DEER FORAGE IN A BURNED AND BURNED-THINNED PINE PLANTATION

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Abstract: Total deer *(Odocoileus virginianus)* forage (grass, forb, vine, woody) in August was significantly ($P < 0.05$) greater on burned (481 kg/ha) and burned-thinned (554 kg/ha) than on untreated plots (141 kg/ha) in an 8-9 year old loblolly pine *(Pinus taeda)* plantation. Total deer forage also was significantly greater on burned (57 kg/ha) and burned-thinned (53 kg/ha) than untreated plots (26 kg/ha) in February, 1979 and 1980. Total deer forage on burned plots declined 52 percent in August and 50 percent in February in the second year after treatment. The decline was only 18 percent (August) and 24 percent (February) on the burned-thinned plots.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 34:476-481

Southern pine forests are expected to produce much of the nation's wood and fiber and intensive forest management is required. Many pine-hardwood forests are being converted to pine plantations in the South and this conversion may affect white-tailed deer habitat and populations. Pine plantations can provide adequate deer habitat (Blair 1967, Wood et al. 1974, Blair et al. 1977). Intensive management includes control burning and precommercial thinning (stocking control) (Wolter and Schmidtling 1975, Blair and Enghardt 1976). This paper describes the effects of burning and burning-thinning on deer forage abundance in a pine plantation.

METHODS

A 32-ha loblolly pine plantation in east central (Kemper County) Mississippi was studied. The plantation was in the Interior Flatwoods Region, which is nearly flat, mostly forested, poorly drained, and has acid-clayey soils in the Wilcox Series (Savannah, Prentiss, Wilcox). The climate is mild (252 frost-free days), and rainfall averages 114 cm/year (Hodgkins et al. 1976, Pettry 1977).

The site had been occupied by a mature pine-hardwood forest dominated by oaks *(Quercus* spp.), hickories *(Carya* spp.), other hardwoods and pine *(P. taeda, P. echinata)*. The area was clearcut in 1968 and site prepared, sheared, windrowed-burned, and bedded in 1970. One-year-old loblolly pine seedlings were hand-planted with a spacing of 2.4 x 2.1 m in January 1971. Site index for loblolly pine was 22.2 m at age 25 years (Brooks 1979, Campo 1980).

Eight plots were established in the plantation in February 1978. Two plots (30.5 x 30.5 m) were used as control plots (no treatment) and stocking averaged 1,431 trees/ha. Four plots, three 30.5 x 30.5 m and one 21.3 x 42.7 m, were control burned by headfire on February 22, 1978 and thinned from 1,431 to 865 trees/ha in March 1978. The trees were left where felled. Trees selected to be cut were those with small stems or poorly developed crowns and those infected with fusiform rust. Two other plots, one 19.8 x 30.5 m and one

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30.5 x 30.5 m, were control burned (strip headfire) on February 22, 1978, but not thinned. Stocking averaged 1,431 trees/ha (Campo 1980).

Burned plots had a basal area of 25.4 m^2/ha one growing season and 29.2 m^2/ha two growing seasons after treatment. Burned-thinned plots had a basal area of 14.4 m^2/ha one growing season and 17.1 m^2/ha two growing seasons after treatment. Control plots had a basal area of 25.4 m^2/ha one growing season later and 30.9 m^2/ha two growing seasons later.

Deer forage abundance was sampled using the ranked-set sampling method, with 9 sets per sample plot. A set consisted of 3 circular hoops, each 107 cm in diameter (Halls and Dell 1966, Dell and Clutter 1972). Deer forage was sampled in August, 1978 and February, 1979 (at plantation age 8 years), and August 1979 and February, 1980 (at plantation age 9 years). Only green, new-growth, succulent parts of plants usually eaten by deer in Kemper County were clipped, up to 1.52 m high (Warren 1980). The plants were separated into grass, forb, vine, and woody categories. The woody category included leaves, buds, and new-growth portions of twigs. Vegetation was oven-dried at 80°C for 72 hrs and weighed (Brooks 1979, Campo 1980).

A two-way analysis of variance (ANOVA) was used to test for significance (kg/ha) of treatments for each year, by sample period. Years were compared using a three-way ANOVA to test the significance of treatments between years. Data were pooled, by category and treatment to determine net significance ($P < 0.05$) of years and treatments on deer forage abundance (Nie et al. 1975).

RESULTS

Total deer forage was significantly ($P < 0.05$) greater on burned and burned-thinned plots than on control plots in August 1978 and significantly greater on burned-thinned plots than on control plots in August 1979 (Table 1). Pooled means of August samples indicated that total deer forage was significantly greater on burned-thinned and burned plots than on control plots (Table 2).

Table 1. Deer forage in August, mean oven-dry weight (kg/ha) on burned and burned-thinned plots in a loblolly pine plantation at age 8 and 9, Kemper County, Mississippi.

Plant category	Year	Burned	Burned and thinned	Control
grass	1978	14.8 a[1]	5.7 b[2]	2.5 b
	1979	11.3 a	12.7 a	1.3 b
forb	1978	54.4 ab[2]	56.1 a	3.0 b
	1979	13.0 ab	32.7 a	2.9 b
vine	1978	446.7 ab[2]	477.3 a	113.8 b
	1979	220.5 a	398.0 b	138.5 a
woody	1978	132.9 a	70.4 ab	8.6 b
	1979	69.4 a	54.9 a	11.1 b
total	1978	648.9 a[2]	609.5 a	127.9 b
	1979	314.2 ab	498.2 a	153.7 b

[1]Significantly different between treatments (across row), $P < 0.05$, if not followed by the same small letter.

[2]Means significantly different, $P < 0.05$, between years, for given plant category and treatment.

Table 2. Means oven-dry weight (kg/ha) of deer forage in August using pooled means over a two-year period in a loblolly plantation, age 8 and 9 years, Kemper County, Mississippi.

Plant category	Burned	Burned and thinned	Control
grass	13.1a[1]	9.2 a	1.9 b
forb	33.8 a	44.4 a	2.9 b
vine	333.6 a	437.6 b	126.1 c
woody	101.1 a	62.7 a	9.8 b
total	481.5 a	553.8 a	140.8 b

[1]Significantly different between treatments (across row), $P < 0.05$, if not followed by the same small letter.

In August 1978, grass forage, mostly *Panicum* spp., was significantly greater on burned than on burned-thinned and control plots. Forb forage, mostly *Dioclea*, *Lespedeza*, *Aster*, and *Eupatorium*, was more abundant (not significantly different) on burned and burned-thinned plots than on control plots. Vine forage, mostly blackberry *(Rubus argutus)*, but also *Smilax* spp., *Vitis* spp., *Anisostichus* sp., averaged 462 kg/ha on treated plots and 144 kg/ha on control plots. Woody forage, *Nyssa*, *Acer* and *Vaccinium*, was also more abundant on treated plots.

In August 1979, grass forage remained significantly greater on treated plots than on control plots, and significantly increased on burned-thinned plots. Forb and vine forage was significantly greater on burned-thinned plots than on control plots. Forb and vine forage declined significantly on burned plots in 1979. Woody forage decreased on treated plots, but was significantly greater than on control plots. Analysis of the pooled means for August indicated that grass, forb, woody and total deer forage were significantly greater on treated than on control plots. Vine forage was significantly greater on burned-thinned than on burned and control plots, and vine forage on burned plots was significantly greater than on control plots.

Table 3. Deer forage in February, mean oven-dry weight (kg/ha) on burned and burned-thinned plots in a loblolly pine plantation at age 8 and 9 years, Kemper County, Mississippi.

Plant category	Year	Burned	Burned and thinned	Control
grass	1979	2.3	2.6	1.0[2]
	1980	3.1 a[1]	3.4 a	0.2 b
forb	1979	9.2 a	3.1 b	0.5 b
	1980	2.7 a	2.5 a	0.5 b
vine	1979	60.9[2]	52.2	44.3[2]
	1980	30.2	32.0	5.7
woody	1979	3.0	2.3	0.0
	1980	1.7	8.0	0.1
total	1979	75.4[2]	60.2	45.8[2]
	1980	37.7 ab	45.9 a	6.5 a

[1]Significantly different between treatments (across row), $P < 0.05$, if not followed by the same small letter.

[2]Means significantly different, $P < 0.05$, between years, for given plant category and treatment.

Table 4. Means oven-dry weight (kg/ha) of deer forage in February using pooled means over a two-year period in a loblolly pine plantation, age 8 and 9 years, Kemper County, Mississippi.

Plant category	Burned	Burned and thinned	Control
grass	2.7 a[1]	3.0 a	0.6 b
forb	6.0 a	2.8 b	0.5 c
vine	45.6	42.1	25.0
woody	2.3	5.1	0.1
total	56.6 a	53.0 a	26.1 b

[1]Significantly different between treatments (across row), $P < 0.05$, if not followed by the same small letter.

Total deer forage was more abundant on treated plots than on control plots in February 1979. In February, 1980, total deer forage was significantly greater on burned-thinned than on control plots (Table 3). Pooled means for the February samples indicated that total deer forage was significantly greater on treated plots than on control plots (Table 4).

Grass forage was more abundant on treated plots than on control plots in February 1979 and significantly greater in February 1980. Forb forage was significantly greater on burned than on burned-thinned and control plots in February 1979 and significantly greater on treated plots than on control plots in 1980. Vine forage was more abundant on treated plots than on control plots in February 1979 and 1980. There was more woody forage on treated plots than on control plots in February 1979 and woody forage was highest on burned-thinned plots in February 1980. Pooled means of the February samples indicated that grass was significantly greater on treated plots than on control plots. Forb forage was significantly greater on burned plots than on burned-thinned plots, which in turn had significantly more forb forage than control plots.

DISCUSSION

Burning and precommercial thinning increased deer forage abundance in the pine plantation in August (peak biomass) and February (minimum biomass). Burning "top-killed" the old, tall (2.4 - 3.7 m) blackberry stems and promoted new growth on all forage plants in the deer's feeding range (Lay 1956). The nutritive content of new growth is greater than that of old stems (Stransky and Halls 1978, Dills 1970). Warren (1980) found that deer ate all species of plants, even those not normally utilized, on recently burned pine plantations in Kemper County.

Thinning reduced the basal area and allowed sunlight to reach the forest floor. The combination of burning and thinning was expected to produce more deer forage than burning alone. However, total deer forage was slightly greater on burned plots than on burned-thinned plots in the August and February samples taken in the first year after treatment. Samples taken in August and February two years after treatment revealed that the burned-thinned plots had much more total deer forage than burned plots (Wood et al. 1974). Two factors brought about these results. First, leaving felled trees on the burned-thinned plots may have reduced total forage production the first growing season after treatment by suppressing and shading ground vegetation. Secondly, basal area increased from 25 m^2/ha one year after treatment to 30 m^2/ha two years after treatment on burned plots. Basal area on burned-thinned plots was only 14 m^2/ha and 17 m^2/ha for the same

periods. The much greater basal area on burned plots caused a 52 percent reduction in total deer forage in August 1979 compared to August 1978. Deer forage was reduced 49 percent on burned plots in February 1980 compared to February 1979. Decreases in deer forage were recorded on burned-thinned plots, but the declines were not nearly as great (Blair 1967, Halls 1973).

The increases in deer forage brought about by the treatments, particularly burning alone, were temporary. However, the increased forage abundance came at a stage in plantation development when deer forage was greatly reduced because of pine canopy closure (Hurst and Warren 1980). Burning and precommercial thinning should be performed as early as possible, age 5-7 years in Kemper County, to improve deer habitat and stand conditions (Jones 1974). If precommercial thinning is delayed, costs increase and deer forage declines (Warren 1980). Burning before thinning makes thinning easier. Whether or not the manager precommercially thins he should consider control burning plantations at an early age, 5-7 years, and every 2 years thereafter to increase deer forage. Intensive management, which entails thinning and burning as soon and as often as possible, will produce good deer habitat.

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