White-tailed Deer Use of Small-Area Fuelwood Cuttings in West Virginia

Edwin D. Michael, *Division of Forestry, West Virginia University, Morgantown, WV 26506*

William P. Klein, *Division of Forestry, West Virginia University, Morgantown, WV 26506*

Jenny M. Dickson, *Division of Forestry, West Virginia University, Morgantown, WV 26506*

Abstract: Six slash-disposal treatments were applied to 24 0.05-ha plots in a mixed hardwood forest in northern West Virginia to determine white-tailed deer (*Odocoileus virginianus*) use of small fuelwood cuts. Fuelwood harvest resulted in an increase in woody stems during the first year following cutting, but there was no significant effect by type of slash-disposal treatment on number of stems that regenerated. Deer use, as evidenced by pellet groups, differed among treatment plots, yet no consistent preference for specific treatments was detected. All treatment plots, except improvement cut plots, received higher deer use than did control plots.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 44:243–249

The opportunity exists to manage for both fuelwood and wildlife on small wooded tracts (Giles and Nielsen 1990). Diversity of wildlife species often is a goal of landowners that can improve the aesthetic value of woodlands following a timber harvesting operation. Of the 3.7 million non-industrial private forest ownerships in the northeastern region of the United States, 72% are in blocks of ≤4 ha (Birch et al. 1982). One goal for many non-industrial private forests is the optimal enhancement of the forest for fuelwood production and wildlife with a minimal expenditure of time, energy, and money.

While private landowners receive satisfaction from viewing wildlife on their property, they often are reluctant to cut trees solely for wildlife benefit (Applegate 1981). Successful wildlife management on small private tracts will require a different approach than the more common approaches geared towards large-acreage landowners (Kellert 1981). The objective of this study was to determine if white-tailed deer use in West Virginia's mixed hardwood forests could be increased by harvesting fuelwood through small-patch cuts.

Methods

The 24 research plots included in this study were located in the West Virginia University Forest (Monongalia and Preston counties), approximately 24 km northeast of Morgantown, West Virginia. Forest stands in the study area resulted from stump sprouting and natural seeding following logging operations and forest fires which occurred in the early 1900s. These forest stands are classified as the northern red oak-white oak-yellow poplar type (Carvell 1973), and the dominant tree species were northern red oak (*Quercus rubra*), white oak (*Q. alba*), chestnut oak (*Q. prinus*), red maple (*Acer rubrum*), yellow-poplar (*Liriodendron tulipifera*), and sassafras (*Sassafras albidum*). Also present were black birch (*Betula lenta*), black locust (*Robinia pseudoacacia*), and cucumber magnolia (*Magnolia acuminata*). Understory species included greenbrier (*Smilax spp*), viburnum (*Viburnum spp*), mountain laurel (*Kalmia latifolia*), huckleberry (*Vaccinium spp*), and hay-scented fern (*Dennstaeditia punctilobula*).

Six treatments applied from March through July to 24 0.05-ha research plots included: 1) improvement cuts, 2) small-patch cuts with slash left on the cut, 3) small-patch cuts with slash burned, 4) small-patch cuts with the slash formed into brush piles, 5) small-patch cuts with scarification of the site, and 6) uncut controls. Two blocks of 12 plots contained 1 replication of each treatment. Blocks were 3 km apart and plots within the blocks were 100–200 m apart. No trees were left standing on the leave-slash, pile-slash, burn-slash, or scarify plots. No trees were cut on the control plots, while 63% of the trees and 41% of the cordwood were removed from the improvement cuts. An effort was made to select sites which were topographically and vegetatively similar, but this was not entirely possible due to mountainous terrain. Plots of 0.05 ha were chosen because that size area in intermediate age Appalachian hardwoods will provide 1 year's supply of fuel for persons who heat entirely with wood.

Improvement cuts removed trees of poor form or low quality, severely injured trees, undesirable species, or trees of little value to wildlife. Understory vegetation was not cut, and slash was left where it fell. Small-patch cuts removed all canopy and woody understory species with the exception of understory species such as dogwood (*Cornus florida*) that were highly preferred by wildlife. Improvement and patch cuts were done in March 1983 while slash manipulation occurred between April and July 1983. Burns were initiated from a central slash pile and allowed to burn over the entire plot to simulate the effects of a prescribed burn undertaken to eliminate slash and prepare the site for regeneration. Slash-left and slash-piled plots involved the least manipulation. In the former, slash was spread evenly over the entire plot, and in the latter, at least 3 brush piles were formed per plot. For scarification, logs were pulled over the plot, exposing mineral soil, to simulate the effect of skidding fuelwood during harvesting.

All woody vegetation taller than 1 m was tallied for each plot before cutting began (1982) and 2 years following cutting (1985). Understory vegetation was measured at 20 random sample points within each treatment plot. At each sample point, the vegetation in a 1-m^2 (0.71–1.41 m) area was recorded. Percent coverage was estimated for each species <1 m high and occurring within or overlapping the sampling frame. Measures of overstory and understory vegetation were averaged for each plot having similar treatments. Relative cover was determined by dividing the coverage of each species by the sum of coverages for all species. Number of stems of tree species and percent coverage of all vegetative cover were determined for each plot in 1982 and 1985.

Deer use was estimated by conducting total counts of fecal pellet groups within each plot during March–April before the growth of herbaceous vegetation. Pellet groups were removed during each search; thus, the total number of groups represent deposition since leaf fall (approximately 150 days). Although the entire plot was systematically searched, some groups may have been missed and leaf fall may not have covered all groups. Pellet groups were counted in spring 1983 (pre-treatment) and in spring 1984, 1986, 1987, 1988, and 1989. Number of pellet groups recorded in 1982–83 and 1985–86 may have been biased upward because groups were not removed the prior year. However, this did not affect the comparisons of relative use between treatments because all were affected proportionately. Analysis of variance (ANOVA) with an alpha level of 0.05 was used to test the hypothesis that deer use, as estimated by pellet groups, did not differ between treatments. Although pellet groups may not directly reflect intensity of overall use, we assumed that they reflected relative use between plots.

Results

Prior to harvest, each plot averaged 59.2 trees containing an average 3.7 cords of wood (Table 1). Number of trees/plot and cords did not differ significantly between plots. Species composition did not differ ($P > 0.05$) between plots within the same block, although the amount of sassafras differed ($P < 0.05$) between the 2 blocks. This difference did not affect statistical analyses.

Sassafras, black cherry (*Prunus serotina*), and red maple were the most abundant hardwood species in the plots following treatment (Table 2). Small-patch cuts

Table 1. Tree density on 0.05-ha plots 1 year before and 1 year after treatments (4 plots/treatment), West Virginia, 1982–85.

	Burn slash		Pile slash		Leave slash		Scarify		Improvement cut		Control		
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	Mean
N trees													
Before	59.5	12.1	58.0	14.8	65.5	10.3	63.5	9.2	51.3	22.6	57.5	4.6	59.2
After	0	0	0	0	0	0	0	0	18.8	8.5	57.5	4.6	38.2
N cords													
Before	4.3	0.4	3.3	0.7	3.4	0.3	4.0	0.7	3.9	0.9	3.4	0.3	3.7
After	0	0	0	0	0	0	0	0	2.3	1.0	3.4	0	0

Table 2. Density (stems/m^2) of hardwood tree species on 0.05-ha plots 24 months following harvest treatments (4 plots/treatment), West Virginia, 1985.

	Burn-slash		Pile-slash		Leave-slash		Scarify		Improvement cut		Control		
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	Mean
Sassafras	3.75	1.45	2.58	0.75	3.08	0.88	0.85	0.25	1.15	0.37	0.30	0.08	1.95
Red oak	0.04	0.01	0	0	0.09	0.02	0	0	0.09	0.03	0	0	0.04
Chestnut oak	0.06	0.02	0.16	0.04	0.09	0.03	0.06	0.01	0.04	0.01	0.04	0.01	0.07
White oak	0.01	0.01	0.06	0.01	0.04	0.01	0	0	0.13	0.05	0.11	0.03	0.06
Black cherry	0.51	0.01	0.41	0.07	0.90	0.31	0.36	0.07	0.54	0.09	0.23	0.10	0.49
Red maple	0.75	0.17	0.36	0.08	0.40	0.03	0.48	0.11	1.06	0.23	0.50	0.08	0.59
Black birch	0.46	0.05	0.04	0.01	0.19	0.07	0.45	0.21	0.03	0.01	0	0	0.20
Yellow poplar	0.20	0.06	0.06	0.03	0.08	0.02	0.35	0.05	0.05	0.01	0	0	0.12
Other	0.01	0.01	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.01
Total	5.79		3.67		4.87		2.55		3.10		1.19		3.53

had a mean of 4.2 stems/m^2 (range 2.5–5.8). The type of slash-disposal treatment did not have an effect ($P > 0.05$) on number of stems that regenerated. However, all patch cut treatments contained significantly more stems than did the control plots, and all treatments except scarify contained more ($P < 0.05$) stems than did improvement cuts.

Plots revegetated naturally with a variety of plants. Woody vegetation was the most abundant (35%), followed by ferns (20%), grasses-sedges (19%), berry-producers (14%), greenbrier (9%), and herbaceous vegetation (4%). Woody vegetation dominated control plots (43%), improvement-cut plots (52%), and leave-slash plots (43%). Grasses-sedges (32%) and ferns (25%) dominated the scarified plots, while grasses-sedges (34%) and woody vegetation (24%) dominated burned-slash plots. Ferns (45%) and woody vegetation (29%) dominated the slash-piled plots.

No hardwood vegetation had become established after 5 years except for small groups of black cherry, red maple, and sassafras. These trees occupied only small portions of each plot, averaging 29% coverage for the 4 patch cut treatments.

Non-woody vegetation (herbaceous, grasses-sedges, and ferns) occupied 53% of all plots with patch cut treatments. Ferns were the only major class of vegetation which dominated specific plots, with 2 plots containing >50% fern cover.

No consistent pattern of deer use of specific treatments was detected (Table 3). Control plots received the smallest amount of use, followed by improvement-cut plots. Year-to-year variations made it impossible to determine which treatment received the highest overall use, although all patch cut plots received higher use than did control plots or improvement-cut plots.

Discussion

Fuelwood patch cuts apparently attract deer, and the combined effects of fern growth and deer browsing prevented hardwood species from dominating the plots. This delayed succession created a site in which deer and other wildlife may be more visible than they would be in an area totally dominated by woody vegetation. It is often more important to the landowner to increase wildlife visibility than to increase their abundance.

All classes of vegetation provided deer forage at some time of the year, but stump sprouts of hardwood trees (especially oaks) were heavily browsed by deer during all seasons. Several authors have found stump sprouts to be heavily browsed because of their nutritive value (Moore and Johnson 1967, Healy 1971). Although no data were collected on use of sprouts or seedlings by deer, regeneration of oaks in our study was reduced due to the repeated browsing.

Based on observations during this study and results of other studies (McCaffery and Creed 1969, Marquis 1981), the recommended treatment for landowners who wish to attract deer is to patch cut and pile the slash. Piling the slash also creates cover for small mammals and certain songbirds (Dickson 1986, Klein 1986), and it can act as a physical barrier to prevent deer from browsing some hardwood sprouts. In our study, plots with brush piles had several saplings growing up through these

Table 3. Winter use (pellet groups/plot) of various treatment plots (4 plots/treatment) by white-tailed deer before (1982–83) and after treatment (1983 to 1989), West Virginia.

	Burn-slash		Pile-slash		Leave-slash		Scarify		Improvement cut		Control		
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	Mean
1982–83	9.3	7.3	16.5	11.2	12.5	10.2	15.0	2.9	12.3	9.6	9.0	5.6	12.4
1983–84	3.8	1.3	20.5	16.4	19.8	10.8	3.0	2.4	6.8	5.4	4.8	2.1	9.8
1985–86	19.8	9.1	33.3	31.2	29.3	17.2	10.5	7.3	15.3	13.7	12.8	5.2	20.2
1986–87	18.0	11.5	20.5	12.9	39.5	25.2	23.5	14.4	13.5	11.2	4.0	2.2	19.8
1987–88	32.0	29.0	24.0	21.2	27.5	17.4	28.0	15.7	12.0	9.5	7.0	6.8	21.8
1988–89	33.3	23.4	67.8	46.9	38.5	25.2	26.3	14.2	22.0	18.1	9.5	6.4	32.9
Post-treatment mean	21.4		33.2		30.9		18.3		13.9		7.6		20.9

piles. Small-patch cutting and the associated impacts of deer and ferns may result in poor regeneration, especially of oak species. Thus, for those landowners who have timber production as their main objective, improvement cutting would be a better alternative.

Small fuelwood cuts result in poor regeneration of desirable tree species; thus, most landowners may not be interested in such cuts as a means of increasing deer visibility. Regeneration within the plots should produce additional fuelwood in 40–50 years although oaks may be scarce. It is not yet possible to predict what type of stands will develop in 75–100 years, although they will most likely be dominated by black cherry and red maple.

Literature Cited

Applegate, J. E. 1981. Landowner's behavior in dealing with wildlife values. Pages 64–72 *in* R. T. Dumke, G. V. Burger, and J. R. March, eds. Proceedings of symposium: wildlife management on private lands. LaCrosse Printing Co., LaCrosse, Wis.

Birch, T. W., D. G. Lewis, and H. F. Ford. 1982. The private forest-land owners of the United States. Resour. Bul. WO–1. Wash., D.C. USDA For. Serv. 64pp.

Carvell, K. L. 1973. Effects of improvement cutting and thinnings on the development of cove and mixed oak stands. Bul. 616T W.V. Univ. Agric. Exp. Sta., Morgantown. 20pp.

Dickson, J. M. 1986. Wildlife utilization: small fuelwood cuttings in mixed hardwood forests. M.S. Thesis, W.V. Univ., Morgantown, 103pp.

Giles, R. H., Jr., and L. A. Nielsen. 1990. A new focus for wildlife resource managers. J. For. 88:21–26.

Healy, W. M. 1971. Forage preferences of tame deer in a northwest Pennsylvania clearcutting. J. Wildl. Manage. 35: 717–723.

Kellert, S. R. 1981. Wildlife and the private landowner. Pages 18–33 *in* R. T. Dumke, G. V. Burger, and J. R. March, eds. Proceedings of symposium: wildlife management on private lands. LaCrosse Printing Co., LaCrosse, Wis.

Klein, W. P. 1986. Wildlife and plant successional responses to small-patch firewood cutting. M.S. Thesis, W.V. Univ., Morgantown. 139pp.

Marquis, D. A. 1981. Effect of deer browsing on timber production in Allegheny hardwood forests of northwestern Pennsylvania. USDA, For. Serv. Res. Pap. NE–475. Northeast. For. Exp. Sta., Broomhall, Pa. 10pp.

McCaffery, K. R. and W. A. Creed. 1969. Significance of forest openings to deer in northern Wisconsin. Wis. Dep. Nat. Resour. Tech. Bul. 44. 104pp.

Moore, W. H. and F. M. Johnson. 1967. Nature of deer browsing on hardwood seedlings and sprouts. J. Wildl. Manage. 31: 351–353.