Wild Turkey Brood Habitat Use in Fire-type Pine Forests

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Abstract: We studied habitat selection by radio-tagged eastern wild turkey (*Meleagris gallopavo silvestris*) hens with broods ≤30 days old in the fire-maintained pine (*Pinus*) forests of southwestern Georgia from 1988 to 1990. Habitat selectivity was determined for 14 hen-poult groups that were tracked for 1 week or more. Hens with young broods preferred ($P \leq 0.05$) oldfields and woodlands grazed by cattle. Bonferonni confidence intervals for individual hen-poult groups with >20 locations revealed considerable variation among individuals. Individual brood hens showed preferences ($P \leq 0.05$) for oldfields, hardwoods, annually burned pinelands, and grazed woodlands. Insect abundance in intensively used brood areas was significantly ($P \leq 0.05$) greater than in typical winter-burned pinelands where no brood use was detected. For early brood habitat in Coastal Plain pine forests, we recommend providing oldfields or lightly grazed woodlands when possible in addition to frequently winter-burned pinelands.

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Quality brood range long has been recognized as an important component of wild turkey habitat. This is especially true for early (<30 days) brood habitat due to high mortality rates (Glidden and Austin 1975, Everett et al. 1980), specialized diet (Blackburn et al. 1975, Hurst and Stringer 1975), and small home ranges (Pack et al. 1980). Typical brood range is usually some type of forest opening with a rich herbaceous groundcover (Speake et al. 1975, Kennamer et al. 1980) that supports high invertebrate populations (Hamrick and Davis 1971, Healy 1985).

In the Coastal Plain pine forests of the Deep South these types of openings may

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be few or absent. Under these circumstances, prescribed burning long has been considered an effective means of providing wild turkey brood habitat. Stoddard (1963:30) recommended providing "burned-out spots in pine woodlands" for brood habitat, but also recognized the value of "pastures rich in clovers . . . or stubble fields where mixed hays or small grains have been cut," where they occurred. Recent telemetry studies have shown a preference by hen-poult groups for recently prescribed burned areas in heavily forested pinelands (Exum et al. 1987, Campo et al. 1989, Burk et al. 1990). Our objectives were to determine habitat selectivity of hens with young poults in an area with a long history of extensive annual burning and a significant proportion of openings, and to characterize the insect abundance in these areas.

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Methods

The study area was approximately 5,000 ha centered around Pebble Hill Plantation in Thomas and Grady counties, southwestern Georgia. This part of the Coastal Plain physiographic region is characterized by gently rolling red clay hills dominated by the Greenville-Magnolia soil association, and is generally known as the Tallahassee Red Hills Region (Brueckheimer 1979). Large, privately-owned hunting plantations made up 90% of the study area. The remaining acreage consisted of industrial forest land and a large dairy farm. The major land use was for northern bobwhite (*Colinus virginianus*) hunting. The area included annually burned pinelands (36%), hardwoods (27%), openings (21%), 1–3 year unburned "roughs" in the pinelands (7%), unburned pinelands (4%), pine-hardwoods (2%), pine plantations (2%), and grazed woodlands (1%). Uplands consisted primarily of old-field loblolly (*P. taeda*) and shortleaf pine (*P. echinata*) forests. Hardwood hammocks and cypress (*Taxodium* spp.) and/or gum (*Nyssa* spp.) bays were interspersed throughout the area. Most pine uplands have been prescribed burned annually for nearly a century to maintain park-like stands for bobwhite quail management and hunting. Forest openings consisted of oldfields, pastures, first-year pine plantations, and agricultural fields. Small, scattered agricultural fields usually were planted to grain crops (e.g., corn, sorghum, etc.) or winter greenery (e.g., wheat, oats, etc.). For a more detailed description of the study area see Sisson et al. (1990).

Wild turkey hens were captured in late winter with alpha-chloralose treated corn (Williams 1966), leg-banded, outfitted with solar-powered radio transmitters equipped with motion switches (Everett et al. 1978), and released at or near the capture site. Hens were monitored daily by telemetry to determine nesting activity. Upon onset of incubation, nest sites were flagged from a distance (Everett el al.

1980), then monitored daily to determine their fate. Nests were located after hens departed to determine if they had successfully hatched and, if so, the number of poults in the brood. Hens successfully hatching broods were located 3 times daily for the first 2 weeks with 1 location occurring in each of 3 time periods (morning, mid-day, afternoon). After the first 2 weeks, broods were located daily with each time period receiving equal numbers of locations. Broods were counted by roost or flush counts at 2 weeks and again at 1 month to determine loss rates. Additional counts were made whenever the opportunity presented itself.

Telemetry locations were acquired using a hand-held directional yagi antenna, and were accepted only if 2 azimuths intercepted at an angle of 90° ± 30° and were both located <1.6 km from the bird. Otherwise, more readings were taken from points closer to the animal to insure an accurate location. Telemetry locations were plotted in the field as they were obtained. Locations were ground checked if any uncertainty existed in triangulation. Most locations were made from as close a range as possible without disturbing the birds to insure a high degree of accuracy in habitat use data. A high percentage of habitat use data was obtained without the use of triangulation. Due to the secretive nature of hens with young poults and the types of habitat they used, we were able to approach close enough to determine exact locations without disturbing them in most cases.

Chi-square analysis of preference was performed to determine whether habitat use differed from availability. Habitat selectivity was determined by setting up a family of 95% confidence intervals around the proportion of locations in a given habitat (Neu et al. 1974, Byers et al. 1984). These limits were compared with expected values based on habitat availability. Statistical significance was $P \leq 0.05$. Brood hens were analyzed as a group, as well as separately to evaluate variability among individuals (Thomas and Taylor 1990). Only hens with >20 locations were used in individual analysis to minimize Type II error (Alldredge and Ratti 1986). Use minus availability was calculated and plotted for each brood hen as an additional measure of variability (Thomas and Taylor 1990). Habitat availability was defined as the area within the outermost telemetry locations. To determine available percentages, habitat types were measured from topographic cover type maps using a planimeter.

Insect samples were collected each year from the 3 most heavily used brood areas (as determined by telemetry), as well as from 3 typical annually winter-burned pinelands (the most common habitat) where no brood use was detected. Samples were collected using a standard sweep net with a 40-cm hoop diameter. Each site was subjected to 2 simultaneous, non-overlapping samples of 250 sweeps each. Collections were made systematically along parallel lines perpendicular to the long axis of the site so that they were uniformly distributed. All sampling was done on dry days in early June between 1000 and 1600 hours to standardize the samples (Hurst 1972) and to concur with the season of peak use by poults. Invertebrates were killed in the field by submersing them in a solution of 70% isopropyl alcohol and water. They were then taken to the lab where they were hand separated and measured volumetrically.

Comparisons of insect abundance were made on the basis of water displacement in a 100-ml graduated cylinder. Analysis of variance was used to compare volume of insects between brood areas and annually winter burned pinelands where no use was detected. Duncan's New Multiple Range Test (DNMRT) was used to distinguish means that were significantly ($P \leq 0.05$) different.

Results

We monitored 20 broods during the 3 reproductive seasons. Nine hens hatched 4 broods in 1988, 18 hens hatched 9 broods in 1989, and 11 hens hatched 7 broods in 1990. Thirteen of the 20 broods were lost completely before they reached 2 weeks of age. Of these, 2 were lost due to the brood hens being killed by mammalian predators when their poults were 2 and 5 days old, respectively. An additional brood hen was killed by a mammalian predator when her poults were 40 days old. The 6 remaining hens that were successful raised a total of 13 poults. Poult mortality for the 3 years averaged 88% at 2 weeks and 90% at 1 month.

Habitat use by hen-poult groups was different ($P \leq 0.05$) from expected use, based on availability. Brood habitat preference was determined from 310 locations of 14 individual hen-poult groups that were tracked for 1 week or more. As a group, hens with young broods selected ($P \leq 0.05$) forest openings and grazed woodland habitats (Table 1). Annually burned pine, 1–3 year roughs, and unburned pine were used less ($P \leq 0.05$) than expected. Hardwood, pine-hardwood, and pine plantations were used in proportion to their availability.

Habitat selection varied considerably among individual hen-poult groups (Fig. 1). Hardwoods and annually burned pinelands were used approximately equal to or less than expected by all but 2 broods each. Grazed woodlands were used equal to their availability by all but 1 brood, which used this type much more than expected. Forest openings were used more than expected by 8 broods, approximately equal to

Table 1. Simultaneous confidence intervals using the Bonferonni approach for habitat utilization of wild turkey hen-poult groups in Thomas and Grady counties, Georgia, 1988–1990.

Habitat type	Expected proportion of usage	Actual proportion of usage (P)	Bonferonni interval for P
Forest openings	0.212	0.407	$0.333 \leq P \leq 0.481$[a]
Grazed woods	0.009	0.089	$0.046 \leq P \leq 0.132$[a]
Annually burned pine	0.355	0.173	$0.116 \leq P \leq 0.230$[a]
Rough (1–3 yr.)	0.072	0.025	$0.002 \leq P \leq 0.048$[a]
Unburned pine	0.040	0.009	$0 \leq P \leq 0.023$[a]
Hardwood	0.273	0.248	$0.188 \leq P \leq 0.308$
Pine-hardwood	0.021	0.027	$0.003 \leq P \leq 0.051$
Pine plantations	0.018	0.023	$0 \leq P \leq 0.046$

[a]Indicates a difference at the 0.05 level of significance.

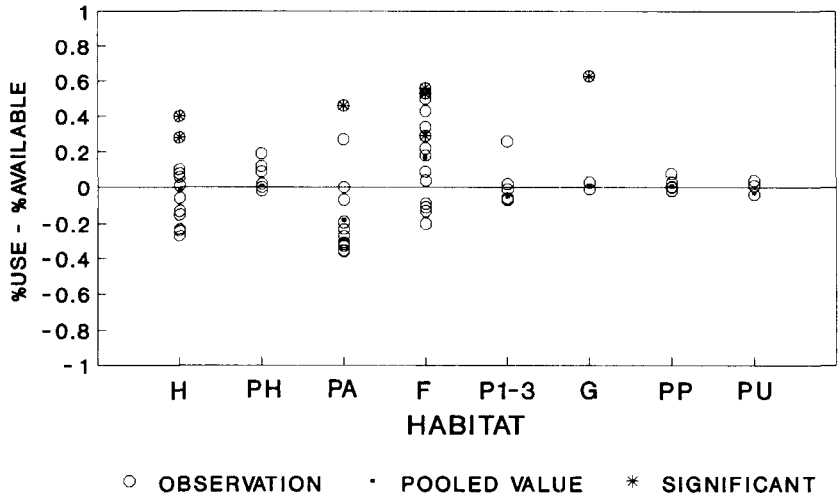

Figure 1. Percentage of habitat use minus percent available (Thomas and Taylor 1990) for 14 wild turkey hen-poult groups illustrating selection variability among individuals and habitat types; Thomas and Grady counties, Georgia, 1988–1990. (Habitats: H = hardwood, PH = pine-hardwood, PA = annually burned pinelands, F = fields, P1-3 = unburned roughs, G = grazed woodlands, PP = pine plantations, PU = unburned pinelands).

the expected use by 2, and less than expected by 4. Little variability existed in the use of other habitats (Fig. 1). Seven hen-poult groups with >20 locations were analyzed individually for habitat preference. Bonferonni confidence intervals for each of these showed that 3 preferred ($P \leq 0.05$) oldfields; 2, hardwoods; 1, annually-burned pinelands; and 1, grazed woodlands (Fig. 1).

A total of 9,000 sweeps were obtained from 36 separate samples. Significant differences ($P \leq 0.05$) existed among years, therefore each year was analyzed separately. Intensively used brood areas had a significantly ($P \leq 0.05$) greater volume of insects than winter-burned pinelands for each of the 3 years (Table 2). In both 1988 and 1990, certain portions of annually winter-burned pinewoods were selected as brood habitat by radio-tagged hens. These areas were sampled for insects and included in the high-use brood area category. They were later analyzed separately and found to contain a significantly ($P \leq 0.05$) greater volume of insects than the other winter-burns sampled, none of which were used by hen-poult groups (Table 2). Further analysis of the data indicated that the relationships between insect volumes held true for numbers of insects as well (Folkerts et al. 1991).

Discussion and Management Implications

Prescribed burning of pine woods long has been recognized and recommended as a wild turkey brood habitat management practice. On our study area, a long

Table 2. Mean invertebrate abundance (ml of insects/ 250 sweeps) for sweep net samples from prescribed burned pinelands and intensively used wild turkey brood areas in Thomas and Grady counties, Georgia, 1988–1990.

Year	Intensively used brood areas	Winter burns	Winter-burned brood areas
1988	41.6 A[a]	4.8 B	13.1 C
1989	37.5 A	13.8 B	
1990	18.6 A	5.8 B	20.1 A

[a]Means in each row followed by the same capital letter are not different ($P > 0.05$).

history of burning has developed a rich herbaceous groundcover over thousands of hectares of pinelands. However, of the 14 broods monitored, only 2 used this habitat type more than expected. Forest openings were the most important brood habitat with 8 of the 14 broods using them more than expected. Although both types had rich herbaceous groundcovers, insect populations were generally much higher in forest openings than in typical winter-burned pinelands. The openings used consisted primarily of recently (1–3 years) abandoned corn fields; therefore, residual fertility may have contributed to the higher insect volume. The groundcover in these fields was primarily forbs and grasses that had been maintained in an early successional state by burning or mowing annually. The height of the vegetation was such that it provided concealment for the young poults while allowing the brood hen to maintain surveillance. Other types of openings used to a lesser degree were winter grazed pastures of small grains, bahia grass pastures, and intensively site-prepared first year clearcuts. The pastures were used more extensively as the poults grew older.

The 2 areas of prescribed burned pinelands that were used by young broods appeared to be typical of annually burned pinewoods throughout the study area. They had been maintained in an open condition and subjected to mostly annual burning for decades to enhance quail habitat. The fact that these 2 areas had higher insect levels than the other winter-burns unused by broods is significant. This suggests that the use of these particular areas was probably influenced by unusually abundant insects produced for reasons other than burning alone. Healy (1978) found higher insect populations in forest stands with higher site indices and abundant herbaceous vegetation in West Virginia. Such special areas should be closely analyzed in pine forests to see if site factors (e.g., soil fertility) were involved and if woodland brood areas can be developed through management.

Individual preferences also were demonstrated for hardwoods and grazed woodlands. We believe the use of these habitats was influenced by the close proximity of openings, which were the preferred brood habitat. Phalen et al. (1986) reported a similar situation in Mississippi in which use of certain brood habitats was influenced by the proximity of preferred habitat. Pack et al. (1980) reported a brood preference

for openings but indicated that broods actually spent more time in forested areas. On our study area, the intense use of hardwoods by 2 broods was in a hardwood bottom with oldfield on 1 side and pasture of the other. The surrounding fields received a considerable amount of use, especially as the poults aged beyond 2 weeks.

Grazed woods made up only a small percentage of the study area but were used by 2 broods, 1 almost exclusively. This was creekbottom hardwood habitat adjacent to winter pasture for dairy cattle. A combination of winter cattle grazing and abundant sunlight from the sides had kept the woods open and maintained a herbaceous groundcover with high insect levels ideal for early brood habitat. Hillestad and Speake (1970) reported preferred brood range on a study area in Alabama to be permanent pasture and grazed woodlands. They went on to say that "some of the highest turkey populations and some of the best hunting in Alabama occur where a high percentage of the land is devoted to cattle production on perennial pastures and grazed woodland (Hillestad and Speake 1970:250)." Everett et al. (1985) also reported preferred brood range to be grazed pastures and adjacent grazed woodlands, with broods often found feeding along this edge. On our study area, pre-flight stage broods were found primarily in the grazed woodlands where there was more cover. As the poults aged beyond 2 weeks they were found progressively more along the edge of the woods and in the pastures themselves.

This study supports the findings of many others concerning the importance of forest openings as wild turkey brood habitat (Hillestad and Speake 1970, Hon et al. 1978, Hayden 1979). It also reveals the preference for this habitat even in an area where prescribed burning has created an abundance of forest land with a rich herbaceous groundcover. Martin and McGinnes (1975) found insect abundance to be greater in openings than beneath the forest canopy in Virginia. Our study supports this relationship in the fire-maintained pine forests of the Deep South. Further, it reveals the importance of insect levels in the selectivity of habitats by hen-poult groups.

Prescribed burning can and should be used as a wild turkey habitat management tool, and as a method of providing brood habitat in Coastal Plain pine forests; especially those with little or no cultivated or grazed openings. Hurst (1978) recommended a 3-year burn rotation for brood habitat management in pine-hardwood forests in Mississippi. Exum et al. (1987) identified brood habitat preference in Alabama for pinelands burned within 1–2 years, with stands not burned for more than 2 years being almost completely avoided. The only use by broods of burned pinelands on our study area was on annual burns. Pinelands burned less frequently were avoided by broods and used less than expected by turkeys in general, but 1- to 3-year roughs were highly preferred nesting habitat (Sisson et al. 1990). These differences in recommendations for fire frequency are most likely a reflection of soil fertility, overstory density, burn history, and history of land use. Recommendations for prescribed burning should be tailored to best suit local conditions.

Where feasible, forest openings in the form of oldfields, cool season small grains, or pastures should be maintained as the primary source of brood habitat in Coastal Plain pinelands. Ecotones created by grazed woodlands adjacent to pastures

also can provide good brood habitat. The use of winter greenery or rotations of summer grain crops in openings is recommended as a way of maintaining soil fertility and providing additional food sources. Burning can be used in openings to maintain a herbaceous groundcover and decrease litter accumulations. Hens with broods on our study area revealed a distinct preference for these habitats over abundantly available prescribed burned pinelands. Insect abundance appeared to play a key role in the selection of these habitats, and in determining which areas of burned pinelands were used by broods. Fields of the type used made up only a small percentage of the total acreage of openings on the study area. We feel the lack of this critical habitat type as well as unusually high predation on young poults are severely limiting turkey populations on this area at the present time. More research is needed on ways to increase the quality of brood range within prescribed burned pinelands where the maintenance of fields is not a feasible option.

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