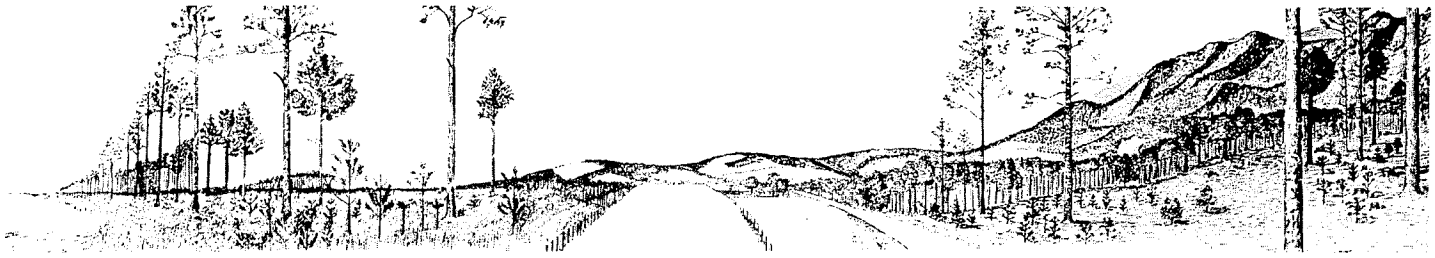


U.S.D.A. Forest Service Research Note SE-110 February 1969

Intensive Cleaning Increases Sapling Growth and Browse Production in the Southern Appalachians

Abstract: All woody stems except selected crop trees were cut in an II-year-old mixed-hardwood sapling stand in the Southern Appalachians to determine the effect of intensive cleaning on crop-tree growth and deer-browse production. During the 6-year post-cleaning period, crop trees in cleaned compartments produced significantly more basal area and grew more in diameter than did crop trees in uncleaned compartments. In addition, the intensive cleaning significantly increased browse production.

Even-aged hardwood management in the Southern Appalachians is here to stay. With clearcutting now being used to regenerate mature hardwood stands, even-aged stands of mixed-hardwood saplings will soon become commonplace on our rugged mountainsides. As a silvicultural system, clearcutting results in thousands of seedlings and sprouts per acre. In turn the prolific growth serves a dual purpose by providing wildlife browse and shelter and by providing free-to-grow regeneration for future timber stands. However, about 10 years after clearcutting, a typical sapling stand ranges from 20 to about 30 feet in height, appears overly dense, contains both desirable and undesirable tree species, and has outgrown its usefulness in providing browse for small game and white-tailed deer. Early cleaning will definitely improve stand composition and reduce competition. But will competition be reduced enough by cleaning to substantially increase the growth rate of selected crop trees? How much browse will be produced? And how long will the browse last?

The aim of this study was to provide answers to the above questions by determining the effect of an intensive cleaning on crop-tree growth and browse production in an 11-year-old stand of hardwood saplings.

Intensive cleaning as defined here is a modified form of normal silvicultural cleaning. In normal cleaning, desirable saplings are released by cutting competing stems within a limited radius of several feet around each crop tree. In this intensive cleaning, all woody stems other than selected crop trees were cut throughout the sapling stand.

Partial answers to the browse-production phase of this study were reported earlier.[1] The effect of this intensive cleaning on crop-tree growth and more answers to the browse-production questions are reported in this paper.

METHOD

In the fall of 1959 a 70-acre hardwood sapling stand located in the mountain complex surrounding the Pink Beds plateau of the Pisgah National Forest was selected for the study site. Elevations in the study area range from 3,080 to 3,680 feet; slopes average 42 percent, ranging from 18 to 72 percent; aspect is predominantly northeast; the major soil is Porters stony loam.

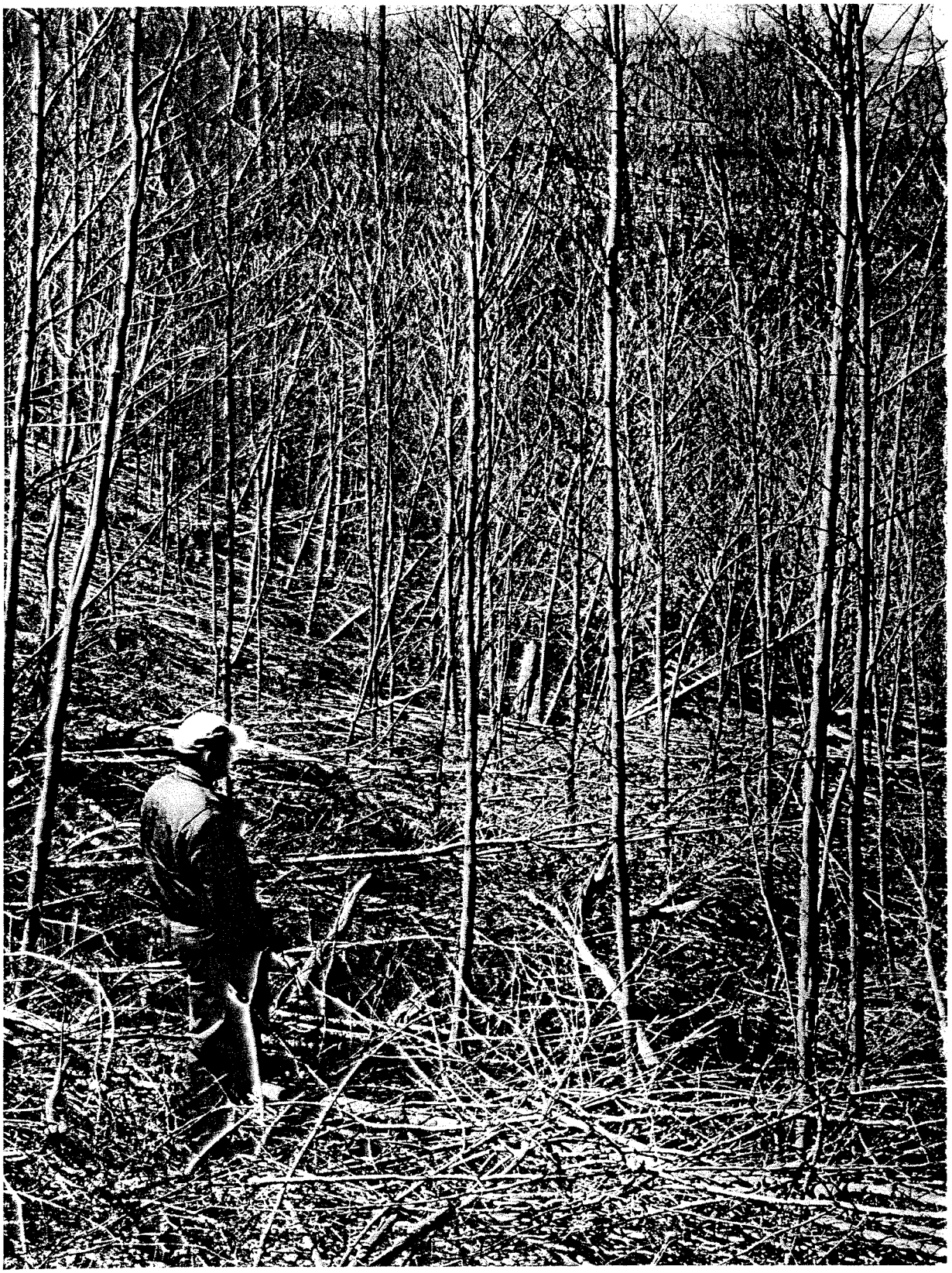
The sapling stand on the study site originated after mature hardwoods were clearcut in 1949.[2] By 1959, many of the saplings were over 20 feet tall, the stand appeared overstocked, browse was scarce, and stand composition needed to be improved. A cleaning seemed appropriate; so, during the winter of 1959-1960, this

[1] Della-Bianca, Lino, and Johnson, Frank M. Effect of an intensive cleaning on deer-browse production in the Southern Appalachians. J. Wildlife Manage. 29 (4) : 729-733. 1965.

[2] Morriss, D. J. Correlation of wildlife management with other uses on the Pisgah National Forest. J. Forest. 52 (6) : 419-422. 1954.

Southeastern Forest Experiment Station - Asheville, North Carolina

U. S. Department of Agriculture - Forest Service



An intensive cleaning in a mixed-hardwood sapling stand in the Southern Appalachiana.

study was installed on 35 of the 70 acres included in the original clearcutting. The study area was divided into five blocks, and each block was subdivided into an upper-slope and a lower-slope unit. Cleaned and uncleaned compartments were then randomly assigned to each slope unit (fig. 1). In the cleaned compartments, all woody stems other than selected crop trees were cut.

The following timber species were selected as crop trees: yellow-poplar; northern red, white, chestnut, black, southern red, and scarlet oaks; red maple; black locust; hickories; white pine; sweet birch; and others (table 1) . Saplings of seedling origin were favored over sprouts, and only one sprout per sprout clump was kept. Crop-tree spacing was variable; it averaged 9 by 9 feet. Stumps were not poisoned because maximum regrowth was wanted.

A network of 80 permanent sampling points provided 240 sample plots in which various size classes of tree stems, from seedlings to crop-tree saplings, were measured. Crop trees were measured at d.b.h. and permanently marked so that the same trees could be remeasured. Measurements were made in the spring of 1960 immediateiy after the intensive cleaning and again in the spring of 1963 and 1966.

RESULTS

As anticipated, the immediate effect of cleaning was improvement of stand composition.[3] In addition, the selected crop trees in the cleaned compartments were left free to grow (see figures 2 and 3).

Growth results for the period from 1960 through 1965 showed that crop trees in the cleaned compartments produced significantly more (l-per-cent level) basal area than did crop trees in the uncleaned compartments. The 6-year increase in basal area in the cleaned compartments was 20.6 square feet per acre on the upper slopes and 30.7 square feet per acre on

[3] Although the composition percentages in table 1 appear comparable for cleaned and uncleaned compartments, they are for crop trees only and do not include the remaining non-crop-tree stems in the uncleaned compartments.

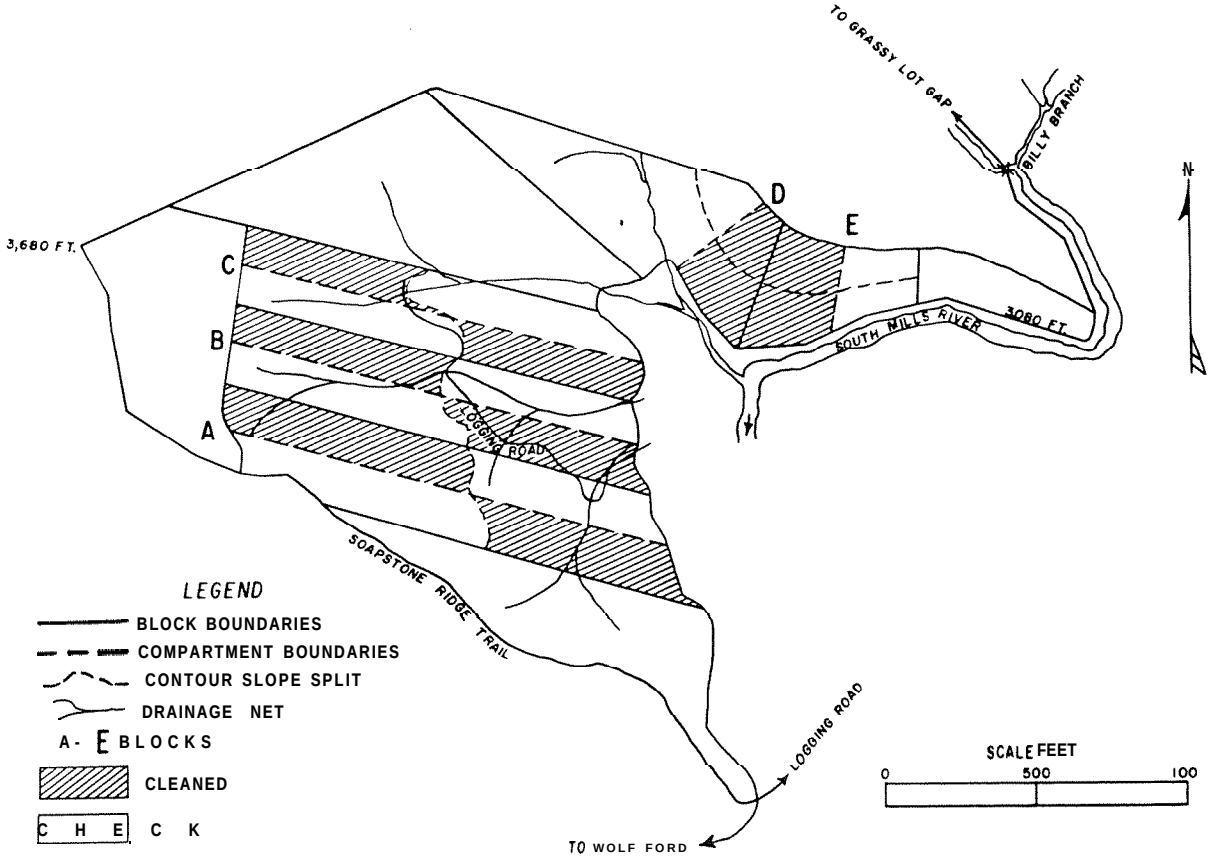


Figure 1.—The cleaning study area on the Pisgah National Forest.

Table 1.—Species composition of crop trees by slope position and treatment, 1963

Species	Cleaned	Uncleaned
	UPPER SLOPE	
	• • • *Percent* • • •	
Yellow-poplar (*Liriodendron tulipifera* L.)	20	13
White oaks (*Quercus* spp.)	17	14
Red oaks (*Quercus* spp.)	19	25
Hickories (*Carya* spp.)	3	2
Red maple (*Acer rubrum* L.)	9	9
Black locust (*Robinia pseudoacacia* L.)	8	13
Eastern white pine (*Pinus strobus* L.)	3	0
Sweet birch (*Betula lenta* L.)	1	
Other[1]	20	2:
Total	100	100
	LOWER SLOPE	
Yellow-poplar	6	27
White oaks	16	13
Red oaks	26	15
Hickories	4	2
Red maple	11	12
Black locust	9	11
Eastern white pine	16	8
Sweet birch	3	3
Other[1]	9	9
Total	100	100

[1]Includes: blackgum (*Nyssa sylvatica* Marsh.), sourwood (Oxydendrum *arboreum* (L.) DC.), sassafras (*Sassafras albidum* (Nutt.) Nees), Fraser magnolia (*Magnolia fraseri* Walt.), mountain silverbell (*Halesia carolina* var. *monticola* Rehd.), flowering dogwood (*Cornus florida* L.), and eastern hemlock (*Tsuga canadensis* (L.) Carr.).

the lower slopes (table 2). In the uncleaned compartments, crop-tree basal area averaged 18.6 square feet per acre for combined slope positions. The average 6-year percentage increase in basal area for cleaned and uncleaned compartments was 230 percent and 140 percent, respectively.

Diameter growth was also significantly greater (1-percent level) in the cleaned compartments than in the uncleaned ones. For combined slope positions, the average 6-year diameter growth in cleaned compartments was 1.7 inches but only 1.2 inches in the uncleaned compartments (table 2).

Although intensive cleaning significantly increased both basal area and diameter growth of crop trees, the data analysis showed that neither slope position nor the slope × cleaning interaction were significant. The lack of significance for slope position indicates that sapling growth was accelerated by the intensive cleaning- on both the upper and lower slopes.

Table 2.-Crop tree status by slope position and treatment

	Density		Average d.b.h.		Basal area	
	Cleaned	Uncleaned	Cleaned	Uncleaned	Cleaned	Uncleaned
	Number/acre		*Inches*		9.2 *Sq. ft./acre*	
	UPPER SLOPE					
Spring 1960	432	534	2.0	2.2	29.8	14.6
Spring 1966	400	520	3.7	3.4		33.0
Change	- 3 2	- 1 4	+ 1.7	+ 1.2	+ 20.6	+ 18.4
	LOWER SLOPE					
Spring 1960	610	684	2.0	1.9	13.1	12.9
Spring 1966	594	642	3.:	3.0	43.8	31.7
Change	—16	4 2	+ 1.7	+ 1.1	+ 30.7	+ 18.8

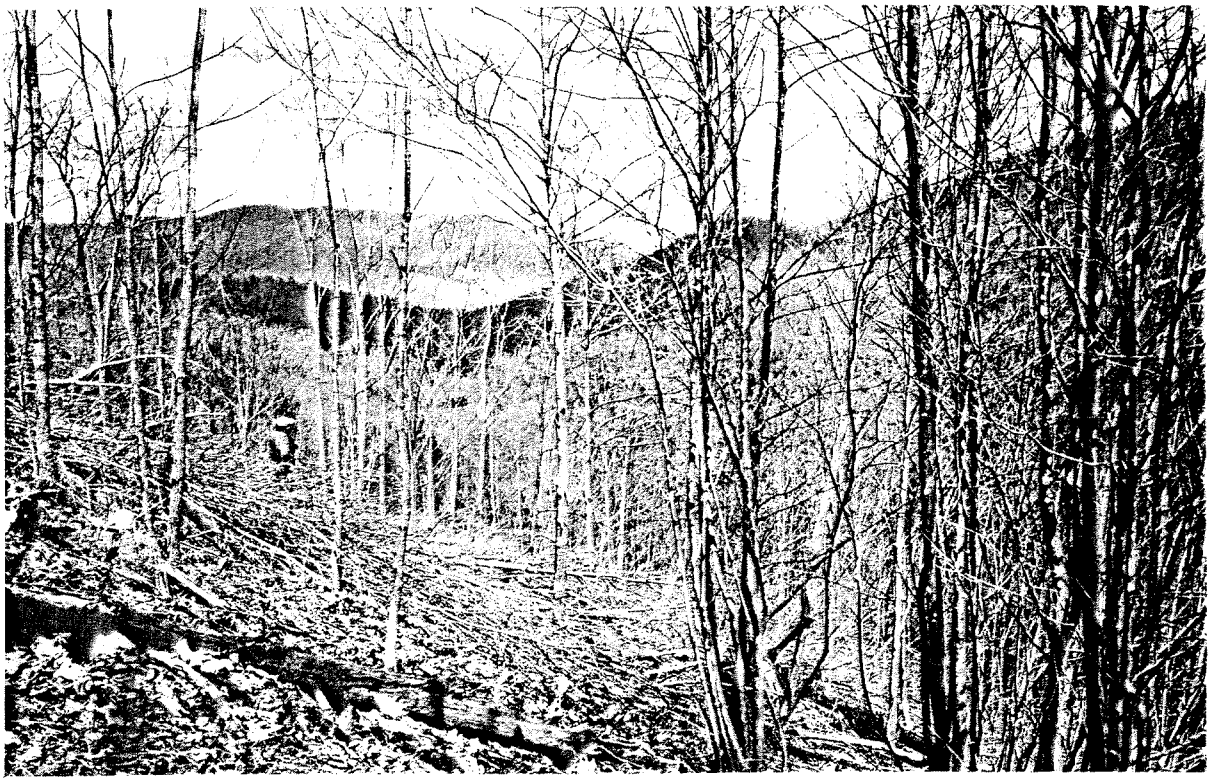


Figure P.-Cleaned and uncleaned portions of the sapling stand soon after treatment.

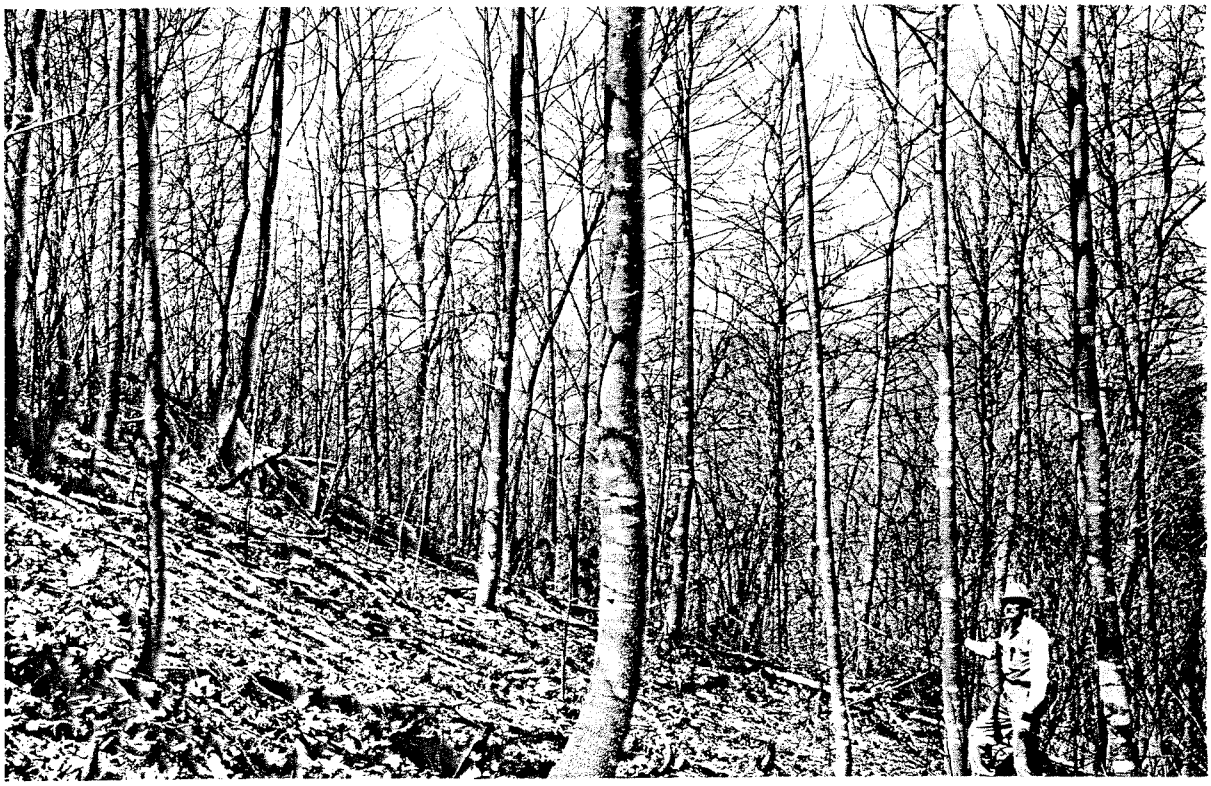


Figure 3.—Crop trees 3 years after cleaning. The selected stems of the better species are now growing faster.

Abundant regrowth appeared the first growing season after cleaning. And it grew rapidly. Excluding crop trees, by spring 1966 there were 1,305 large regrowth stems (stems over 4.4 feet high and 0.4 inch d.b.h.) per acre in the cleaned upper-slope compartments and 1,290 stems per acre in the cleaned lower-slope compartments. The basal area produced by these stems (table 3) amounted to 28 percent and 14 percent, respectively, of the total basal area produced in the cleaned upper- and lower-slope compartments.

Table 3.—Basal area of large regrowth stems (excluding crop trees) in cleaned compartments from 1960 to 1966 by slope position

	Upper slope	Lower slope
	Sq. ft./acre	
Spring 1960	0.9[1]	0.0
Spring 1963	5.4	2.0
Spring 1966	9.1	5.1
Change	+8.2	+5.1

[1]Stems missed during the 1960 cleaning.

In the cleaned compartments, regrowth stems shorter than 4.5 feet high increased greatly in numbers and then declined again during the 6-year period after cleaning (table 4). In the uncleaned compartments, excluding crop trees, natural mortality greatly reduced the number of stems per acre during the second decade of stand growth. Stems shorter than 4.5 feet are Considered available browse in the Southern Appalachians. By spring 1966, there were only 1,100 stems per acre of available browse left in the cleaned compartments and only 50 stems per acre in uncleaned compartments. Accordingly, the plentiful supply of browse provided by the 1960 cleaning (reported as 33,020 stems per acre on lower slopes in spring 1961) was nearly gone by 1966.

As a silvicultural tool, this intensive cleaning in a mixed hardwood sapling stand in the Southern Appalachians did accelerate crop-tree growth and produce abundant deer browse. Accelerated sapling growth was being maintained 6 years after cleaning. But the available-browse supply had diminished considerably by then. Subsequent crop-tree measurements will show whether the effect of cleaning is of short duration, or whether cleaning can effectively shorten the rotation.

Table 4.—Stems per acre (excluding crop trees) in spring 1960, 1963, and 1966 by slope poaition, size class, and treatment

UPPER SLOPE

	0 to 0.9 foot high		1.O to 4.4 feet high		Over 4.5 feet high, under 0.5 inch d.b.h.		Over 4.5 feet high and 0.5 inch d.b.h.		Total	
	Cleaned	Uncleaned	Cleaned	Uncleaned	Cleaned	Uncleaned	Cleaned	Uncleaned	Cleaned	Uncleaned
	Number									
Spring 1960	750	1,110	700	1,300	30	565	35	1,830	1,515	4,805
Spring 1963	2,100	1,000	2,900	650	2,810	450	1,055	1,670	8,865	3,770
Spring 1966	1,200	0	1,250	0	1,235	185	1,340	1,380	5,025	1,565
Net change (1960-1966)	+450	-1,110	$550	-1,300	+1,205	-380	+1,305	450	+3,510	—3,240

LOWER SLOPE

spring 1960	1,550	600	650	500	35	580		2,235	2,235	3,915
Spring 1963	1,185	250	3,745	200	3,135	330	738	2,045	8,795	2,825
Spring 1966	1,000	200	950	0	2,000	245	1,290	1,785	5,240	2,230
Net change (1960-1966)	-550	-400	$300	-500	+1,965	-335	+1,290	450	$3,005	-1,685

Lino Della-Bianca
Associate Silviculturist