

The Effects of Prescribed Burning and Fertilization on Browse Production in Hardwood Stands

By Dr. Craig Harper and Chris Shaw

The effects of forest management on food and cover for white-tailed deer have been well documented through sound research over the past few decades. Available nutrition and cover can be increased through various regeneration methods and timber stand improvement (TSI) practices. Clearcutting, shelterwood harvests and various types of thinnings and cuttings are often used by landowners to manage their forests and woodlots for tim-

ber and/or wildlife management. However, there is a significant number of landowners who want to improve their forested acreage for white-tailed deer, but are reluctant to harvest timber or intentionally kill trees (without harvesting them).

Prescribed fire and fertilization are also commonly promoted and implemented to enhance food and cover for white-tailed deer. The effects of burning and fertilization in old-fields and managed pine stands have been investigated, but the effects of burning and fertilization on browse availability in upland hardwood stands have not been documented. In particular, effects of those practices on browse availability in hardwood stands that have not received any canopy disturbance are relatively unknown. Given the interest among private landowners who would like to manage their forests or woodlots for deer without harvesting or killing any trees, we thought it worthy to implement these treatments and document the effects.

What We Did

We identified a mixed upland hardwood stand on private property in southeast Tennessee (SETN) and another at Ames Plantation in southwest Tennessee (SWTN) to implement prescribed fire, fertilization, and prescribed fire with fertilization. Treatments were duplicated across and within both stands. We sampled browse along transect lines within each treatment area.



Most habitat managers are familiar with prescribed fire for managing pine stands, but fire can also be used effectively and safely in hardwood stands in the right season and burning conditions. This article details research that indicates burning and fertilization in closed-canopy hardwood stands is less beneficial to deer than burning following forest management that provides increased sunlight into the stand.

Incidence of deer browsing was recorded by species for relative preference, and browse biomass production by species was determined by collecting leaves off the plants up to 4.5 feet above ground, drying them, and weighing. Browse data were collected pre-treatment in 2004 and post-treatment in 2005. We also collected soil samples pre- and

post-treatment. We estimated nutritional carrying capacity considering a mixed diet of 12 percent crude protein comprised of selected browse species and dry matter intake of 3 pounds per day. We used these constraints to be consistent with those used by researchers at Mississippi State University when determining nutritional carrying capacity for white-tailed deer in managed pine stands in Mississippi.

We burned during the last week of March and the first week of April, 2005. We applied fertilizers along identified transects within each treatment area in mid-May, 2005. Phosphate (P) and potash (K) were applied according to soil tests at each site to reach medium fertility levels. Nitrogen (N) was applied at 45 lbs./acre.

What We Found

Fertilization and/or burning had no effect on soil pH at either site. Soil pH ranged from 4.3 to 4.6 at the SETN site and 6.0 to 6.6 at the SWTN site, but was not influenced by treatment. As would be expected, P and K were increased with fertilization at both sites, but prescribed fire did not influence P or K availability at either site.

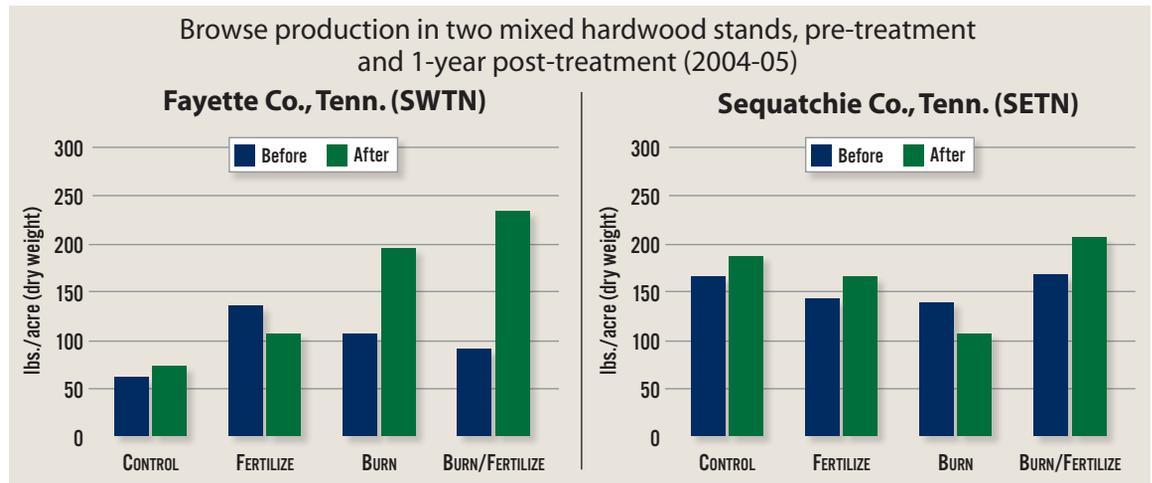
Preferred browse species at the SETN site included greenbriar, blackgum and blackberry. Preferred browse species at the SWTN site included greenbriar, supplejack, blackgum, wild rose and winged elm.

Browse quality following burning and fertilization varied among species. Generally, crude protein levels increased slightly following burning and fertilization. Among species selected by deer, average crude protein prior to burning and fertilization increased from 12.4 to 13.9 and 13.4, respectively. Interestingly, forage quality of species found at both sites did not differ, even though soil pH and nutrient availability on control sites at the SWTN site was considerably higher than that at the SETN site.

At the SETN site, burning increased overall browse availability, but fertilization did not. Nutritional carrying capacity (deer days per acre), however, was increased by burning (4.5), fertilization (4.6), and the combined treatment (6.3) over control areas (2.8), based on the response of plants selected by deer.

At the SWTN site, burning and/or fertilization did not influence overall browse availability. Nutritional carrying capacity, however, was decreased by burning (2.1), but was not influenced by fertilization (8.5) or the mixed treatment (4.2) when compared to control areas (6.9).

We also determined herbaceous species response to the treat-



ments. However, at both sites, there was either no effect from treatment, or the response (pounds per acre) was so small, that it did not affect carrying capacity estimates.

What We Conclude From the Data

Our data show burning and fertilization in closed-canopy mixed hardwood stands can produce variable effects on browse availability with regard to species present, site productivity, and the available seedbank. That is, plant response to burning and fer-

Continued.



These photos were taken at one of the sampling sites a little over one month after burning (above) and again at sampling time two months later (below). The impact on browse varied across sample sites, but in all cases the increase in browse quality and quantity did not compare with results seen in similar studies where timber stand improvement (TSI) was used to increase sunlight.



tilization may differ somewhat on different sites. That is why replication across sites is so important when evaluating any natural resource management practice.

However, any difference in response across our study sites pales in comparison to differences in plant response when these treatments are implemented after a stand has been managed and additional sunlight is allowed into the stand. Browse availability following forest management commonly exceeds 500 lbs./acre. Following burning and fertilization, there were only 195 and 106 lbs./acre of available browse, respectively, at the SETN site, and only 104 and 163 lbs./acre, respectively, at the SWTN site. In other mixed hardwood stands in Tennessee where prescribed fire was implemented after retention cutting admitted approximately 30 to 40 percent sunlight into the stand, nutritional carrying capacity estimates for white-tailed deer exceeded 30 deer days per acre. The highest treatment response at the SETN site and the SWTN site only provided available nutrition for approximately 6 to 9 deer days per acre.

What We Recommend for Management

Based on our data, we do not recommend fertilization for increased or improved browse availability in closed-canopy mixed hardwood stands, and we recommend burning closed-canopy stands for increased browse production with caution. Although fertilization increased the nutritional carrying capacity at the SETN site, there was no effect at the SWTN site. Regardless, any effect must be evaluated based on cost-efficiency. The cost of additional browse produced by fertilization exceeded \$22 per pound (\$51 at current prices)! This is further compounded when

you consider any effect from fertilization is decreased the following year unless additional fertilizer is applied. Therefore, we do not recommend fertilizing closed-canopy woods. Money for fertilization would be much better spent on food plots where the cost of desirable forage is usually less than one penny per pound.

We caution the use of prescribed fire in closed-canopy hardwoods because of variable results. However, these data were collected in the growing season following treatment. Past research has shown browse availability in managed stands often increases during years two and three following prescribed fire.

Although some landowners may be reluctant to harvest or otherwise manipulate canopy cover in their woods, we strongly recommend they reduce canopy cover prior to implementing prescribed fire if their objective is to improve browse availability as well as the associated cover. Otherwise, their efforts will most likely not be justified given the associated cost.

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About This Article

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