EFFECTS OF CONTROLLED BURNING ON WILD TURKEY POULT FOOD HABITS

GEORGE A. HURST, Department of Wildlife and Fisheries, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Mississippi State, MS 37962

Abstract: Food habits of pen-raised wild turkey poults (*Meleagris gallopavo silverstris*), age 4-14 days, were studied for a 3-yr. period (1975-1977) in the loblolly pine-shortleaf *pine* (*Pinus taeda, P. echinata*, forest type in eastcentral Mississippi. Crop and gizzard contents of poults that fed on recently burned subplots (0.65 ha) were compared to the contents of poults that fed on 3- and 4-yr.-old "roughs" or unburned subplots. Total animal food eaten (insects, spiders, snails, etc.) was significantly ($P < 0.01$) higher on burned subplots. Mean oven-dry weight of selected animal food eaten (insects and spiders), was not significantly different when recently burned areas were compared to 3-yr.-old "roughs." However, a highly significant ($P < 0.01$) difference was detected for recently burned subplots compared to 4-yr.-old "roughs" for selected animal food. Total plant food, mostly seeds of dewberry (*Rubus trivialis*), was significantly ($P < 0.01$) greater on unburned subplots. A 3-yr. burning rotation for brood habitat management is suggested. One-third of a griven forest compartment should be burned annually.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 32: 30-37

Perhaps the most critical and least understood stage in a wild turkey's (*Meleagris gallopavo silvestris*) life is the first 2 weeks after hatching. High rates of poult mortality have been reported (Wheeler 1948, Schroger 1966). A 57% loss of poults in the first 2 weeks was reported by Glidden (1975). Healy and Nenno (1978) found that of 55 poults hatched in West Virginia, only 12 reached age 28 days.

Food habits of poults have been reported (Wheeler 1948, Latham 1956, Stoddard 1963, Schroger 1966, Healy 1974). Animal food, primarily insects, was most important in the first several weeks of a poult's life (Hurst and Stringer 1975). Stoddard (1963) realized the great importance of "insect-catching grounds" as part of wild turkey management. He thought that this critical part of wild turkey habitat could be supplied by the wise use of controlled fire or improved pastures.

The objective of this study was to determine the effects of fire on wild turkey poult food habits in the loblolly pine-shortleaf pine forest type. I wish to thank C. Owen, C. Hayes, C. Brewster, I. Brocato, R. Warren and G. Schuster for their help in the field. Laboratory assistants D. J. Moore and B. J. Blatner also contributed greatly. The project was funded by the Mississippi Agricultural and Forestry Experiment Station.

STUDY AREA

The study was conducted on Noxubee National Wildlife Refuge, about 29 km south of Starkville, Mississippi. The refuge contains about 19,035 ha, of which 324 ha are hayfields and 284 ha are in row crops. There are 81 ha in other nonforested habitats. The refuge has a variety of forest types, including bottomland hardwoods, pine, upland hardwoods and mixed pine-hardwood. The wild turkey population on the refuge has been estimated to number about 700.

The study area was in the Interior Flatwoods Region of the Hilly Coastal Plain Province (Hodgkins et al. 1976). The topography was flat to gently sloping. The soils, Adaton, Wilcox and Longview, were acid, pH 4.9 - 5.4, and were poorly drained. The frost-free period was about 215 days (Pettry 1977).

The pine-mixed hardwoods forest was uneven-aged and averaged 45 years old. The forest was first control-burned in February, 1962, and was subsequently burned 6 more times between 1962 and 1974. Timber stand improvement, by injection, was performed in 1965 and 1967, with a combination pulpwood-sawtimber thin and improvement cut in 1966.

Average pine basal area was 12.6m^2/ha with loblolly pine the dominant species, but shortleaf pine was in the forest. The dominant hardwoods were southern red oak (*Quercus falcata*), post oak (*Q. stellata*) and white oak (*Q. alba*). Twenty-seven other species of hardwoods, primarily hickory (*Carya spp.*) and sweetgum (*Liquidambar styraciflua*), were present. Hardwood basal area averaged 6.1 m^2/ha. Loblolly pine averaged 27.9 m in height and hardwoods averaged 25 m.

Controlled burning is a regular practice on the refuge with an average of 1,336 ha of pine forest being burned annually. Late winter or early spring, February-March, burns are used. Burning rotation is 3 years.

METHODS

Pen-raised wild turkey poults were used to sample treated (burned) and untreated (not burned) subplots. A captive flock of wild turkeys supplied the eggs. The eggs were incubated in a Jamesway incubator, and upon hatching the poults were placed with broody mixed-breed chicken hens in brood cages. A brood cage was 1.2 m long x 1 m wide x 1 m high.

The hen and about 15 poults (brood) were left in the cage for 24 hours to allow imprinting. On the second day the brood was placed in a 10 m^2 fenced pen in a grassy area. The poults learned to forage for food and respond to hen calls. On subsequent days the broods were allowed to roam at will in a hayfield. The educational ventures continued until the poults reached a desired age, 4 to 14 days old, to be used as sampling units. Sick or weak poults were eliminated during the education process.

While in the brood cage the poults were fed Purina Gamebird Starter and water. All food was removed from the brood about 5 hours prior to sampling time.

Poults from the same hatch and with the same educational experiences sampled the same plot. One hen and her poults were randomly assigned to a subplot, e.g. treated. The other hen and her poults would then be placed on the untreated subplot. The broods were allowed to forage on the untreated subplot. The broods were allowed to forage on the subplot for 2 hours, usually 1500-1700. Field assistants made sure the broods stayed on the assigned subplots. At the end of the 2 hour sampling period, or a shorter time due to inclement weather, 5 poults from each brood (subplot) were randomly selected and killed in 1975. An increase in the size of the captive flock allowed the poult sample size to be increased to 10 poults killed per subplot in 1976 and 1977. The poults were individually marked with leg-bands.

The gastro-intestinal tract, upper esophagus to and including the gizzard, was removed and placed in 10% iso-propyl alcohol. Contents of the crop and gizzard were handled separately in the laboratory, but were combined for analysis. All contents were air-dried, manually sorted, counted, oven-dried for 7.5 hours at 87 C and weighed. The material eaten was placed into 4 classes, total animal (insects, spiders, harvestmen, snail shells, crayfish parts, etc.), selected animal (insects, spiders, harvestment), total plant (seeds) and total food (animal plus plant). The selected animal class was created to delineate the insects, a very important type of food for poults. Insects in the gizzard were generally not identifiable to insect order so the material was called "insect parts." Seeds in the gizzard were readily identifiable.

The entire forest was burned on 5 March 1974. No poult food habits sampling was conducted in the spring of 1974. A representative part of the forest was chosen as the study area. Eight plots, each divided into 2 subplots, were established in a nested plot design in February, 1975. A subplot was 40 m x 161 m (0.65 ha). Poult food habits were studied on the untreated subplots in the spring of 1975 to determine if the subplots were comparable. The vegetation was in its second growing season.

On 19 November 1975, 1 subplot of each plot was randomly selected and was burned by headfire. A complete "top-kill" of hardwood brush, mainly sweetgum and hickory,

was obtained. Most of the forest litter was burned, leaving exposed mineral soil. Poult food habits were sampled on burned versus unburned subplots. Burned subplots were in their third to fifth month of vegetative growth when sampled. The unburned subplots were in their third year of plant growth.

The same subplots that were burned in the fall of 1975 were burned on 6 February 1977. Again the hardwood brush was completely "top-killed" and most litter was burned. Food habits of poults were sampled on the subplots in the spring of 1977. The unburned subplots were in their fourth growing season. Sampling of poult food habits was conducted in the period when most wild turkey eggs hatch in this location, mid-May to mid-June.

To determine the effects of burning on the vegetation, line transects were used on each subplot in August, 1976. From the center of each subplot 2 lines, each 15.24 m, were placed at 45° angles to each other, forming an "X" in the subplot. The line was placed 61 cm above the ground and occupancy by plant species of each 3 cm was recorded. A 100% timber cruise was conducted in August, 1976. Every stem over 2.54 cm d.b.h. was measured with a diameter tape.

All statistical analyses were performed by R. F. Heiser, Department of Statistics, Computing Center, Mississippi State University. One-way analysis of variance procedures in the BMDP2V package were used.

RESULTS

Comparison of poult food habits on untreated subplots - 1975

Poults age 4-12 days fed on all 8 plots, 16 subplots, from 20 May-12 June. Poults age 5-14 days also fed on plots 1-5 from 12 June-3 July, 1975. Analysis of variance of mean oven-dry weight of total animal food, selected animal food, total plant food (seeds) and total food eaten showed there to be no significant differences between the untreated subplots (Table 1).

Table 1. Mean oven-dry weight (g) of food eaten by wild turkey poults, age 4-14 days, that fed on untreated subplots, 195[a].

Food category	*(Subplots*[b] *(N = 65)*	*Subplots (N = 65)*
Total animal	0.032	0.027
Selected animal[c]	0.024	0.023
Total plant	0.053	0.046
Total food	0.085	0.073

[a] Poults sampled the subplots from 20 May-3 July.

[b] These subplots became the treated (burned) subplots in 1976 and 1977.

[c] Excludes snail shells and crayfish parts, includes insects and spiders.

Most of the animal matter eaten was "insect parts." The identifiable insects were mostly beetles (Coleoptera), larvae (Lepidoptera), small wasps and ants (Hymenoptera) and leafhoppers (Homoptera). Spiders were the most often eaten non-insect animal food. The most important plant foods were seeds of dewberry, sedge (*Carex* spp.) and nut-rush (*Scleria* spp.).

Comparison of poult food habits on burned versus unburned subplots - 1976

Each plot, 1-8, was sampled by 6 day old poults and 10 day old poults from 8 May-17 June, 1976. Total animal food eaten was significantly higher for the 6 day old poults and

the combined data for 6 and 10 day old poults that fed on burned subplots ($P < 0.05$). Selected animal food was only slightly higher on burned subplots than on unburned subplots. A highly significant difference ($P < 0.01$) was found for total plant food in favor of the unburned subplots, both for 6 and 10 day old poults. Total food eaten was equal on burned and unburned for 6 day old poults, but was significantly higher ($P < 0.05$) on the unburned subplots for the 10 day old poults. The combined data for 6- and 10 day old poults was not significantly different (Table 2).

Table 2. Mean oven-dry weight (g) of food eaten by 6 and 10 day old wild turkey poults, on burned and unburned subplots, from May 8-June 17, 1976.

	6-days-old		*10-days-old*		*6- and 10-days-old, combined*	
Food Class	*Burned*[a] *(N = 79)*	Unburned *(N = 80)*	Burned *(N = 79)*	Unburned *(N = 79)*	Burned *(N = 158)*	Unburned *(N = 159)*
Total animal	0.046*	0.033	0.043	0.036	0.045*	0.034
Selected animal[b]	0.035	0.031	0.036	0.031	0.036	0.031
Total plant	0.011	0.025**	0.021	0.054**	0.016	0.040**
Total food	0.058	0.058	0.064	0.090*	0.061	0.074

[a]Burned subplots in first growing season after burning in November, 1975. Unburned subplots in their third growing season.

[b]Excludes snail shells and crayfish parts, includes insects and spiders.

* Means significantly different, $P < 0.05$.

**Means significantly different, $P < 0.01$.

Insect parts accounted for most of the animal food eaten. Beetles, small wasps, ants and leafhoppers were the most often eaten types. Spiders made up 9% of the animal food eaten by 6 day old poults on burned subplots and 21% on unburned subplots. With 10 day old poults, spiders had 7% of the total animal weight on burned and 25% on unburned subplots Snail shells eaten by both age poults totaled 0.02 g on burned and only 0.01 g on unburned subplots. Dewberry seeds made up most of the plant weight.

Comparison of poult food habits on burned versus unburned subplots - 1977

Total animal and selected animal means were significantly higher ($P < 0.01$) for poults that fed on burned subplots. Total plant food eaten was significantly higher ($P < 0.01$) for poults that fed on unburned subplots. Total food eaten was not significantly different (Table 3).

The most important insect types eaten, in descending order of percentage of the total weight, were beetles, ants, small wasps, grasshoppers, moth larvae, true bugs (Hemiptera), leafhoppers and flies (Diptera). Most of the weight was in insect parts. Dewberry seeds accounted for most of the plant weight.

Analyses of poult classes by years, treatment and years by treatment

Analyses of variance tests showed there to be no significant difference between years, 1976 and 1977, for total animal food. However, a highly significant difference ($P < 0.01$) was detected for selected animal, total plant and total food eaten between the years 1976 and 1977. Mean selected animal food declined in 1977 due to the much lower average on the 4 year old unburned subplots. Therefore, a highly significant difference ($P < 0.01$) was detected between years. Mean total plant increased greatly in 1977, accounting for a highly significant difference ($P < 0.01$) in total plant and total food between years. A

Table 3. Mean oven-dry weight (g) of food eaten by wild turkey poults, age 8-12 days, on burned and unburned subplots, from May 24-July 8, 1977.

Food Class	*Burned*[a] (*N* = 75)	Unburned (*N* = 73)
Total animal	0.051**	0.028
Selected animal[b]	0.034**	0.018
Total plant	0.056	0.144**
Total food	0.108	0.142

[a] Burned subplots in first growing season following burning in February, 1977. Unburned subplots in their fourth growing season.

[b] Excludes snail shells and crayfish parts, includes insects and spiders.

**Means significantly different ($P < 0.01$).

highly significant difference ($P < 0.01$) was detected for treatment for all food classes averaged over both years.

The analyses of poult food classes for years by treatment did not detect significant differences for total animal or total food. Selected animal, with a $P = 0.068$ indicated that there was some effect of treatment over time. Since the selected animal mean was about the same on burned subplots, the detected "weak" difference was in the lower selected animal mean for unburned subplots. A significant difference ($P = 0.013$) of the effect of treatment over time (years) was detected for total plant food (Table 4).

Table 4. Analysis of variance tests of poult food habits by years (1976 and 1977), treatment and years by treatment.

Food Class	*Statistical probability*[b]		
	Year	*Treatment*	*Yr X Trt*
Total animal	$P = 0.584$	$P < 0.01$	$P = 0.154$
Selected animal[a]	$P < 0.01$	$P < 0.01$	$P = 0.068$
Total plant	$P < 0.01$	$P < 0.01$	$P = 0.013$
Total food	$P < 0.01$	$P < 0.01$	$P = 0.195$

[a] Excludes snail shells and crayfish parts, includes insects and spiders.
[b] Two-way analysis of variance procedures in the BMDP2V package were used.

Line transects - 1976

A total of 149 species of plants were recorded on burned subplots and 148 on unburned subplots (Table 5). Forbs, including legumes, were the dominant (most occupancy) form of vegetation at the 61 cm level and below. Woody brush, vines, grasses and sedges followed the forbs in percent occupancy.

Forbs had a higher average occupancy on burned subplots than on unburned. The most prevalent forb was aster (*Aster dumosus*) Agalinis (*Agalinis purpurea* and A. *tenuifolia*) were much more prevalent on burned subplots. Frequency of occurrence for aster and agalinis was much higher on burned subplots. Average occupancy by legumes was about the same on burned and unburned subplots.

Table 5. Number of species, average percent occupancy and average frequency of occurrence of plants on recently burned and unburned subplots, August, 1976[a].

Plant life form	*Burned subplots*[b]			*Unburned subplots*[c]		
	No. spp.	*Avg. % occup.*	*Avg. fre. of occur.*	*No. spp.*	*Avg. % occup.*	*Avg. fre. of occur.*
Forbs	57	38.0	2.7	51	25.3	1.8
Legumes	18	11.4	2.9	17	11.7	2.6
Grasses	20	7.6	1.4	19	6.3	1.2
Sedges	13	4.7	1.8	9	2.5	1.4
Vines	11	10.3	3.6	12	14.8	4.2
Woody	29	19.5	1.8	29	33.2	2.4
Ferns	1	0.3	1.0	1	0.5	0.9
Total	149	91.8		148	94.3	
Vegetative debris		5.8			4.1	
Mineral soil		1.4			0.0	

[a] Average of 8 line transects, each 30.5 long.

[b] Vegetation on burned subplots had completed 1 growing season.

[c] Vegetation on unburned subplots had completed 3 growing seasons.

Grasses and sedges generally had higher average occupancies and frequency of occurrences on burned subplots. The vines, *Smilax* spp., *Rubus* spp. and *Vitis* spp. had higher occupancies on unburned subplots. Woody brush occupancy was much higher on unburned subplots, average of 33% to 20% on burned subplots. The major difference was sweetgum, which had a frequency of occurrence of 19.2 on unburned and only 9.2 on burned subplots.

DISCUSSION

Poults that fed on recently burned subplots in the pine-mixed hardwoods forest ate significantly more animal food than poults that fed on 3 and 4 year old "roughs." Most of the animal foods eaten were insects, but spiders and snail shells were also eaten. Spiders were more frequently eaten on unburned subplots. Apparently the lack of cover or "clean" nature of the recently burned subplots was less acceptable to spiders and harvestmen. However, snail shells were more available on the litter-free burned subplots, and more were eaten by poults on burned subplots. It appeared that most often the poults ate only snail shells, not living snails. Snail shells would be a source of calcium for poults.

Insects, because of their high protein content, must be the prime consideration in brood habitat management (Hurst and Stringer 1975, Stringer 1977). Selected animal weight, mostly insects, was not significantly different on burned versus 3 year old "roughs," but a highly significant difference was detected between burned and 4 year old "roughs." Although effect of treatment, burning, over time was not significantly different, the decrease in selected animal food eaten by poults on 4 year old "roughs" was important.

Plant food is also important in the poult diet, amounting to 46% of the diet by the second week and 63% by the third week of a poult's life (Hurst and Stringer 1975). Berries and seeds provide carbohydrates. Dewberry seeds accounted for most of the dry weight in the plant food category. Usually the pulp part of the berry was rapidly digested and was not weighed. Poults that fed on 3 and 4 year old unburned subplots ate significantly more

dewberry than poults that fed on burned subplots. Very few berries were produced on dewberry stems in their first year of growth after being burned to ground-level.

Mean weight of sedge and nut-rush seed eaten was greater in poults that fed on burned subplots than unburned, 4 year old "roughs." The small seeds of these plants would be easier to find on recently burned areas. Average occupancy of sedge and nut-rush plants was higher on recent burned subplots than 3 year old "roughs."

Blackberry (*Rubus argutus*) ripens about a month later than dewberry. Blackberries were usually not in the poult feeding zone, up to 30 cm. Blackberries could be important for broods that hatch late and for juvenile turkeys.

Burning reduced the hardwood brush and vines. Forbs increased on burned subplots but grasses (*Andropogon* spp., *Uniola* spp., *Panicum* spp.) showed little change as a result of fire. The lack of a dense grass-forb plant community apparently accounted for the low density of insects on the plots in the pine-mixed hardwood forest type.

Burning in the longleaf pine-slash forest type is a widely accepted practice. The loblolly pine-shortleaf pine forest type, also referred to as the pine-mixed hardwood type, is not generally burned yet it covers some 22 million ha in the South (Halls and Stransky 1971). The pine-mixed hardwood type is often converted to pine type and controlled burning should be used.

Ideally each forest compartment should contain recently burned and unburned tracts, up to age 3 years. Unburned areas provide good nest habitat, good escape and brood-holding cover. Unburned areas also provide more dewberries and perhaps more litter dependent insects (ground beetles) than recently burned areas.

Burned tracts provide "insect catching grounds" (Stoddard 1963). Either there are more insects or they are more available on burned areas versus 4 year old "roughs." Poults easily run-about foraging for insects on recently burned areas. The open, "clean" nature of burned areas allows poults to scurry about and not get wet from the vegetation. Vegetation on burned areas dries faster than on unburned areas due to the openness.

Another advantage of burning is that it appears to control ticks. Only 1 poult out of 59 that fed on burned subplots in 1977 was infested by 1 tick (*Amblyomma americanum*). Forty-one ticks were found on poults that fed on unburned plots (Jacobson and Hurst 1978). Stoddard (1963) presumed that fire controlled ticks and chiggers (mites) on wild turkey range.

The pattern of burning is also important. Recently burned tracts should be located next to unburned tracts so that the "best of both" is readily available. In the study area 2 wild turkey hens nested on unburned subplots but were near burned subplots. One turkey hen with poults was observed on a burned subplot.

Results of this study suggest that for turkey brood habitat management, in the pine-mixed hardwoods forest type, the burning rotation should be 3 years. A 3 year old "rough" would be the oldest recommended age because poult insect consumption declined on subplots 4 years old. Two and 3 year old "roughs" would suply berries. The manager can establish a burning program so that one-third of the forest compartment is burned every year. The "edge," burned next to unburned, would always be present.

The 4 year old "rough" had one important feature that should be noted. An abundance of soft mast was present. The fruit of greenbrier (*Smilax* spp.), poison-ivy (*Rhus toxicodendron*), sumac (*Rhus copallina*), grape (*Vitis* spp.), American beauty bush (*Callicarpa americana*) and huckleberry (*Vaccinium* spp.) were abundant in 1977. These fruits are important foods for older turkeys and many other species. The forest or wild turkey manager could lengthen the rotation period to 4 years as long as one-fourth of the compartment was burned each year.

Controlled burning in the loblolly pine-shortleaf pine forest type is recommended as a brood habitat management practice. However, burned or unburned tracts in this forest

type are not good brood habitat when compared to pastures or fields (Hurst and Stringer 1975). The turkey manager should not rely on the forest as the only source of brood habitat. The best brood habitat is poorly managed (unimproved) pastures (Owen 976). These diverse plant communities have an abundance of a variety of insects, spiders, snails, pill bugs (*Asellus oniscus*), dewberry, blackberry, sedge, nut-rush, forbs and a permanent grass sod. Cover, such as clumps of trees and bushes, is generally very good. Burning portions of these poor pastures or old fields would be good brood habitat management. Burned old-field plant communities had twice as much insect biomass and density as did unburned (Hurst 1972).

LITERATURE CITED

Glidden, J. W., and D. E. Austin. 1975. Natality and mortality of wild turkey poults in southeastern New York. Pages 48-54 *in* L. K. Halls, ed. Proc. Third National Wild Turkey Symposium, San Antonio, Texas.

Healy, W. M. 1974. Wild turkey traits. Turkey call 2(1):17-24.

_____ and S. Nenno. 1978. Turkey broods and hairy snoods. Turkey call. 5(3):12-17.

Hodgkins, E. J., T. K. Cannon and W. F. Miller. 1976. Forest habitat regions from satellite imagery, Alabama and Mississippi. Dept. Forestry, Auburn University and Mississippi State University.

Hurst, G. A. 1972. Insects and bobwhite quail brood habitat management. Pages 65-82 *in* J. A. Morrison and J. C. Lewis, eds. Proc. First National Bobwhite Quail Sym. Oklahoma State University, Stillwater.

_____ and B. D. Stringer, Jr. 1975. Food habits of wild turkey poults in Mississippi. Pages 76-85 *in* L. K. Halls, ed. Proc. Third National Wild Turkey Symposium, San Antonio, Texas.

Jacobson, J. J., and G. A. Hurst. 1978. Incidence of *Amblyomma americana* parasitism of wild turkey poults as influenced by prescribed burning J. Wildlife Diseases (in press).

Latham, R. M. 1956. Complete book of the wild turkey. The Stackpole Co., Harrisburg, Pa. 265 pp.

Owen, C. N. 1976. Food habits of wild turkey poults in pine stands and fields; and the effects of mowing hayfield edges on arthropod populations. M.S. Thesis. Mississippi State Univ., Mississippi State. 62 pp.

Pettry, D. E. 1977. Soil resource areas of Mississippi. Information sheet no. 1278, Miss. Agricul. and Forestry Exper. Sta., Miss. State University.

Schorger, A. W. 1966. The wild turkey; its history and domestication. University of Oklahoma Press, Norman. 625 pp.

Stoddard, H. L. 1963. Maintenance and increase of the eastern wild turkey on private lands of the coastal plain of the deep southeast. Bull. No. 3, Tall Timbers Research Station, Tallahassee, Fla. 49 pp.

Stringer, B. D., Jr. 1977. Food habits and behavior of wild turkey poults in eastcentral Mississippi. M.S. Thesis. Mississippi State Univ., Mississippi State. 131 pp.

Wheeler, R. J. 1948. The wild turkey in Alabama. Alabama Dept. of Conservation Bull., Montgomery. 92 pp.