Parker, manager of Nilo Plantation, provided valuable assistance and co-operation during the study.

The data presented is a portion of that gathered during the quail investigations study funded through the Federal Aid to Wildlife Restoration Act under Pittman-Robertson project W-41-R and the Georgia Game and Fish Commission.

Description of Study Area

The study area is a 1,262-acre tract on Nilo Plantation in Dougherty and Baker counties, southwest Georgia. Forested land, including planted pine rows, constitute 60% of the study area, croplands 10%, open areas and idle fields 20%; the remaining 10% consists of natural ponds.

The overstory is made up primarily of slash pine (Pinus elliottii), longleaf pine (Pinus palustris), live oak (Quercus virginiana), southern red oak (Quercus falcata), post oak (Quercus stellata), and water oak (Quercus nigra). Shrubs consist mainly of sassafras (Sassafras albidum), sumac (Rhus spp.), blackberry (Rubus spp.), and oak sprouts (Quercus spp.). Herbaceous plants consist primarily of broomsedge grass (Andropogon spp.), panic grass (Panicum spp.), Indian grass (Sorghastrum secundum), aster (Chrysopsis spp.), beardgrass (Gymnopogon spp.), partridge pea (Cassia nictitans and C. fasciculata), lespedeza (Lespedeza spp.), beggarweed (Desmodium spp.), dogfennel (Eupatorium spp.), and ragweed (Ambrosia spp.).

Since the initiation of this study, the fall population has exceeded 2 quail/acre. As evidenced by the high population density, the area is managed intensively for quail. Habitat management consists mainly of prescribed burning, planting food patches, and cultivating fields usually of no more than 5 acres. Supplemental feeding is conducted during winter and early spring. Predator control using steel traps was more intensive before 1969 than in 1969-71.

Within the 1,010 acres of nesting habitat present, during the 3 years of study, an annual average of 662 acres (66%) was burned each year; of the 348 acres (34%) of unburned habitat, 233 acres (23%) were at 1 yr, 77 acres (8%) at 2 yr, and 38 acres (3%) at more than 2 yr postburn. Unburned areas were small, having maximum sizes of 2 or 3 acres each in 1969 and 1970. In 1971, unburned areas, due to design and wet burning conditions, ranged up to 40 acres each, with 4 areas containing 20 acres or more. A considerable portion of these larger areas in 1971 were in pond areas that are excluded from nesting cover acreage.

Procedures

The study was conducted during the nesting seasons of 1969, 1970, and 1971. Personnel, consisting of 3 individuals, made daily searches for nests from May through August each year. They were each assigned a different section of the area and usually worked independently. All cover areas, whether considered prime nesting habitat or not, were searched on foot with the aid of a staff for parting vegetation. Two to 3 weeks were required to cover the entire study area once. When found, a nest was flagged with colored plastic surveying tape. Flags were placed far enough away from active nests to avoid attracting predators to the nest sites. Active nests were usually checked once a week. Some nests were visited more frequently near their estimated hatch dates. The area around active nests was disturbed as little as possible.

Initiation dates of nests were determined by back dating with the following criteria: 23 days for incubation, 1 day between cessation of laying and incubation, 1 day per egg deposited in a nest, 2 days between construction and laying, and 1 day for construction. The time intervals were obtained from data collected during this study. The interval per egg deposited in a nest is slightly greater than the mean (0.8 eggs per nest per day), but is approximately the same as the observed mode for egg production.

Prescribed burning was conducted in late March and early April by plantation personnel. Little effort was made to leave unburned areas of any certain size, particularly during 1969 and 1970.

Results and Discussion

Nesting and Nesting Success in Relation to Postburn Interval

The interval since the last prescribed burn was known for sites of 842 quail nests containing eggs during the 3 nesting seasons. Nests occurring on areas burned in the current spring totaled 174 (21%). Nests on unburned areas in relation to the interval since the last prescribed burn numbered 503 (60%) on areas 1 yr postburn, 101 (12%) on areas 2 yr postburn, and 64 (8%) on areas more than 2 yr postburn.

Areas left unburned for 1 year (Table 1) were the most preferred nesting habitat with 1 nest occurring per 1.4 acres. Areas burned in the current spring were least preferred, with 1 nest occurring per 11.4 acres; however, burned habitat became more favorable during the latter portion of the nesting season than it was during the early season. This will be discussed later in more detail.

Unsuccessful nests, those producing no chicks, made up 685 (81%) of the 842 nests. The distribution of these nests according to postburn intervals closely paralleled that of all nests (Table 1). Areas 1 yr postburn had the highest incidence of nests, containing 1 nest per 1.6 acres, and areas burned in the current spring had the lowest, with 1 nest per 17.8 acres.

Successful nests totaled 157 (19%) of the total nests observed. Nesting success was significantly greater on burned areas than on unburned (Chi-square, $P < 0.05$). Nesting success according to burn interval was 36% on areas burned in the current year, 15% on areas 1 yr postburn, 16% on areas 2 yr postburn, and 5% on areas more than 2 yr postburn.

Areas burned in the current spring were relatively unproductive in spite of the lower nesting effort per successful nest, from the standpoint of the amount of habitat per successful nest. The yearly average of the number of acres of habitat per successful nest was 32.0 for areas burned in the current spring, 9.2 on areas 1 yr postburn, 14.5 on areas 2 yr postburn, and 38.0 on areas more than 2 yr postburn (Table 1). Thus, it is evident that despite a smaller proportion of successful nests to total nests on areas 1 and 2 years postburn, when compared to that for areas burned the current spring, a higher number of successful nests occurred per unit of habitat.

It is also evident that the postburn interval (Table 1) did not have as much influence on the use of unburned areas for nesting as it did on nesting success. The incidence of successful nests on unburned areas having a 1-yr-postburn interval was about 58% higher than on areas 2 yr postburn and 318% higher than on areas more than 2 yr postburn.

Nest Initiation Dates and Burn Interval

Initiation dates and postburn intervals were known for 385 nests active when found. Eighty of the nests (21%) occurred on areas burned during the current spring and 305 nests (79%) on unburned areas.

A comparison of the distribution of initiation dates of all nests and of unsuccessful nests through the season, according to interval since the last burn, revealed little difference between the 3 unburned categories. The chronological distribution of successful nests did differ. This could be due, however, to the small number of successful nests in the 2- and more than 2-yr-postburn intervals. Because the initiation dates of nests occurring on the 3 categories of unburned areas corresponded so closely, the combined total of these were compared with the distribution of nest initiation dates on areas burned in the current spring.

The period of greatest nesting on areas burned during the current spring was later in the nesting season than the peak nesting period on unburned areas. A comparison of initiation dates for nests on areas burned during the current spring to those for nests on unburned areas indicated that burned habitat became desirable for nesting during the latter part of June (Table 2). Herbaceous cover had developed to a suitable density for screening of nests and quail movement. Also, pine needle cast, pine needles being a major nest material, had begun by this period. During this period prior to 16 June, unburned areas were utilized much more than burned areas. However, the use of unburned areas decreased after 15 June and the use of burned areas increased. Of the 225 nests begun prior to 16 June, 14 nests (6%) were on burned

areas (66% of the study-area nesting cover) and 211 nests (94%) on unburned areas (34% of the study-area nesting cover). Nests initiated after 15 June totaled 160, of which 66 nests (41%) were on burned areas and 94 nests (59%) on unburned areas. The decline in nesting attempts after 15 June on unburned areas, particularly areas 1 yr postburn, was not necessarily due to these areas becoming less desirable but because the burned areas had become suitable nesting habitat and constituted a higher percentage of the nesting cover present.

Two peaks of nest initiation were evident on areas burned in the current spring and 1 peak on unburned areas. The first peak on burned areas was about 1 month later than the peak on unburned areas. The peaks of nest construction were 16 May - 15 June on unburned areas and 1-15 July and 1-15 August on burned areas. The overall peak period of construction of all nests, with initiation dates of nests on burned and unburned areas combined, was 1-15 June, after which there was a steady decline in nests initiated.

Additional information relating to prescribed burning and its effect on quail nesting was gained by determining nest initiation dates on the basis of nesting success. Of the 385 nests with known initiation dates, 107 nests were successful and 278 nests unsuccessful.

Initiation dates of unsuccessful nests on areas burned in the current spring and on unburned areas made up a large percentage of initiation dates for all nests, and thus paralleled initiation dates for all nests (Table 3). The nests started before 16 June totaled 192 of which 9 nests (5%) were on burned areas and 187 nests (95%) were on unburned. Of the 82 unsuccessful nests begun after 15 June, 29 nests (35%) were on burned areas and 53 nests (65%) were on unburned areas. Peaks of initiation occurred during the period 1-15 August on burned areas and 16-31 May on unburned areas.

No successful nests were initiated before June on areas burned in the current spring (Table 4). However, few nests were constructed on burned areas before this date. Of the successful nests initiated before 16 June, 17% were on burned areas and 83% on unburned areas. The percentage of the successful nests initiated after 15 June on areas burned in the current spring and on unburned areas was about even, 47% and 53% respectively.

The peaks of initiation of successful and of all nests on areas burned in the current spring were the same, 1-15 July and 1-15 August. Peaks of successful nest construction on unburned areas occurred 1-15 June and 1-15 July. However, the number of nests initiated for the periods 1-15 June, 16-30 June, 1-15 July, and 16-31 July were relatively constant.

Despite the increase in occurrence of successful nests with improvement of cover conditions as the nesting season progressed, the amount of habitat acreage per successful nest for areas burned in the current spring was still higher than that for unburned areas (Table 5). Of the successful nests initiated after 15 June, 1 nest occurred per 53.8

acres of nesting cover on burned areas as compared to 1 nest per 25.4 acres on unburned areas. It must be concluded that while successful nests on areas burned in the current spring compose a higher proportion of the successful nests during late season than during the early season, the most valuable nesting benefit derived from prescribed burning is in creating suitable nesting cover conditions that usually exist 1 and 2 years postburn (4).

The low success for nests initiated prior to June was due to nest predation. This was influenced partly by the burning design, i.e., percent of the area annually burned and the size of individual areas of unburned habitat. The bobwhites, along with cottontail rabbits (Sylvilagus floridanus) and various ground-nesting birds and rodents, were concentrated during their respective periods of breeding activity on the 34% of the cover area that was unburned. Predators heavily utilized the unburned cover as feeding areas because of this concentration. When cover on the burned areas became suitable for use, nesting attempts were spread over the entire area and made discovery by predators more difficult.

During the study period, the concentration of the majority of successful nests in late summer had no measurable adverse effects on fall population densities. However, in a year that had unfavorable environmental conditions for good nesting success or chick survival during August or September, the fall population density could be substantially reduced. Additional study of burning design is needed in order to be able to maintain habitat as near optimum as possible for quail and increase the success of nesting attempts initiated before mid-June.

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Table 1. Number of nests and the number of acres of habitat per nest in relation to postburn intervals.

Postburn interval	No. of acres	No. of nests			Average yearly amount of habitat/nest (acres)		
		Total	Unsucc.	Success.	Total	Unsucc.	Succeas.
None	662	174	112	62	11.4	17.8	32.0
1 Yr	233	503	427	76	1.4	1.6	9.2
2 Yr	77	101	85	16	2.3	2.7	14.5
>2 Yr	38	64	61	3	1.8	1.9	38.0

Table 2. Incidence of active nests according to initiation date and interval since prescribed burn.

Initiation dates	Burned in spring	Unburned in spring			Total
		1 yr.	2 yr.	>2 yr.	
March 16-31	-	-	1 (2.1%)	-	1 (.3%)
April 1-15	-	5 (2.2%)	1 (2.1%)	-	6 (2.0%)
April 16-30	3 (3.6%)	28(12.4%)	9 (18.8%)	5 (15.6%)	42 (13.8%)
May 1-15	2 (2.5%)	30(13.3%)	9 (18.8%)	7 (21.9%)	46 (15.1%)
May 16-31	3 (3.6%)	46(20.4%)	6 (12.5%)	6 (18.8%)	58 (19.0%)
June 1-15	6 (7.5%)	46(20.4%)	5 (10.4%)	7 (21.9%)	58 (19.0%)
June 16-30	14(17.5%)	26(11.6%)	7 (14.6%)	5 (15.6%)	38 (12.5%)
July 1-15	18(22.5%)	20 (8.9%)	2 (4.2%)	1 (3.1%)	23 (7.5%)
July 16-31	12(15.0%)	12 (5.3%)	4 (8.3%)	-	16 (5.2%)
August 1-15	18(22.5%)	6 (2.7%)	3 (6.3%)	1 (3.1%)	10 (3.3%)
August 16-31	4 (5.0%)	6 (2.7%)	1 (2.1%)	-	7 (2.3%)
Total	80(99.7%)	225(99.9%)	48(100.2%)	32(100.0%)	305(100.0%)

Table 3. Incidence of unsuccessful active nests according to initiation date and interval since prescribed burn.

Initiation dates	Burned in spring	Unburned in spring			Total
		1 yr.	2 yrs.	>2 yr.	
March 16-31	-	-	-	-	-
April 1-15	-	4 (2.3%)	1 (2.6%)	-	5 (2.1%)
April 16-30	3 (7.9%)	26(15.1%)	9 (23.7%)	5 (16.7%)	40 (16.7%)
May 1-15	2 (5.3%)	26(15.1%)	9 (23.7%(	7 (23.3%)	42 (17.5%)
May 16-31	3 (7.9%)	41(23.8%)	6 (15.8%)	6 (20.0%)	53 (22.1%)
June 1-15	1 (2.6%)	36(20.9%)	4 (10.5%)	7 (23.3%)	47 (19.6%)
June 16-30	5 (13.2%)	18(10.5%)	5 (13.2%)	5 (16.7%)	28 (11.7%)
July 1-15	6 (15.8%)	12 (7.0%)	-	-	12 (5.0%)
July 16-31	7 (18.4%)	4 (2.3%)	2 (5.3%)	-	6 (2.5%)
August 1-15	9 (23.7%)	4 (2.3%)	1 (2.6%)	-	5 (2.1%)
August 16-31	2 (5.3%)	1 (.6%)	1 (2.6%)	-	2 (.8%)
Total	38(100.1%)	172(99.9%)	38(100.0%)	30(100.0%)	240(100.1%)

Table 4. Incidence of successful active nests according to initiation dates and interval since prescribed burn.

Initiation dates	Burned in spring	Unburned in spring			Total
		1 yr.	2 yr.	>2 yr.	
March 16-31	-	-	1 (10.0%)	-	1 (1.5%)
April 1-15	-	1 (1.9%)	-	-	1 (1.5%)
April 16-30	-	2 (3.8%)	-	-	2 (3.1%)
May 1-15	-	4 (7.5%)	-	-	4 (6.2%)
May 16-31	-	5 (9.4%)	-	-	5 (7.7%)
June 1-15	5 (11.9%)	10 (18.9%)	1 (10.0%)	-	11 (16.9%)
June 16-30	9 (21.4%)	8 (15.1%)	2 (20.0%)	-	10 (15.4%)
July 1-15	12 (28.6%)	8 (15.1%)	2 (20.0%)	1 (50.0%)	11 (16.9%)
July 16-31	5 (11.9%)	8 (15.1%)	2 (20.0%)	-	10 (15.4%)
August 1-15	9 (21.4%)	2 (3.8%)	2 (20.0%)	1 (50.0%)	5 (7.7%)
August 16-31	2 (4.8%)	5 (9.4%)	-	-	5 (7.7%)
Total	42(100.0%)	53(100.0%)	10(100.0%)	2(100.0%)	65(100.0%)

Table 5. Acres of habitat per nest initiated before June 16 and after June 15 in relation to postburn interval.

Nest classification	Date initiated	Average yearly habitat (acres)/nest				
		Burned in spring	Unburned in spring			
			1yr.	2yr.	>2yr.	Total
Total	Before June 16	140.9	3.0	7.5	4.6	5.0
	After June 15	30.1	10.0	13.5	16.5	11.1
Unsuccessful	Before June 16	220.7	5.3	7.9	4.6	5.6
	After June 15	68.2	17.9	25.7	22.4	19.7
Successful	Before June 16	389.4	31.9	110.0*	--	45.2
	After June 15	53.8	22.6	28.5	54.3*	25.4

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THE INTERSPERSION INDEX AS A TECHNIQUE FOR EVALUATION OF BOBWHITE QUAIL HABITAT

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Abstract:

An index based on the interspersion of vegetative types proved useful in evaluating quail habitat. Application of the technique for related studies indicated that interspersion indices may find wider application for assessing habitat deficiencies, for evaluating land areas for production of a diversity of wildlife species, and for planning.

Over 40 years ago, the concept of habitat interspersion was advanced by Aldo Leopold (6). Indicating then that "we are only on the threshold of an understanding of the ecology of game species," Leopold went on to