

Habitat Use of Wild Turkey Gobblers on Tallahala Wildlife Management Area, Mississippi

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Abstract: Seasonal habitat use was monitored for 130 radio-equipped wild turkey (*Meleagris gallopavo*) gobblers on Tallahala Wildlife Management Area, Mississippi, 1986–90. Juvenile and adult gobblers used a variety of habitats within each season and usually exhibited similar trends in habitat use. In summer (Jun–Sep) both age classes used bottomland hardwoods less than expected during most years. However, use of bottomland hardwoods was greater than availability during spring. Use of mature pine (*Pinus* spp.) stands was usually less than availability in spring and greater than availability during summer. Gobblers used mature pine stands burned 1–2 years prior greater than expected, and used stands burned 3–4 years prior in proportion to their availability. Use of pine stands not burned ≥ 5 years was less than availability. During the fall/winter (Oct–Jan 1989), gobbler use of pine stands was less than availability, and use of mixed pine-hardwood stands along secondary creeks was greater than availability. Management implications based on results of this study are discussed.

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Stoddard (1963) stated that wild turkey habitat use varied by sex and age. Most recent studies of turkey habitat use in the Southeast have concentrated on female turkeys (Speake et al. 1975, Martin 1984, Everett et al. 1985, Wigley et al. 1985, Exum et al. 1987, Smith et al. 1990). Gobbler habitat use has been reported, but some studies may have been affected by small sample size or failure to test for significant differences between sexes or age classes (Fleming and Webb 1974, Martin 1984, Everett et al. 1985, Wigley et al. 1985, Exum et al. 1987, Holbrook et al. 1987, Hurst et al. 1991). Quantitative data are needed to better understand gobbler habitat use and improve wild turkey management.

Smith (1981) noted that silvicultural practices were the single most important means used to manipulate wild turkey habitat in the Southeast. Prescribed burning affects habitat use of wild turkeys (Martin 1984, Exum et al. 1987, Palmer 1990, Hurst et al. 1991). However, limited information exists regarding the effect of prescribed burning on gobbler habitat use.

The objectives of this study were to determine the relationship between habitat availability and gobbler use, and to determine the effect of prescribed burning on gobbler use of pine stands.

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Methods

The study was conducted at Tallahala Wildlife Management Area (TWMA), a 14,140-ha tract in the Bienville National Forest, and adjacent lands. The study area was in Jasper, Newton, Scott, and Smith counties, within the Hilly Coastal Plain Province and the Blackland Prairie Soil Resource areas (Pettry 1977). Climatic conditions were mild with a mean annual temperature and precipitation of 18° C and 144 cm, respectively.

The study area was 95% forested and was composed of mature pine (primarily *P. taeda*) (37%), bottomland hardwood (30%), mixed pine-hardwood (17%), and pine and hardwood regeneration areas (11%). Non-forested areas occurred on private lands and were composed of old field (4%), agricultural (1%), and residential (<1%). Hardwood forests were primarily located in alluvial creek drainages. Pine and hardwood regeneration areas averaged 12.7 ha (SD = 7.8) and 5.2 ha (SD = 3.1), respectively.

Pine was regenerated by clearcutting, mechanical site preparation, and planting or the seed-tree method. Mature pine stands were commercially thinned at about 10-year intervals, and prescribe-burned in the winter on an approximate 6-year rotation. Hardwood stands were regenerated by the coppice (clearcut) or shelterwood method.

Gobblers were captured by cannon-netting (Bailey 1976) or drugging with alpha-chloralose (Williams 1966). Capture efforts were conducted from 7 January to 4 March and 1 July to 25 August each year. Each gobbler was fitted with an 107-g "back-pack" radio-transmitter (Wildl. Materials Inc., Carbondale, Ill.) and marked with patagial wing tags (Knowlton et al. 1964) and metal leg bands. Age (subadult, adult) was determined for each gobbler (Williams 1981).

Radio-equipped gobblers were located twice daily every other day using telem-

etry between January 1986–September 1987 (Kelley 1987) and October 1987–September 1990. Efforts were made to obtain independent locations that were equally distributed throughout the diurnal period. Locations were separated into 3 seasons: spring (1 Feb–31 May), summer (1 Jun–30 Sep), and fall/winter (1 Oct–31 Jan). Seasons were based on gobbler behavior. Spring season was that period when gobbler behavior may have been affected by breeding activities. Summer and fall/winter periods were separated at 1 October when hard mast (which may affect gobbler movements) generally became available to turkeys on TWMA. Locations from fall/winter seasons (except 1989) were excluded from analysis due to low sampling intensity.

To assess system error, accuracy tests were performed during leaf-on and leaf-off seasons by individuals taking the majority of telemetry fixes. Individuals not performing accuracy tests placed transmitters at turkey height (approximately 0.8 m) at known locations throughout the study area. A minimum of 15 locations were tested during each season (Palmer 1990).

Photo interpretation and U.S. Forest Service stand data were used to separate habitats into 8 types: pine (>70% pine), hardwood (>70% hardwood), mixed forest (30%–70% pine), regeneration (<4 years post-planting), sapling (5–15 years post-planting), old field, pasture, and agricultural fields (Palmer 1990). Stand maps were digitized using Graphics Editor (MRSC) (Palmer 1990), and transferred to PC Arc/Info (ERSI, Inc. 1989).

Telemetry locations for each season and age class were intersected with the TWMA stand map using the intersect function of PC Arc/Info (ERSI, Inc. 1989) and number of locations within each stand was counted. The outermost locations of each season/age class period were connected to form a use polygon, and area of each stand within use polygons was determined.

Proportion of habitat use was compared to proportion of habitat availability for each season/age period using chi-square analysis and simultaneous confidence intervals protected at $\alpha = 0.10$ (Neu et al. 1974). If chi-square indicated a significant difference between use and availability of habitat types within a period, a set of simultaneous confidence intervals was constructed for the proportion of usage. If proportion of availability of a habitat type was greater than the upper bound of the usage confidence interval, the habitat was considered to be used less than expected. If availability was less than the lower bound of the use interval, use was considered to be greater than expected. If proportion of availability was within the use interval, use was considered equal to availability. Habitats containing <1% of seasonal telemetry locations were excluded from analysis for that period. Statistical tests were protected at $\alpha = 0.10$.

Effect of prescribed burning on gobbler habitat use during 1989 was assessed by comparing use of different age burns to their availability using chi-square analysis and simultaneous confidence intervals (Neu et al. 1974). Pine and mixed forest stands were grouped by age since-burned: 0 year, 1–2 years, 3–4 years, ≥ 5 years.

Data from 1989 were used in the burn analysis due to large samples of gobblers/period and availability of fall/winter data.

Results and Discussion

One hundred thirty radio-equipped gobblers were monitored during January 1986–September 1990, and 7,723 telemetry locations were used in habitat use analysis. Average telemetry system error was 7.2° (SD = 6.3).

Telemetry locations in fields adjacent to TWMA were never greater than 4% and were generally <1% of the total locations within any spring period and age class. Juvenile gobblers used fields greater than expected (% use = 0.03, % availability = 0.01) during spring 1986, and use of fields was equal to availability during spring 1989 (% use = 0.04, % availability = 0.03). In Alabama, gobblers preferred fields during spring (Barwick and Speake 1973, Everett et al. 1985). Percent of locations in fields in summer was 2% and was equal to availability for adult gobblers. Juvenile gobblers used fields even less.

Throughout the study, spring was the only season in which bottomland hardwood forests were used greater than expected (Table 1). Hardwood use/availability ratios for both age classes were consistently higher than other habitats during this period. Everett et al. (1985) concluded that gobblers in northwest Alabama preferred bottomland hardwoods throughout the year. Phalen (1986) and Palmer (1990) reported that hens on TWMA showed strong preference for bottomland hardwoods during the spring and throughout most of the annual cycle. Phalen (1986) noted that hardwood habitats on TWMA were characterized by lush growth of herbaceous vegetation due to prevalence of rich mesic soils, annual flooding clearing the forest floor of debris, and the deciduous canopy which allowed sunlight to reach the forest floor during spring. Williams (1981) noted that during spring adult gobblers spend more energy on breeding activities than feeding. Therefore, hen use of bottomland hardwoods in spring, rather than food availability, may have been the primary reason for gobbler preference of these habitats.

Use of pine habitats was less than availability in 8 of the 10 spring season/age class periods. Palmer (1990) believed hen avoidance of pine stands on TWMA during spring was due to lack of herbaceous vegetation.

During summer, gobbler use of mature pine habitats was generally greater than availability (Table 2). Both age classes used pine stands more than any other habitat type during summer for all years. Additionally, pine use/availability ratios were higher than those for other types except during 1989 and 1990 when juvenile gobblers used regeneration areas during summer. Exum et al. (1987) reported that gobblers on an intensively managed pine forest in Alabama used pine forests ≥ 10 years old more than any other habitat type during summer and believed preference for these areas was due to availability of soft mast, green forage, grass seeds, and insects.

Regeneration areas were used greater than expected during summer by adult gobblers in 1988 and 1989 and by juvenile gobblers in 1989 and 1990. Regeneration areas heavily used by gobblers generally had been burned (site preparation) within 2 years. These areas were field-like in vegetative structure and provided green vegetation, seeds, and insects. Bidwell et al. (1989) noted that turkeys preferred pine

Table 1. Spring habitat use by radio-equipped wild turkey gobblers on Tallahala Wildlife Management Area, Mississippi, 1986-90.

Year	Age	N ^b	Habitat ^a														
			Pine			Hardwood			Mixed			Regeneration			Sapling		
			% Use	% Avail	Sig ^c	% Use	% Avail	Sig	% Use	% Avail	Sig	% Use	% Avail	Sig	% Use	% Avail	Sig
1986	Adult	240	0.48	0.50	=	0.30	0.21	>	0.09	0.14	<	0.11	0.12	=	0.00	0.20	<
	Juv	657	0.37	0.49	<	0.35	0.21	>	0.12	0.13	=	0.10	0.14	<	0.02	0.03	=
1987	Adult	634	0.34	0.38	=	0.31	0.32	=	0.16	0.18	=	0.11	0.07	>	0.03	0.05	<
	Juv	165	0.42	0.44	=	0.30	0.23	=	0.14	0.17	=	0.09	0.09	=	0.04	0.05	=
1988	Adult	476	0.33	0.40	<	0.35	0.28	>	0.17	0.18	=	0.09	0.06	=	0.06	0.06	=
	Juv	73	0.26	0.30	=	0.58	0.41	>	0.06	0.16	<	0.06	0.06	=	0.02	0.07	<
1989	Adult	1198	0.30	0.38	<	0.44	0.30	>	0.16	0.18	=	0.04	0.05	=	0.05	0.07	<
	Juv	288	0.44	0.39	=	0.24	0.28	=	0.18	0.20	=	0.07	0.04	=	0.03	0.07	<
1990	Adult	291	0.39	0.46	<	0.38	0.25	>	0.19	0.16	=	0.07	0.04	=	0.03	0.09	<
	Juv	186	0.51	0.49	=	0.19	0.14	=	0.20	0.25	=	0.07	0.04	=	0.02	0.06	<

^aPine = mature pine forest; hardwood = mature hardwood forest; mixed = mixed pine-hardwood forest; regeneration = pine regeneration areas, age 0-4 years; sapling = pine regeneration areas, age 5-15 years.

^bNumber of telemetry locations used in analysis.

^cSignificance, = use equals availability, > use greater than availability, < use less than availability, (P < 0.10).

Table 2. Summer habitat use by radio-equipped wild turkey gobblers on Tallahala Wildlife Management Area, Mississippi, 1986-90.

Year	Age	No	Habitat ^a														
			Pine			Hardwood			Mixed			Regeneration			Sapling		
			% Use	% Avail	Sig ^c	% Use	% Avail	Sig	% Use	% Avail	Sig	% Use	% Avail	Sig	% Use	% Avail	Sig
1986	Adult	278	0.67	0.43	>	0.10	0.27	<	0.08	0.17	<	0.13	0.10	=	0.01	0.02	=
	Juv	718	0.70	0.41	>	0.07	0.30	<	0.13	0.16	<	0.09	0.08	=	0.01	0.04	<
1987	Adult	240	0.54	0.43	>	0.18	0.26	<	0.15	0.15	=	0.07	0.09	=	0.05	0.06	=
	Juv	70	0.49	0.43	=	0.20	0.24	=	0.21	0.18	=	0.06	0.10	=	0.04	0.05	=
1988	Adult	393	0.67	0.42	>	0.10	0.28	<	0.06	0.16	<	0.14	0.04	>	0.04	0.09	<
	Juv	186	0.56	0.43	>	0.12	0.25	<	0.15	0.18	=	0.07	0.06	=	0.08	0.07	=
1989	Adult	842	0.63	0.42	>	0.13	0.27	<	0.10	0.17	<	0.07	0.04	>	0.07	0.09	=
	Juv	330	0.43	0.46	=	0.16	0.21	<	0.11	0.20	<	0.17	0.03	>	0.10	0.08	=
1990	Adult	142	0.49	0.42	=	0.25	0.31	=	0.16	0.14	=	0.04	0.03	=	0.06	0.10	=
	Juv	122	0.57	0.76	<				0.12	0.12	=	0.25	0.07	>	0.06	0.10	=

^aPine = mature pine forest; hardwood = mature hardwood forest; mixed = mixed pine-hardwood forest; regeneration = pine regeneration areas, age 0-4 years; sapling = pine regeneration areas, age 5-15 years.

^bNumber of telemetry locations used in analysis.

^cSignificance, = use equals availability, > use greater than availability, < use less than availability, (P < 0.10).

regeneration areas <4 years old that had vegetative characteristic similar to small permanent openings.

During fall/winter 1989, radio-equipped gobblers used pine stands less than expected (% use = 0.37, % availability = 0.42) and used mixed forest habitats greater than expected (% use = 0.23, % availability = 0.18). Mixed stands provided hard mast during fall/winter, and were often juxtaposed between upland pine and bottomland hardwood areas. Although we believe hard mast production was relatively high on TWMA during 1989, gobblers did not show a preference for bottomland hardwoods (% use = 0.28, % availability = 0.27). Fall/winter use of regeneration areas was greater than availability (% use = 0.09, % availability = 0.04), while sapling stands were used less than expected (% use = 0.02, % availability = 0.09). Regeneration areas provided food items such as seeds of legumes during fall/winter. However, estimates of use of these small habitats may be affected by telemetry system error (White and Garrott 1986). Also, regeneration areas contained only 9% of the total telemetry locations during this season, but use was greater than expected due to low availability.

Because male poulters were not equipped with radio-transmitters, juvenile gobblers were not monitored during fall/winter. Fall/winter habitat use was examined only for 1989 due to low sampling intensity during other years.

Time since burning affected gobblers use of pine habitats (Table 3). While use of bottomland hardwoods was generally greater than availability during spring, gobblers used pine stands that had been burned during the previous late winter-early spring according to availability during this period. Gobblers used these stands immediately following burning, and again with the resurgence of green vegetation. However, these stands were used less than expected by both age classes of gobblers during other seasons.

Adults and juvenile gobblers used stands with 1- to 2-year-old burns greater than expected during summer, and consistently used 3- to 4-year-old burns in proportion to their availability. Hurst (1981) noted that prescribed burning reduced woody ground cover and increased forb and grass cover. Palmer (1990) reported that hens on TWMA consistently selected stands that had been burned within the last year over all other pine stands. Gobbler avoidance of <1-year-old burned areas during summer may have been partially due to utilization of soft mast which was available in older-aged burns. Fruit is not produced by most woody plants the year they are burned (Hurst 1981). However, plants produce more fruit for several years after being burned. Johnson and Landers (1978) reported that areas burned within 2-3 years yielded more soft mast such as huckleberries (*Gaylussacia* spp.), blueberries (*Vaccinium* spp.), and blackberries (*Rubus* spp.). Speake et al. (1975) recommended burning on a 2- to 4-year rotation to insure some fruit production.

Gobbler use of pine stands with burns ≥ 5 years old was always less than availability. Exum et al. (1987) noted that pine stands burned within 3 years were most suitable for turkey use. These areas have vegetative structures which are conducive to turkey movement and provide a diversity of food items. Fire is used in the Southeast to control hardwood underbrush and keep pine stands open (Stoddard

Table 3. Use of mature pine forests by years since last prescribed burned, by radio-equipped gobblers on Tallahala Wildlife Management Area, Mississippi, 1989.

Season ^a	Age	N ^b	Years since burned	% Use	% Avail	Sig ^c
Spring	Adult	306	0	0.17	0.15	=
			1-2	0.44	0.52	=
			3-4	0.34	0.24	=
			5+	0.03	0.07	<
Spring	Juv	48	0	0.04	0.11	=
			1-2	0.67	0.61	=
			3-4	0.19	0.23	=
			5+	0.00	0.02	<
Summer	Adult	438	0	0.02	0.18	<
			1-2	0.72	0.50	>
			3-4	0.22	0.23	=
			5+	0.02	0.06	<
Summer	Juv	114	0	0.05	0.18	<
			1-2	0.75	0.51	>
			3-4	0.16	0.23	=
			5+	0.00	0.06	<
Fall/Wnt	Adult	322	0	0.09	0.18	<
			1-2	0.46	0.50	=
			3-4	0.33	0.23	=
			5+	0.03	0.06	<

^aSpring = 1 Feb-31 Mar; summer = 1 Jun-30 Sep; fall/winter = 1 Oct-31 Jan.

^bNumber of telemetry locations used in analyses.

^cSignificance: = use equal to availability, > use greater than availability, < use less than availability.

1963). It was thought that turkeys generally avoided areas with dense brush stratum, and most managers agreed that burning was useful in manipulating ground cover (Hurst 1981). However, recommended burning regimes are subjective, and data on turkey use of pine stands with different years since-burned were limited. Results from this study suggest that prescribed burning on a 4-year rotation would best suit gobbler needs on TWMA.

Adult and juvenile gobblers usually exhibited similar trends in habitat use. However, some differences were observed between age classes. During spring 1987, 1989, and 1990 juveniles used pines more and hardwoods less than adult gobblers. Caution must be used in making inferences based on age class/season periods with low sample sizes (e.g., juveniles/summer 1987, juveniles/spring 1988) which increases the probability of type II errors (Alldredge and Ratti 1986). However, trends in selection/avoidance and use/availability ratios were similar throughout the study suggesting that habitat use patterns were invariant.

Byers et al. (1984) noted 3 assumptions which applied to the Neu et al. (1974) technique for analyzing use-availability data. First, habitats must be equally available to study animals. Due to the mosaic-like availability of habitat types on TWMA, all major habitat types were available within most home ranges, regard-

less of a gobbler's spatial location on the area. Another assumption was that study animal movements must be mutually independent. Radio-equipped gobblers were occasionally together in social groups. However, these groups were relatively small (generally 2 gobblers) and very dynamic. Therefore, gobbler locations were treated independently. Finally, locations must be temporally independent (e.g., not autocorrelated). Efforts were made to obtain locations equally distributed throughout the diurnal and seasonal periods. Hourly telemetry locations (excluded from this analysis) taken during a concurrent study of gobbler movements suggested that gobblers on TWMA often traversed several habitat types within 1 hour. We believe that our sampling schedule provided temporally independent locations and that available statistical tests of autocorrelation have limited applicability when analyzing turkey habitat use in areas with mosaic-like habitat availability.

Gobbler use of a variety of habitats suggests the importance of maintaining habitat diversity within even-aged pine-hardwood forests. The mosaic pattern of stands created by silvicultural practices made several habitats (and age-burns within habitats) available within gobbler home ranges. Mature pine stands were consistently important to gobblers, especially during the summer period. Number of years since-burned affected how gobblers used pine habitats, and stands not burned ≥ 5 years were consistently used less than expected. Management of pine dominated forests for wild turkeys should include prescribed burning on a 2- to 4-year rotation. Annual burning, which would adversely affect soft mast production, would not be recommended.

Bottomland hardwoods were preferred by gobblers during spring, and were important to hens on TWMA throughout most of the year. Therefore, maintenance of mature hardwood stands would be recommended on southern forests managed for wild turkeys.

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