

Response of Deer, Hare, and Grouse to Whole-Tree Harvesting in Central Appalachia¹

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Abstract: The effects of whole-tree harvesting upon white-tailed deer (*Odocoileus virginianus*), snowshoe hare (*Lepus americanus*), and ruffed grouse (*Bonasa umbellus*) were studied from 1978 through 1981 in southcentral West Virginia. Transect sampling by recording fecal pellets was conducted in mature forest and in clearcuts ranging from 0 to 8 years of age. Use of clearcuts created by whole-tree harvesting was compared to use of those created by conventional clearcutting. Deer used whole-tree clearcuts more than conventional clearcuts, but hare used conventional clearcuts more than whole-tree clearcuts. Ruffed grouse data were too limited to indicate the influence of type or age of clearcut. Whole-tree harvest can be used to increase certain species of wildlife, but additional studies are needed to determine the long-range impacts.

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Data are available on impacts of timber harvest on many wildlife species, but no studies have measured the impacts of whole-tree harvest in the Appalachian region on game animals. This timber harvesting technique was first introduced to forest industries in 1971 (Young 1974). The general procedure involves felling all above-ground woody vegetation and transporting it to a chipper. High-quality saw logs are removed while all remaining material is chipped. Chipped material is hauled to a pulp mill where it is used in the production of paper. This harvesting technique results in a cut-over area that is almost totally devoid of any postlogging residue (slash).

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Impacts of conventional forest management practices on white-tailed deer have been investigated by Shaw and Ripley (1966), Stiteler and Shaw (1966), McKee (1972), Segelquist and Rogers (1974), Umber and Harris (1974), Crawford et al. (1975), and Stransky and Halls (1978). Effects of clearcutting on snowshoe hare in the northeast have been measured (Conroy et al. 1979), but no studies have been conducted within the Appalachians due to the scarcity of hares in that region. Effects of clearcutting on ruffed grouse have been thoroughly studied in the northeast where aspen (*Populus* spp.) is common (Berner and Gysel 1969, Gullion 1972, Svoboda and Gullion 1972). Impacts of intensive timber harvest on ruffed grouse in the Appalachians are poorly understood although a few studies have been conducted (Edwards 1959, Sharp 1963).

The primary objective of this study was to determine whether whole-tree harvesting is followed by measurable changes in utilization by white-tailed deer, snowshoe hare, and ruffed grouse. A secondary objective was to determine if whole-tree harvesting results in different use of clearcuts than does conventional clearcutting.

Methods

Data were collected from 1978 through 1981 in Greenbrier County, West Virginia, on the Gauley Woodlands of the Westvaco Corporation. Gauley Woodlands lie in the Appalachian Plateau Province where relief is rugged and mountainous. Elevation of the study area ranges from 976 to 1220 m. Much of the area was logged in the 1910–1950 period, resulting in extensive clearcut areas. These woodlands are now being systematically clearcut by means of whole-tree harvesting, in units approximately 16 ha in size. The study area was uniform in vegetative cover and dominated by an Appalachian oak forest (Hahn 1980).

Seventeen clearcuts were selected to represent various postharvested age classes. Five had been clearcut (3 in 1973, 1 in 1974, and 1 in 1978) using conventional methods ("round logged") and 12 had been clearcut (2/year, 1973–1978) using the whole-tree method ("chipped"). This provided study areas exhibiting vegetative succession ranging from 0 through 8 years. All clearcuts were surrounded by northern hardwoods of similar age and size.

Each study site was sampled for fecal groups with paired, 285-m belt transects. The paired transects were separated from each other by 30 m and consisted of 19 15-m segments. The transects extended 90 m into the forest and 195 m into the clearcut. Transects were aligned perpendicular to clearcut edge and were located midway between the top and bottom of the clearcut.

Transects were walked during April of each year, following snow melt and before growth of herbaceous vegetation. All fecal groups within a 1-m-

wide belt were identified and recorded. Transects were cleared of pellets during each count, thus counts represent an entire year of use. Some decomposition may have occurred but we assumed this was equal on all transects.

For purposes of statistical analysis, fecal group data from all 4 years of this study (1978–1981) were combined. Grouse data could not be statistically analyzed due to the small sample size. An analysis of variance test (ANOVA) ($P < 0.05$) was employed to test for differences in fecal group numbers within chipped or round-logged clearcuts, the location along the transect (clearcut, edge or woods), and possible interactions between cutting strategy and location, and between cutting strategy and age.

Linear regression analysis ($P < 0.05$) was performed to examine the effect that distance into the clearcut (the independent variable) had on the number of white-tailed deer and snowshoe hare pellet groups (the dependent variable).

Results

Location of the transect segments (clearcut, edge, or woods) had a significant influence ($P < 0.05$) on the number of deer pellet groups (Table 1). The number of pellet groups per 15-m transect segment in clearcuts ($\bar{x} = 0.42$) was almost twice that in woods ($\bar{x} = 0.22$) (Fig. 1).

More snowshoe hare pellet groups were found per 15-m transect segment in the edge ($\bar{x} = 0.32$) than either the clearcut ($\bar{x} = 0.21$) or the woods ($\bar{x} = 0.16$). The differences were not significant (Table 1). Grouse droppings were equally distributed within the 3 locations although sample size was low (Fig. 1).

There was no apparent relationship between distance into the clearcut

Table 1. Analysis of Variance Summary with Number of Deer and Snowshoe Hare Pellet Groups as the Dependent Variable

Source of Variation	df	White-Tailed Deer		Snowshoe Hare	
		Sum of Squares	F-Value	Sum of Squares	F-Value
Model	24	107.3		189.0	
Cutstrategy	1	21.9	14.02*	1.3	1.33
Location	2	8.8	2.81	3.1	1.61
Cutstrategy * Location	2	6.3	2.00	2.8	1.49
Age	8	20.7	1.65	17.1	2.22*
Cutstrategy * Age	8	9.1	0.73	26.2	3.40*
Year	3	40.2	8.56*	77.7	26.86*
Error	1,229	1,924.6		1,184.0	

* $P < 0.05$.

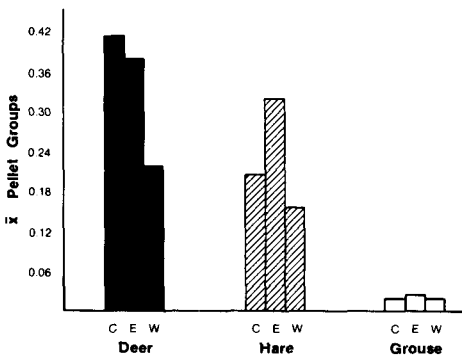


Figure 1. Mean number of pellet groups found per 15-m transect segment in Clearcut (C), Edge (E) and Woods (W). Combined data from 17 sites during 4 years of study (1978–1981).

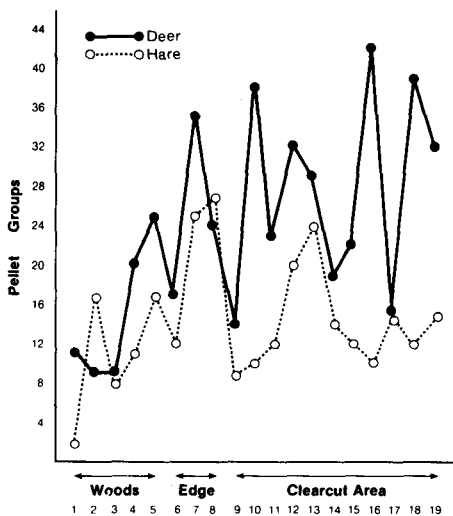


Figure 2. Number of pellet groups found along individual 15-m segments of transects extending from woods into the clearcut. Combined data from 4 years (1978–1981) and 17 sites.

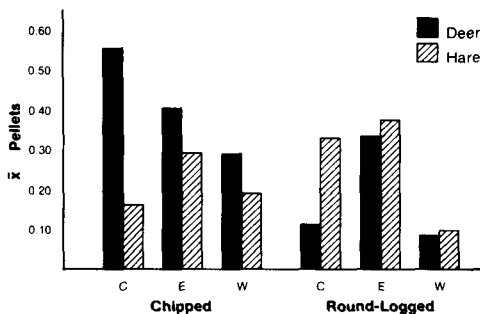


Figure 3. Mean number of pellet groups found per 15-m transect segment in chipped vs. round-logged clearcut sites. C refers to clearcut, E to edge, and W to woods. Combined data from 4 years (1978–1981) and 17 sites.

and the number of deer and snowshoe hare pellet groups found (Fig. 2). Linear regression analysis of the relationship of pellet groups to distance into the clearcut resulted in an R-square value of 0.0002 for deer and 0.001 for hare. F-values were 0.15 for deer and 1.11 for hare.

A greater number of deer pellet groups occurred per 15-m transect segment in chipped clearcuts ($\bar{x} = 0.46$) than in round-logged clearcuts ($\bar{x} = 0.12$) ($P < 0.05$) (Table 1, Fig. 3). Cutting strategy (chipped or round-logged) did not influence the number of snowshoe hare pellet groups (Table 1). However, more pellet groups were found in the woods surrounding round-logged clearcuts ($\bar{x} = 0.09$) (Fig. 3).

Deer and snowshoe hare pellet groups increased significantly over time ($P < 0.05$) (Table 1). Deer pellet groups increased from 64 in 1978 to 151 pellet groups in 1979, declined to 58 in 1980 and increased again in 1981 to 182 pellet groups. Snowshoe hare pellet groups increased from 0 in 1978 and 1979 to 19 in 1980 and 252 in 1981. No grouse droppings were found in 1978, 6 in 1979, and 10 in 1981.

Age of the clearcut was correlated with an increase in snowshoe hare pellet groups but was not correlated with deer pellet groups (Table 1). Hare used older clearcuts more than younger ones.

There was significant interaction ($P < 0.05$) between cutting strategy and age when examining the number of snowshoe hare pellet groups found. Almost all pellet groups found in round-logged clearcuts were in 3-year old sites ($\bar{x} = 1.21$) or 8-year-old sites ($\bar{x} = 1.08$). Chipped clearcuts exhibited a more uniform spread of pellet groups in different age sites. Six-year-old sites had the largest number of pellet groups per 15 m transect segment ($\bar{x} = 0.52$).

Discussion

Findings of this study support other studies which document the significance of clearcuts to wildlife. Deer made more use of clearcut areas than of adjacent uncut woods. This apparently was due to an increased food supply, as has been documented by several authors (Segelquist and Rogers 1974, Stransky and Halls 1978). Clearcuts were not so attractive to hare, as indicated by their equal use of clearcut areas and adjacent woods.

Whole-tree clearcutting resulted in more deer use than did conventional round-log clearcutting. In contrast, round-log clearcuts were more attractive to hare than were whole-tree clearcuts. Round-logged areas had more slash in the form of tree tops and limbs than did whole-tree clearcuts. This slash may have been more attractive to hare because of the increased cover. Hares used the woods surrounding chipped clearcuts more than the chipped clearcuts themselves and more than the woods surrounding the round-logged clearcuts.

Clearcuts rapidly became vegetated as secondary succession progressed (Hahn 1980). Many clearcuts had over 50% ground cover of blackberry (*Rubus* spp.) by 4 or 5 years after timber harvest. From the standpoint of vegetative succession, this study was of relatively short duration. Availability and composition of food and cover changed significantly during the early years of succession. Annual changes in vegetative composition should be obvious throughout at least the first 10 years after clearcutting. Differences between round-logged and chipped clearcuts should be minimal after 15–20 years. Slash will have decayed and thus be insignificant to most large wildlife. During this same time period, woody cover will have progressed to the point where there is no difference in round-logged and chipped clearcuts.

More areas will be clearcut using the whole-tree technique if the demand for paper products increases. This harvest method will result in an increase in some wildlife and a decrease in others (Hahn 1980). Long-term impacts of the whole-tree method differ little from those of conventional clearcutting methods. Our study indicates that snowshoe hare may be affected more than white-tailed deer, but these are only short-term results and data must be collected over several years to document the overall impact. Long-term effects of whole-tree removal on soil nutrients and other habitat factors are currently unknown (Brooks et al. 1975).

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