Deer Forage in 13-Year-Old Commercially Thinned and Burned Loblolly Pine Plantations

George A. Hurst, *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Randy C. Warren, *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Abstract: White-tailed deer (*Odocoileus virginianus*) forage was greatly increased in 2 loblolly pine (*Pinus taeda*) plantations after they were control burned and commercially thinned at age 13 years. Forage averaged 26 kg/ha in August 1979 (age 12) before treatment and 326 kg/ha in August 1980 (age 13), 1 growing season after treatment, and 429 kg/ha in August 1981 (age 14). Deer forage averaged 31 kg/ha in February 1981 and 52 kg/ha in February 1982, which exceeded the 4.5 kg/ha average in 12-year-old untreated plantations. A 46% decline of deer forage in 1 plantation and a 26% decline in the other plantation in May 1982 compared to May 1981 indicated that the peak in deer forage occurred in the second year after treatment. Most deer forage was forbs and vines with a small woody (browse) component.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 36:420–426

One goal of The South's Third Forest Committee was to regenerate 12.15 million ha of unproductive forests or fields to pine (*Pinus* spp.) plantations between 1969 and 1985 (South. For. Resource Analysis Comm. 1969). During an average year 0.62 million ha of public and private land across the South are planted to pine (South. For. Institute 1979). Pine plantations are becoming a major habitat type for white-tailed deer.

Baseline data on the effects of silvicultural practices used in pine plantations on wildlife and lesser vegetation are inadequate (Johnson et al. 1974), although effects of some practices in intensively managed plantations have been reported (Hurst and Warren 1980, Hurst et al. 1982). Most plantation management plans do not include precommercial thinning, therefore the first reduction in pine density is the first commercial thinning (Knight and Sheffield 1980). This paper reports the effects of controlled

burning and commercial thinning in 2 13-year-old loblolly pine plantations on deer forage.

We acknowledge the assistance of J. Cutler and G. Pehlman and thank M. Townsend and D. Hull of Weyerhaeuser Company for their help. Statistical analyses were performed by Dr. M. Giesen. The project was supported by the Mississippi/Alabama Region of Weyerhaeuser Company.

Methods

Two loblolly pine plantations (8.9 km apart) in the Hilly Coastal Plain Province, Kemper County, Mississippi, were studied from 1979 to 1982. One plantation (127 ha) was in the Interior Flatwoods Region (flatwoods) and the other (81 ha) was in the Lower Clay Hills Region (hills). The flatwoods have nearly flat topography and very acid, poorly drained soils, which are clayey with a silt loam layer on top. The hills have hilly terrain, with a sandy loam topsoil over a sandy clay to clay subsoil (Hodgkins et al. 1979). The hills plantation was on terraces of Aticka Creek. The climate of east central Mississippi is warm and humid with an annual rainfall of 127-152 cm and a frost-free period of 200-230 days (Pettry 1977). The spring, summer, and fall seasons of 1980 and 1981 were unusually hot and dry.

The flatwoods tract had been a pine forest of large-diameter stems with only a small hardwood component due to past timber stand improvements. The tract was clearcut and site prepared in the summer of 1967. Residual plant material was sheared, raked into piles and burned, then the tract was single-disked. One-year-old loblolly pine seedlings were hand-planted on a 2.13 × 2.44-m spacing (1,922 trees/ha) in December 1967. Site index for loblolly pine on a 25-year basis was 20.1 m.

The hills tract had an average site index of 19.5 m and had been cotton fields until 1964. Plant material on the tract was piled and burned, and then the tract was single-disked in the summer of 1967. Loblolly pine seedlings, 1-year-old nursery stock, were hand-planted at a 2.13 × 2.44-m spacing in February 1968.

The flatwoods plantation was burned (wildfire) in March 1979. Both plantations were control burned in January 1980 and commercially thinned on a tree-selection basis in April 1980, at age 13 years. Trees removed were small diametered and had poor form and/or disease. Stocking was reduced to about 741 trees/ha. An average of 26.2 m^3/ha (about 10 cords/ac) of pine were removed. Both plantations were control burned the second time in late December 1981.

Stand criteria of the flatwoods plantation immediately prior to thinning were: mean tree diameter at breast height (dbh) of 13.97 cm, with an average height of 13.7 m, a basal area of 29.9 m^2/ha, and a stocking of

1,672 trees/ha. Stand data for the hills plantation were not available. Two growing seasons after thinning, pine in the flatwoods averaged 16.8 cm dbh with a height of 13.7 m. The stand had a basal area of 17.2 m^2/ha with 736 trees/ha. Average pine dbh in the hills plantation was 19.3 cm with a height of 13.1 m. Basal area averaged 19.6 m^2/ha with a stocking of 692 trees/ha.

Preferred deer forage, i.e. the green, current-growth of leaves and stems from plant species usually eaten by deer in this area (Warren and Hurst 1981), was sampled by the ranked-set method (Halls and Dell 1966). A set consisted of 3 circular hoops, each 107 cm in diameter. Total area of the 3 hoops was 0.87 m^2. The amount of preferred deer forage in the 3 hoops (set) was ranked as either high, medium or low. Deer forage was hand-picked or clipped to a height of 1.52 m above ground from an equal number of highs, mediums and lows. Forage was placed in paper bags by plant category (grass, forb, vine, woody), oven-dried at 80 C for at least 72 hours, and weighed.

Based on past sampling of deer forage in pine plantations (Hurst and Warren 1980) a certain number of sets (samples), e.g. 48 in August, were taken. Then Stein's Two-Stage Test was used to determine the number of samples required for each plantation (Steel and Torrie 1960). If additional samples were required they were immediately taken. Sampling began 40 m from roads and the samples were situated about 20.12 m apart. Sampling began from a randomly chosen point and was systematic thereafter. Sampling was restricted to the same 13 ha (flatwoods) and 8 ha (hills) areas in the plantations during all sampling periods. Sampling was restricted to a representative part of each plantation to concentrate sampling and decrease variability. Narrow drainage-ways and burned-pile areas were not sampled.

Deer forage abundance was sampled on both plantations in August 1979, before treatment, and then at the end of each season (summer – August, fall – November, winter – February, spring – May), beginning in August 1980 and continuing through May 1982.

Total deer forage by sample period was analyzed by one-way analysis of variance tests for significance ($P < 0.05$). Duncan's Multiple Range Test was used to identify differences among sample means (Nie et al. 1975).

Results

Total deer forage in the flatwoods plantation at age 12 (August 1979) was 41 kg/ha after a wildfire but before thinning. The hills plantation, which was not burned by wildfire, had 11 kg/ha. In August 1980 following controlled burning and thinning, deer forage totaled 355 kg/ha in the flatwoods and 299 kg/ha in the hills (Tables 1, 2). In August 1981, the second grow-

Table 1. Deer Forage (kg/ha) in a Control Burned and Commercially Thinned 13-Year-Old Loblolly Pine Plantation, Kemper County (flatwoods), Mississippi

Year	Treatment	Sample Period	Plant Category				
			Grass	Forb	Vine	Woody	Total[a]
1979	Burned–Mar	Aug	3(8)[b]	6(14)	31(77)	1(1)	41
1980	Burned–Jan	Aug	51(14)	80(23)	209(59)	15(4)	355C
	Thinned–Apr	Nov	114(50)	38(16)	75(33)	2(1)	229B
1981		Feb	13(64)	4(22)	2(13)	1(1)	20A
		May	15(4)	80(22)	218(61)	47(13)	360C
		Aug	51(10)	207(39)	237(45)	30(6)	525D
		Nov	29(11)	116(44)	112(42)	9(3)	266BC
1981	Burned–Dec						
1982		Feb	8(41)	3(13)	9(43)	1(3)	21A
		May	7(4)	76(37)	106(51)	17(8)	206B

[a] Significantly different ($P \leq 0.05$) if not followed by the same letter.
[b] Percent of total weight.

ing season after treatment, deer forage increased significantly to 525 kg/ha in the flatwoods and increased to 329 kg/ha in the hills plantation.

Total deer forage increased significantly from 131 (1980) to 322 kg/ha (1981) between November 1980 and 1981 in the hills plantation, but it did not increase significantly in the flatwoods during this period.

In February 1978, before treatment and at age 10 years the 2 plantations averaged 11 kg/ha of deer forage (Hurst and Warren 1980). After

Table 2. Deer Forage (kg/ha) in a Control Burned and Commercially Thinned 13-Year-Old Loblolly Pine Plantation, Kemper County (hills), Mississippi

Year	Treatment	Sample Period	Plant Category				
			Grass	Forb	Vine	Woody	Total[a]
1979		Aug	<1(1)[b]	1(13)	8(76)	1(10)	11
1980	Burned–Jan						
	Thinned–Apr	Aug	9(3)	160(54)	120(40)	10(3)	299B
		Nov	9(7)	7(5)	109(83)	6(5)	131A
1981		Feb	6(14)	5(12)	29(69)	2(5)	42A
		May	17(5)	95(29)	205(63)	11(3)	328B
		Aug	15(5)	134(40)	166(51)	14(4)	329B
		Nov	26(8)	140(44)	152(47)	4(1)	322B
1981	Burned–Dec						
1982		Feb	4(5)	9(11)	52(61)	12(23)	77A
		May	5(2)	97(40)	102(42)	40(16)	244B

[a] Significantly different ($P \leq 0.05$) if not followed by the same letter.
[b] Percent of total weight.

burning and thinning in 1980, the flatwoods plantation increased to around 20 kg/ha in February 1981 and 1982. In the hills plantation deer forage totaled 42 kg/ha in 1981 and 77 kg/ha in 1982.

Deer forage declined significantly from 360 to 206 kg/ha in the flatwoods and declined from 329 to 244 kg/ha in the hills plantation from May 1981 to May 1982. The decrease was largely due to a decrease of about 100 kg/ha of vines in each plantation.

Vines averaged 57% (hills) and 44% (flatwoods) of the total deer forage. Forbs contributed 27% (flatwoods) and 30% (hills). Grasses accounted for 25% (flatwoods) and 6% (hills) while woody plants contributed only 5% (flatwoods) and 8% (hills) of the total deer forage.

Plants contributing the majority of the deer forage in the plantations were: grasses – *Panicum* spp., *Uniola* sp., *Tridens* sp., *Eragrostis* sp., and *Paspalum* spp.; forbs – *Solidago* sp., *Helianthus* sp., *Euphorbia* sp., *Salvia* sp., *Aster* sp., *Ambrosia* sp., *Eupatorium* sp., *Phytolacca* sp., *Erechtites* sp., *Oenothera* sp., *Heterotheca* sp., *Gnaphalium* sp., and *Scutellaria* sp.; vines – *Rubus argutus, R. trivialis, Lonicera japonica, Rhus radicans, Smilax* spp., *Vitis* spp., and *Campsis radicans;* and woody – *Nyssa sylvatica, Acer rubrum, Prunus serotina, Ulmus alata, Cornus florida, Rosa carolina, Ligustrum sinense, Sambucus canadensis,* and *Callicarpa americana.*

Discussion

Burning and thinning 13-year-old pine plantations significantly increased total deer forage to 326 kg/ha in August 1980, 1 growing season after treatment, and to 429 kg/ha in August 1981, at the end of 2 growing seasons. The treatments restored deer forage abundance to that reported for younger untreated pine plantations, which averaged 327 kg/ha at age 7 years and 455 kg/ha at age 6 years in Kemper County (Hurst and Warren 1980).

Effects of burning and thinning on deer forage were confounded but we think most of the effects attributable to burning were largely limited to the first year after treatment. Hurst et al. (1980) reported that just burning a 7-year-old pine plantation in Kemper County increased deer forage in the first growing season after burning, but forage decreased 52% in the second year. In the same plantation burning and precommercial thinning resulted in an increase in forage the first year and only an 18% decline occurred in the second year.

Comparable data for deer forage in commercially thinned 13-year-old pine plantations are not available. Blair (1960) reported that deer forage in a loblolly pine plantation in Louisiana, which was thinned at age 20 and 25 years, ranged from 241 kg/ha (lightly thinned) to 335 kg/ha (heavily thinned) at age 30 years. Intensively managed pine plantations will be

thinned at a much younger age and the rotation will probably be 35 years (Koch 1980).

How long the treatments will affect deer forage is not known. A significant decrease (43%) in the flatwoods plantation and a 26% decrease in deer forage in the hills plantation in May 1982 compared to May 1981 indicated that the peak in deer forage had occurred in the second growing season after treatment.

Most deer forage in the burned and thinned plantations was forbs and vines. The hardwood component (browse) had been greatly reduced by past agricultural and forestry practices. Managed plantations will be control burned about every third year, which will "top-kill" hardwoods and improve their palatability and keep the browse in the deer's feeding range (Hurst et al. 1980). Grasses comprised a small percent of the total deer forage in the hills plantation, but a higher percent in the flatwoods. Grasses comprised from 20-55% of the deer's diet in winter-spring in the loblolly-shortleaf (*Pinus taeda- P. echinata*) pine-hardwood forest type in central Mississippi (Mitchell 1980).

In 1973 commercial thinning was needed on between 4.05 to 6.08 million ha of pine in the South (Zobel and Kellison 1972). Many more plantations will need thinning by 1983. Thinning and control burning are major pine plantation management practices that can benefit deer habitat.

Literature Cited

Blair, R. M. 1960. Deer forage increased by thinnings in a Louisiana loblolly pine plantation. J. Wildl. Manage. 24:401–405.

Halls, L. K., and T. R. Dell. 1966. Trial of ranked-set sampling for forage yields. For. Sci. 12:22–26.

Hodgkins, E. J., M. S. Golden, and W. F. Miller. 1979. Forest habitat regions and types on a photomorphic-physiographic basis. Southern Cooperative Series 210, Ala. Agric. Exp. Stn., Auburn Univ., Auburn, 64pp.

Hurst, G. A., and R. C. Warren. 1980. Intensive pine plantation management and white-tailed deer habitat. Pages 90–102 *in* R. H. Chabreck and R. H. Mills, eds. Integrating timber and wildlife management in southern forests. Proc. 29th Annu. For. Symp., La. State Univ. 119pp.

———, J. J. Campo, and M. B. Brooks. 1980. Deer forage in a burned and burned-thinned pine plantation. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 34:476–481.

———, ———, and ———. 1982. Effects of precommercial thinning and fertilizing on deer forage in loblolly pine plantations. S.J. Appl. For. 6:140–144.

Johnson, A. S., J. L. Landers, and T. D. Atkeson. 1974. Wildlife in young pine plantations. Pages 147–159 *in* Proc. Symp. on management of young pines. USDA For. Serv., South. and Southeast. For. Exp. Stn. 349pp.

Knight, H., and R. M. Sheffield. 1980. Thinning opportunities in pine plantations

in the southeast during the 1980's. Pages 18–26 *in* Thinning southern pine plantations: integrating economics and biology. Proc. South. For. Econ. Workshop. For. and Harvesting Training Cent. Long Beach. 157pp.

Koch, P. 1980. Concept for southern pine plantation operation in the year 2020. J. For. 78:78–82.

Mitchell, W. A. 1980. Evaluation of white-tailed deer and cattle diets in two southeastern pine forests. Ph.D. Thesis. Miss. State Univ., Miss. State. 236pp.

Nie, N. H., C. H. Hull, J. G. Jenkins, K. Steinbrennen, and D. H. Bent. 1975. Statistical Package for Social Sciences. McGraw-Hill Book Co., New York. 675pp.

Pettry, D. E. 1977. Soil resource areas of Mississippi. Inf. Sheet 1278. Miss. Agric. and For. Exp. Stn., Miss. State. 4pp.

Southern Forest Institute. 1979. South's forest industry plants 629 million new trees: is that enough? South. Pulp and Paper Manufacturer 42:15.

Southern Forest Resource Analysis Committee. 1969. The south's third forest: how it can meet future demands. South. For. Resour. Council, New Orleans. 111pp.

Steel, R. G. D., and J. H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill Book Co., New York. 481pp.

Warren, R. C., and G. A. Hurst. 1981. Ratings of plants in pine plantations as white-tailed deer food. Inf. Bull. 18, Miss. Agric. and For. Exp. Stn., Miss. State. 14pp.

Zobel, B. J., and R. C. Kellison. 1972. Short rotation forestry in the Southeast. TAPPI 55:1205–1208.