United States
Department of
Agriculture

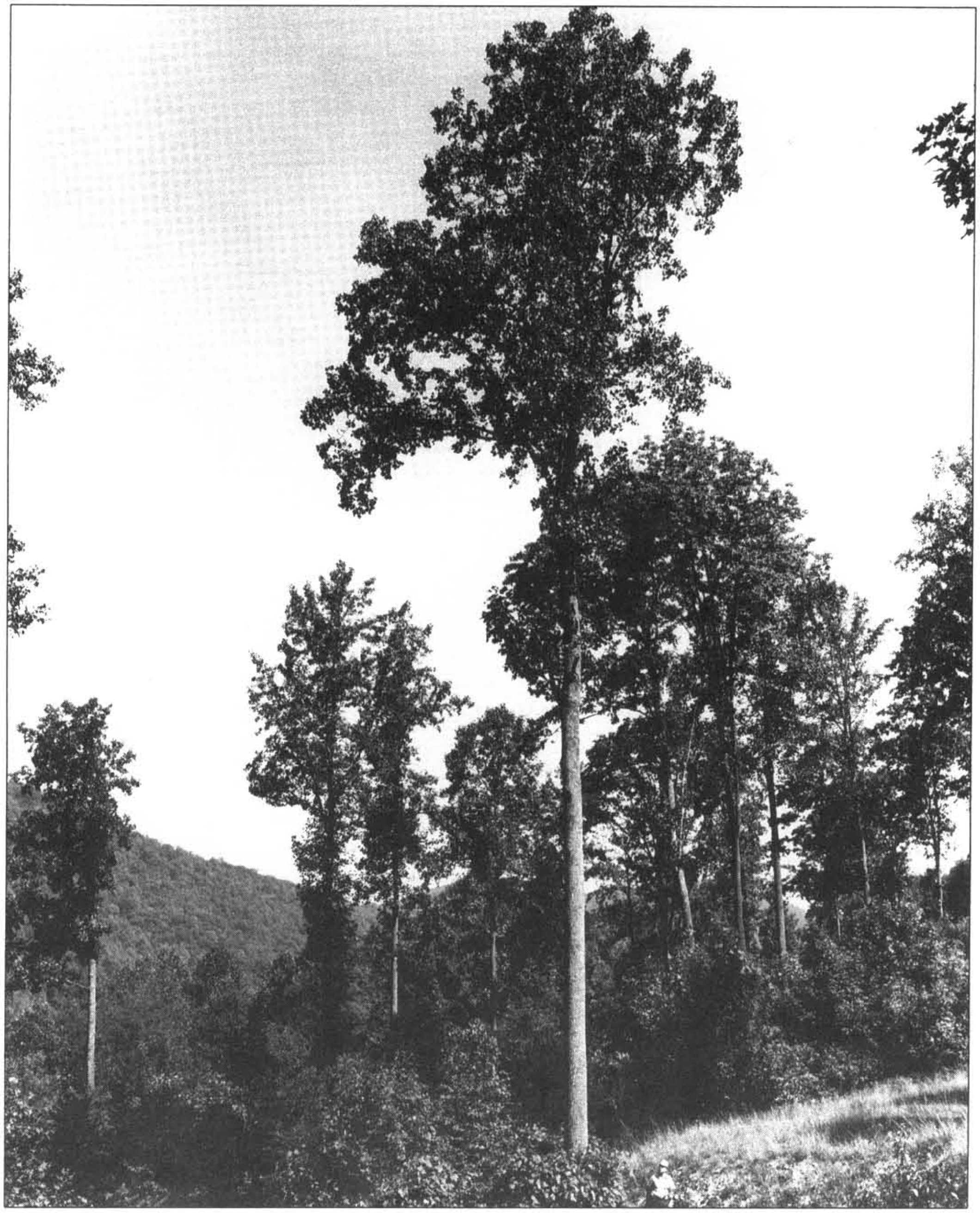
Forest Service

**Northeastern Forest
Experiment Station**

Research Paper NE-702

Epicormic Branching on Central Appalachian Hardwoods 10 Years After Deferment Cutting

Gary W. Miller



Abstract

There is an increased risk of epicormic branching for some commercial hardwoods when tree boles are suddenly exposed by heavy cutting treatments. Tree quality and value can be greatly reduced if such branches form and persist along the lower log sections of the tree. Epicormic branching was monitored over a 10-year period following deferment cutting in four central Appalachian hardwood stands in West Virginia. The cutting treatments left 12 to 15 mature trees/acre and allowed sunlight to reach tree boles for several years until hardwood reproduction developed beneath the residual overstory. Data from 545 codominant residual trees indicated that the average number of epicormic branches on the butt and second 16-foot log sections increased for the first 2 years after treatment. For upper log sections of northern red oak and black cherry, new branches continued to form from the second to the tenth year. The net effect on quality was that 11 percent of residual trees exhibited a reduction in butt-log grade due to epicormic branching. Trees with epicormic branches before treatment later had more grade reductions due to new epicormic branches than trees with clear boles before treatment. Of the few grade reductions observed, white oak, northern red oak, and black cherry were the most susceptible. Less than 1 percent of yellow-poplar trees had lower grades due to epicormic branching. Results are tabulated by species, 8-foot log sections, and time period. Recommendations are made for selecting residual trees to maintain stand quality.

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Manuscript received for publication 8 August 1995

Cover Photo: Deferment cutting treatments left 12 to 15 mature codominant trees per acre.

Published by:
USDA FOREST SERVICE
5 RADNOR CORP CTR SUITE 200
RADNOR PA 19087-4585

March 1996

For additional copies:
USDA Forest Service
Publications Distribution
359 Main Road
Delaware, OH 43015

Introduction

Deferment cutting in central Appalachian hardwoods is designed to regenerate a variety of hardwood species and to maintain a two-age stand structure for esthetic, wildlife habitat, and other nontimber benefits. Such stands resemble those managed using the seed-tree method except that in deferment practices, overstory trees are retained for many years, perhaps until new reproduction matures to rotation age (Fig. 1). Immediately after logging, residual tree crowns are essentially free to grow and tree boles are exposed to direct sunlight for several years until new hardwood reproduction develops and begins to shade the lower logs.

There is an increased risk of epicormic branching for some Appalachian hardwoods when suddenly exposed by relatively heavy cutting treatments (Trimble and Seegrist 1973). Most epicormic branches develop from suppressed accessory buds that originated at the nodes of each year's growth. The formation of secondary suppressed buds continues after lateral branches succumb to natural pruning, thus perpetuating the risk of epicormic branching at any position on the tree bole (Kormanik and Brown 1969). Such buds are suppressed until the quantity or distribution of auxins produced by the tree is altered by a change in light, temperature, nutrients, or moisture (Bowersox and Ward 1968). The conditions for the development of suppressed buds usually occur following disturbances such as fire or a reduction in stand density.

Research has indicated that the development of new epicormic branches is related to aspect of the growing site, species, crown position, stand density, position on the tree bole, and probably genetic variation within a species. The number of new epicormic branches is greater for trees growing on south and west slopes (Clark 1955). Oaks, black cherry, and basswood are more likely to develop new epicormics than yellow-poplar, beech, maples, and white ash (Trimble and Seegrist 1973). Intermediate and overtopped trees develop more epicormics than those in dominant or codominant trees (Brinkman 1955; Smith 1965). Greater reductions in stand density lead to more epicormics (Wahlenberg 1950; Ward 1966). The number of epicormics increases with the height above ground (Smith 1965; Trimble and Seegrist 1973). Individual trees tend to develop new epicormics in proportion to the number of branches present before treatment, implying that genetics plays a key role within species (Ward 1966).

Epicormic branches can reduce tree quality and may have a detrimental impact on stand health. Persistent branches result in knots and other defects that reduce the value of wood products available from the tree. Even short-lived branches serve as potential sites for insect attack or disease

Figure 1.—After deferment cutting in central Appalachian hardwoods, the residual stand included 13 high-quality, codominant trees per acre; residual basal area averaged 20.3 ft²/acre.

that may lead to discoloration of underlying wood or reduce tree vigor and volume growth (Kormanik and Brown 1969).

Deferment cutting is a relatively new silvicultural practice in the United States. Forest managers considering this method need information on potential changes in log quality as an aid in selecting residual trees. This report summarizes the development of epicormic branches on residual white oak, chestnut oak, northern red oak, yellow-poplar, black cherry, and basswood for a 10-year period after deferment cutting. Preliminary recommendations are provided to clarify the criteria for selecting residual deferment trees.

Methods

Deferment cutting was applied in four central Appalachian hardwood stands between 1979 and 1983. Study areas are located in north-central West Virginia. The topography consists of low valleys dissected by northeast-southwest ridges. Elevations range from 1,800 to 3,600 feet above sea level. In general, soils are medium textured and well drained, derived from sandstone shale with occasional limestone influence. The average soil depth exceeds 3 feet. Annual precipitation averages 59 inches and is well distributed throughout the year. The growing season averages 145 frost-free days.

The initial stands were unmanaged, second-growth Appalachian hardwoods with an average age of 75 years that became established after heavy logging in the early 1900's. Periodic fire was common throughout the local area as the stands became established. Chestnut blight also killed some large trees during the 1930's and resulted in patchy reproduction before and during World War II. Forest types included cove and Allegheny hardwoods, and oak-hickory. Stand size ranged from 10 to 15 acres.

The goal in each stand was a residual basal area of 20 ft^2/acre composed of mature, codominant trees. Once residual trees were selected, merchantable sawtimber was removed and all stems 1.0 inch and larger in diameter at breast height (d.b.h.) were cut. For the four study areas, this entailed leaving 12 to 15 trees/acre; the actual residual basal area ranged from 17 to 24 ft^2/acre.

In general, residual trees were selected to retain the highest value sawtimber or veneer products with the highest potential for long-term survival. A characteristic of deferment cutting is that residual trees are retained for relatively long periods, up to the length of a sawtimber rotation (80 years for Appalachian hardwoods). An important guideline used during marking was to avoid selecting high-risk trees that are prone to die or exhibit reductions in quality or vigor if allowed to grow for relatively long periods in a free-to-grow position.

In each stand residual trees were chosen using:

- Crown class: codominant
- Species: oaks, black cherry, and yellow-poplar
- Risk: no evidence of disease, shallow roots, or low forks
- Quality: current or potential high butt-log grades
- Vigor: no evidence of low or declining vigor
- Spacing: crown release on three or four sides.

During marking, each tree was examined closely to detect evidence of stress, for example, insect attack or epicormic branches.

Species, d.b.h., crown class, butt-log grade (Hanks 1976), and number of epicormic branches were recorded for each deferment tree before logging. Deferment trees were reexamined after logging to assess damage to boles and crown branches due to felling and skidding. Live epicormic branches at least 1 foot long were counted by 8-foot bole section to a height of 33 feet before logging, and 2, 5, and 10 years after logging. Butt-log grade was determined before logging and 10 years after logging. Changes in grade were attributed to d.b.h. growth, surface defects, epicormic branches, or deductions for rot.

The effect of species on the number of epicormic branches was tested by analysis of variance, and the effect of log position and time period within a species was tested using paired t-tests. Chi-square analysis was used to test for the interaction of initial number of epicormics and the development of new epicormics by assigning trees to one of two pretreatment groups and one of four posttreatment groups. Changes in butt-log grade over the 10-year study period also were analyzed by a chi-square procedure to detect differences in grade distribution resulting from deferment cutting.

Epicormic branching on 545 trees was observed over the 10-year study period. Data were analyzed to detect differences in the number of epicormics by species, log position, and time period. Data also were used to determine the effect of new epicormic branches on tree quality as measured by butt-log grade. Finally, butt-log grade distributions before and 10 years after deferment cutting were developed for each species to clarify the impact of epicormic branching on residual stand quality.

The effect of crown position was not tested in this study. Previous research has shown that trees in lower crown classes have more epicormics before (Brinkman 1955) and after cutting (Trimble and Seegrist 1973; Smith 1965; Wahlenberg 1950). This information was used in defining criteria for selecting residual trees in this study; thus, all trees were codominant before deferment cutting was applied.

Results

In general, residual trees developed few epicormic branches after deferment cutting. For all species combined, the number of epicormic branches increased by 1.28 on the butt log and 4.48 on the second log (Table 1). The development of new branches differed by time period, log position, and species.

Table 1.—Average number of epicormic branches by species, log position, and time period after deferment cutting in central Appalachian hardwoods

Species	Number of trees	Average d.b.h.	Inclusive log section	Time period: Initial	2 year	5 year	10 year
		Inches	*Feet*	*Number of branches*			
White oak	59	14.4	25-33	1.09	4.48[a]	4.63	5.07
			17-25	0.78	3.81[a]	3.68	3.83
			9-17	0.56	2.42[a]	1.76	2.05
			1-9	0.09	1.29[a]	1.05	0.56
Chestnut oak	12	14.4	25-33	0.50	2.17	2.75	1.50
			17-25	0.00	0.75	0.58	0.50
			9-17	0.00	0.00	0.00	0.00
			1-9	0.00	0.00	0.00	0.00
Red oak	200	16.7	25-33	0.42	2.14[a]	2.72	3.65[a]
			17-25	0.20	1.85[a]	1.91	2.75[a]
			9-17	0.03	1.28[a]	1.33	1.35
			1-9	0.00	0.44[a]	0.35	0.28
Yellow-poplar	190	17.8	25-33	0.12	0.51[a]	0.57	0.75[a]
			17-25	0.01	0.18[a]	0.24	0.32
			9-17	0.01	0.20[a]	0.18	0.20
			1-9	0.00	0.40[a]	0.17	0.06
Black cherry	66	14.2	25-33	0.06	1.15[a]	2.00[a]	4.85[a]
			17-25	0.00	1.35[a]	1.97[a]	3.44[a]
			9-17	0.00	1.12[a]	1.42	1.80
			1-9	0.00	1.26[a]	1.02	0.77
Basswood	18	15.1	25-33	0.39	1.61[a]	3.33[a]	4.17
			17-25	0.11	1.28[a]	3.00[a]	3.33
			9-17	0.11	1.67[a]	2.50[a]	2.44
			1-9	0.00	0.89[a]	0.88	0.44
All species	545	16.2	25-33	0.34	1.68[a]	2.11	2.92
			17-25	0.17	1.38[a]	1.53	2.07
			9-17	0.08	0.99[a]	1.00	1.08
			1-9	0.01	0.62[a]	0.45	0.29

[a]Significant increase in number of epicormic branches compared to previous time period by half-log sections ($P<0.01$).

Development of New Epicormics

Except for chestnut oak, there was a significant increase in the average number of epicormics for each species and half-log section for the first 2 years after deferment cutting (Table 1). Between year 2 and 5, the number of epicormics on upper log sections continued to increase, though only black cherry and basswood had significant increases. Between year 5 and 10, epicormics on upper log sections of black cherry, yellow-poplar, and red oak continued to increase significantly. However, butt-logs (1 to 17 feet above ground) showed no significant change from year 2 to 10 for all species. Regeneration developing beneath the deferment trees provided shade for the butt 16-foot log by year 5. By age 10, the second 16-foot log also was shaded, reducing the risk of new branching (Miller and Schuler 1995).

Upper logs developed more epicormics than lower logs. For all study trees, a paired t-test indicated that the average number of branches on the second 16-foot log was greater than on the butt log both before ($t=7.119$, 544 df, $p < 0.001$) and after ($t=15.759$) the study period. Note that the difference in the number of branches between log sections increased after deferment cutting, and was consistent within individual species and within half-log sections (Table 1). The relationship between log position and branching frequency has been observed in uncut stands (Auchmoody 1972) and following cutting treatments (Wahlenberg 1950; Smith 1965).

The number of epicormics also was related to species. Even though care was taken to avoid selecting trees with existing epicormics, white oak deferment trees had more branches on upper and lower log sections before treatment than other species (Table 2). The susceptibility of white oaks to develop more epicormics compared to other species has been observed in uncut stands (Brinkman 1955) and after reductions in tree density (Trimble and Seegrist 1973; Smith 1966; Ward 1966). After 10 years, white oak, black cherry, and basswood had more epicormics on the butt log than chestnut oak, red oak, and yellow-poplar. On the second log, yellow-poplar and chestnut oak had fewer epicormics than other species after 10 years.

Trees were assigned to categories according to the number of epicormic branches that were present on the butt and second 16-foot logs before and 10 years after treatment (Table 3). There were two categories before treatment (0, and 1 or more) and four categories 10 years after treatment (0-4, 5-8, 9-12, and 13 or more). Chi-square analysis of the resulting distributions indicated that trees with epicormics before treatment developed more new epicormics than trees that had none before treatment. For second logs of white oak, red oak, and yellow-poplar, and butt logs of white oak, the statistical difference was significant ($p < 0.001$).

Changes in Butt-Log Grade

For the 16 trees that had at least one epicormic branch on the butt log before treatment, a relatively high proportion (38 percent) had reduced grades due to new epicormics. Only 10 percent of trees with clear butt logs before treatment were later degraded. Of nine white oaks with at least one branch before treatment, five (56 percent) later had reduced grades due to new epicormics (Table 3). By contrast, of 50 white oaks with no branches before treatment, only 9 (18 percent) had reduced grade. For other species, the relationship between existing and new branches on the butt log could not be tested because few sample trees had epicormics on the butt log before treatment. However, the presence of epicormics on the second log before treatment also was an indicator of potential degrade on the butt log after treatment (Fig. 2). For all species combined, 20 percent of trees with epicormics on the second log before treatment later had reduced grades due to new epicormics on the butt log. For trees with no branches on the second log before treatment, only 9 percent were later degraded (Table 3).

Residual trees were selected partly on the basis of their current high quality or potential to attain high quality with additional diameter growth. As a result, most trees had attained their highest potential grade, limited only by d.b.h., before deferment cutting was applied. Grade rules require that to qualify for butt-log grades 1, 2, and 3, individual trees must have a minimum d.b.h. of 16, 14, or 12 inches, respectively (Hanks 1976). Before treatment, 6 percent of the deferment trees were less than maximum grade due to surface defects other than epicormics, and deductions for sweep, crook, and rot. None of the study trees had reduced butt-log grade due to epicormic branching before treatment.

After the 10-year study period, 8 percent of the deferment trees were less than maximum grade due to surface defects other than epicormics, or deductions for sweep, crook, and rot. New epicormic branches accounted for grade reductions on 11 percent of residual trees, led by black cherry, basswood, and white oak (Table 4). Of 200 red oaks, 24 (12 percent) had reduced grades due to new epicormics. Although the sample included only 12 chestnut oaks, none were degraded by epicormics. Yellow-poplar quality was virtually unchanged by epicormics, verifying results from previous research (Smith 1977).

Of the few trees (11 percent) that were degraded by new epicormic branches, most trees lost two or more grades. For all species combined, 3 percent dropped one grade, 7 percent dropped two grades, and 1 percent dropped below sawlog quality. This trend was consistent for all species; more than 70 percent of the degraded trees lost two or more grades.

Table 2.—Statistical summary for average number of epicormic branches before and 10 years after deferment cutting on the butt and second 16-foot logs

Species	Butt 16-foot log		Second 16-foot log	
	Initial	10 years	Initial	10 years
	----Number of branches----		*----Number of branches----*	
White oak	0.644a[a]	2.610a	1.864a	8.898a
Chestnut oak	0.000b	0.000b	0.500b	2.000b
Red oak	0.030b	1.620b	0.615b	6.385a
Yellow-poplar	0.011b	0.263b	0.132b	1.111b
Black cherry	0.000b	2.576a	0.061b	8.288a
Basswood	0.111b	2.889a	0.500b	7.500a

[a]Values in columns followed by the same letter are not significantly different ($P > 0.01$) using Tukey-Kramer HSD.

Table 3.—Number and proportion of trees that developed new epicormic branches 10 years after deferment cutting by species, log position, and initial number of branches

Species	Initial			Number of new epicormics				Butt-log grade reduced[a]
	Inclusive log section	Epicormics	Trees	0-4	5-8	9-12	>12	
	Feet	*-----Number-----*		*-----Number of trees-----*				
White oak	17-33	0	37	2 (54)[b]	6 (16)	2 (5)	9 (24)	7 (19)
	[c]	>0	22	7 (32)	5 (23)	6 (27)	4 (18)	7 (32)
	1-17	0	50	39 (78)	8 (16)	3 (6)	0	9 (18)
	[c]	>0	9	6 (67)	2 (22)	1 (11)	0	5 (56)
Chestnut oak	17-33	0	9	7 (78)	1 (11)	0	1 (11)	0
		>0	3	3 (100)	0	0	0	0
	1-17	0	12	12 (100)	0	0	0	0
		>0	0	0	0	0	0	0
Red oak	17-33	0	151	99 (66)	17 (11)	4 (3)	31 (21)	13 (9)
	[c]	>0	49	26 (53)	2 (4)	2 (4)	19 (39)	11 (22)
	1-17	0	197	169 (86)	19 (10)	7 (4)	2 (1)	23 (12)
		>0	3	2 (67)	1 (33)	0	0	1 (33)
Yellow-poplar	17-33	0	174	167 (96)	3 (2)	1 (1)	3 (2)	2 (1)
	[c]	>0	16	12 (75)	2 (12)	1 (6)	1 (6)	0
	1-17	0	188	186 (99)	2 (1)	0	0	2 (1)
		>0	2	2 (100)	0	0	0	0
Black cherry	17-33	0	65	32 (49)	5 (8)	3 (5)	25 (38)	14 (22)
		>0	1	0	0	1 (100)	0	1 (100)
	1-17	0	66	54 (82)	4 (6)	5 (8)	3 (5)	15 (23)
		>0	0	0	0	0	0	0
Basswood	17-33	0	12	6 (50)	3 (25)	1 (8)	2 (17)	2 (17)
		>0	6	2 (33)	0	3 (50)	1 (17)	1 (17)
	1-17	0	16	13 (81)	2 (13)	1 (6)	0	3 (19)
		>0	2	2 (100)	0	0	0	0
All species	17-33	0	448	331 (74)	35 (8)	11 (2)	71 (16)	39 (9)
	[c]	>0	97	50 (52)	9 (9)	13 (13)	25 (26)	19 (20)
	1-17	0	529	473 (89)	35 (7)	16 (3)	5 (1)	52 (10)
		>0	16	12 (75)	3 (19)	1 (6)	0	6 (38)

[a]Due to epicormics.
[b]Percentage in parenthesis.
[c]Number of new epicormics related to initial number of epicormics using x^2 $P < 0.01$.

Table 4.—Change in butt-log grade 10 years after deferment cutting by species

Species	Number of trees	Average d.b.h.	Change in butt-log grade			Grade loss due to epicormics
			Reduced	None	Improved	
		Inches	*-----Number of trees-----*			
White oak	59	14.4	16 (27)[a]	22 (37)	21 (36)	14 (24)
Chestnut oak	12	14.4	1 (8)	2 (17)	9 (75)	0
Red oak	200	16.7	25 (12)	103 (52)	72 (36)	24 (12)
Yellow-poplar	190	17.8	9 (5)	137 (72)	44 (23)	2 (1)
Black cherry	66	14.2	14 (21)	24 (36)	28 (42)	15 (23)
Basswood	18	15.1	3 (17)	6 (33)	9 (50)	3 (17)
All species	545	16.2	68 (12)	294 (54)	183 (34)	58(11)

[a]Percentage in parenthesis.

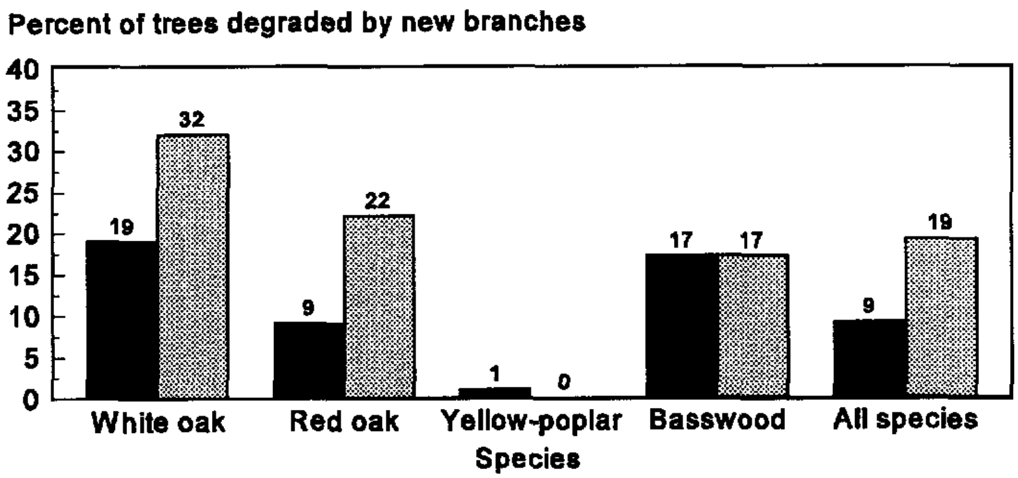

Figure 2.—Percentage of residual trees degraded due to new epicormic branches 10 years after deferment cutting by species and number of branches visible on the second 16-foot log before treatment.

Table 5.—Butt-log grade distributions before and 10 years after deferment cutting

Species	Number of trees	Time period	Average d.b.h.	Butt-log grade 1	2	3	Below grade	X²	P
			Inches	*Number of trees*					
White oak	59	Initial	14.4	16 (27)[a]	16 (27)	16 (27)	11 (19)	7.861	0.049
		10-year		24 (41)	16 (27)	17 (29)	2 (3)		
Chestnut oak	12	Initial	14.4	3 (25)	2 (17)	7 (58)	0	10.000	0.007
		10-year		6 (50)	6 (50)	0	0		
Red oak	200	Initial	16.7	100 (50)	49 (25)	46 (23)	5 (2)	19.851	0.000
		10-year		142 (71)	33 (17)	21 (11)	4 (2)		
Yellow-poplar	190	Initial	17.8	132 (69)	34 (18)	21 (11)	3 (2)	25.311	0.000
		10-year		171 (90)	10 (5)	7 (4)	2 (1)		
Black cherry	66	Initial	14.2	16 (24)	13 (20)	31 (47)	6 (9)	8.595	0.035
		10-year		25 (38)	19 (29)	21 (32)	1 (2)		
Basswood	18	Initial	15.1	6 (33)	8 (44)	4 (22)	0	5.518	0.063
		10-year		13 (72)	3 (17)	2 (11)	0		
All species	545	Initial	16.2	273 (50)	122 (22)	125 (23)	25 (5)	48.060	0.000
		10-year		381 (70)	87 (16)	68 (12)	9 (2)		

[a]*Percentage in parenthesis.*

For each species there was a net improvement in tree-quality distribution over the 10-year study period even though some trees were degraded by epicormic branching (Table 5). Most grade improvements were the result of increasing d.b.h., that is, good trees qualifying for a higher grade because size no longer was a limiting factor. The number of red oaks with grade 1 butt logs increased from 50 to 71 percent over the study period. Yellow-poplar had similar improvements, from 69 to 90 percent. Other species had less dramatic improvements, and for basswood the improvement was not significant ($p = 0.06$), probably because the sample was small.

Discussion

Deferment trees in this study were selected based on the likelihood for long-term survival, and a low risk of developing epicormic branches and other problems related to sudden exposure after treatment. Based on previous research results, trees with the tendency to develop new epicormics (based on species risk, lower crown position, or presence of existing branches) were considered unsuitable as residual deferment trees. In short, residual trees in this study were those expected to have the lowest risk of developing new epicormic branches of all available trees at the time of deferment cutting. Thus, the results reported here indicate a best-case scenario for mature central Appalachian hardwoods after deferment cutting.

General trends observed in this study are consistent with previous research on epicormic branching following reductions in stand stocking. The number of new epicormic branches was related to species, log position, and time period. White oak, black cherry, and basswood formed more new branches on the butt log than other species. Chestnut oak and yellow-poplar formed fewer new branches than other species on the second 16-foot log. In general, upper logs formed more epicormics than lower logs. Most new branches formed in the first 2 years after treatment, though new branches continued to form on black cherry, red oak, and yellow-poplar upper logs for the 10-year study period.

Trees resistant to epicormic branching usually are those of the highest current quality and value. Leaving such trees may reduce current harvest revenues. However, leaving poor-quality trees and cutting better trees may increase current revenues, but quality loss in residual trees due to serious epicormic branching may result in greater long-term losses in revenues. Loss of a butt log grade can have a dramatic influence on tree value depending on species. For example, a red oak 24 inches d.b.h. with three 16-foot logs loses about 30 percent of its value for each grade reduction (Table 6). Leaving the most vigorous trees can minimize future value loss due to grade reductions resulting from epicormic branching.

While other studies examined trees that were partially exposed after treatment, this study was based on residual trees left free to grow with an average crown growing space of 20 feet to adjacent codominant trees and no residual trees in subordinate crown classes to shade lower logs. Although environmental conditions after treatment were suitable for the development of new epicormics, proper selection of residual trees prevented serious reductions in residual tree quality. On the basis of trends observed in this study, codominant trees of several commercial species can withstand heavy reductions in tree density that result from deferment cutting or similar two-age regeneration practices without a significant loss of stem quality due to epicormic branching. The key is to choose trees that show no evidence of stress or declining vigor prior to the cut, as indicated by weaker crown position or the presence of epicormics. If maintaining residual tree quality is a concern, the order of priority in selecting residuals is: yellow-poplar, chestnut oak, red oak, black cherry, basswood, and white oak. Trees with no epicormics on either the butt or second 16-foot log are preferred to minimize the risk of butt-log degrade after deferment cutting (Fig. 3).

Key findings of this study are summarized as follows:

- For all species, the average number of epicormic branches on the butt and second 16-foot log section increased significantly for the first 2 years after treatment; butt logs showed no significant change from year 2 to 10.
- For black cherry and red oak, the number of epicormic branches on the second 16-foot log continued to increase from year 2 to 10.
- Of 545 sample trees, 58 (11 percent) had reduced butt-log grades due to new epicormic branches that developed after deferment cutting; 3 percent dropped one grade, 7 percent dropped two grades, and 1 percent dropped below sawlog quality.
- Most of the trees that were degraded by new epicormic branches dropped two or more grades as measured by Hanks (1976).
- Yellow-poplar maintained high quality; only 1 percent of residual trees had reduced butt-log grade due to new branches.
- Other species were more susceptible to reduced butt-log grade: white oak (24 percent), black cherry (23 percent), northern red oak (12 percent).
- Trees with epicormic branches before treatment developed more new branches and had more grade reductions than trees with none before treatment.

Figure 3.—To minimize potential reductions in quality and value, choose residual trees that have no epicormic branches before treatment.

Table 6.—Relative value of sawtimber trees by butt-log grade and proportions of value by log position[a]

Species	Butt-log grade	Total value ratio	Inclusive log section 1 to 17 feet	Inclusive log section 1 to 33 feet
			Proportion of total value	
White oak	1	1.8	.63	.92
	2	1.4	.48	.79
	3	1.0	.46	.77
Red oak	1	2.7	.50	.80
	2	1.9	.50	.81
	3	1.0	.41	.72
Yellow-poplar	1	18.4	.44	.76
	2	7.5	.68	.96
	3	1.0	.95	.99
Black cherry	1	1.4	.43	.74
	2	1.2	.47	.78
	3	1.0	.43	.74

[a]Based on tree-value conversion standards (DeBald and Dale 1991) for trees 24 inches d.b.h. and 48 feet merchantable height.

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Epicormic branching was monitored over a 10-year period following deferment cutting in four central Appalachian hardwood stands in West Virginia. Data from 545 codominant residual trees indicated that the average number of epicormic branches on the butt and second 16-foot log sections increased significantly for the first 2 years after treatment. For upper log sections of basswood, northern red oak, and black cherry, significant increases continued from the second to the tenth year. The net effect on quality was that 11 percent of residual trees exhibited a reduction in butt-log grade due to epicormic branching. Of the few grade reductions observed, white oak, northern red oak, and black cherry were the most susceptible. Less than 1 percent of yellow-poplar trees had lower grades due to epicormic branching.

Keywords: epicormic branching, two-age management, deferment cutting

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