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Silvicultural control of wild grapevines

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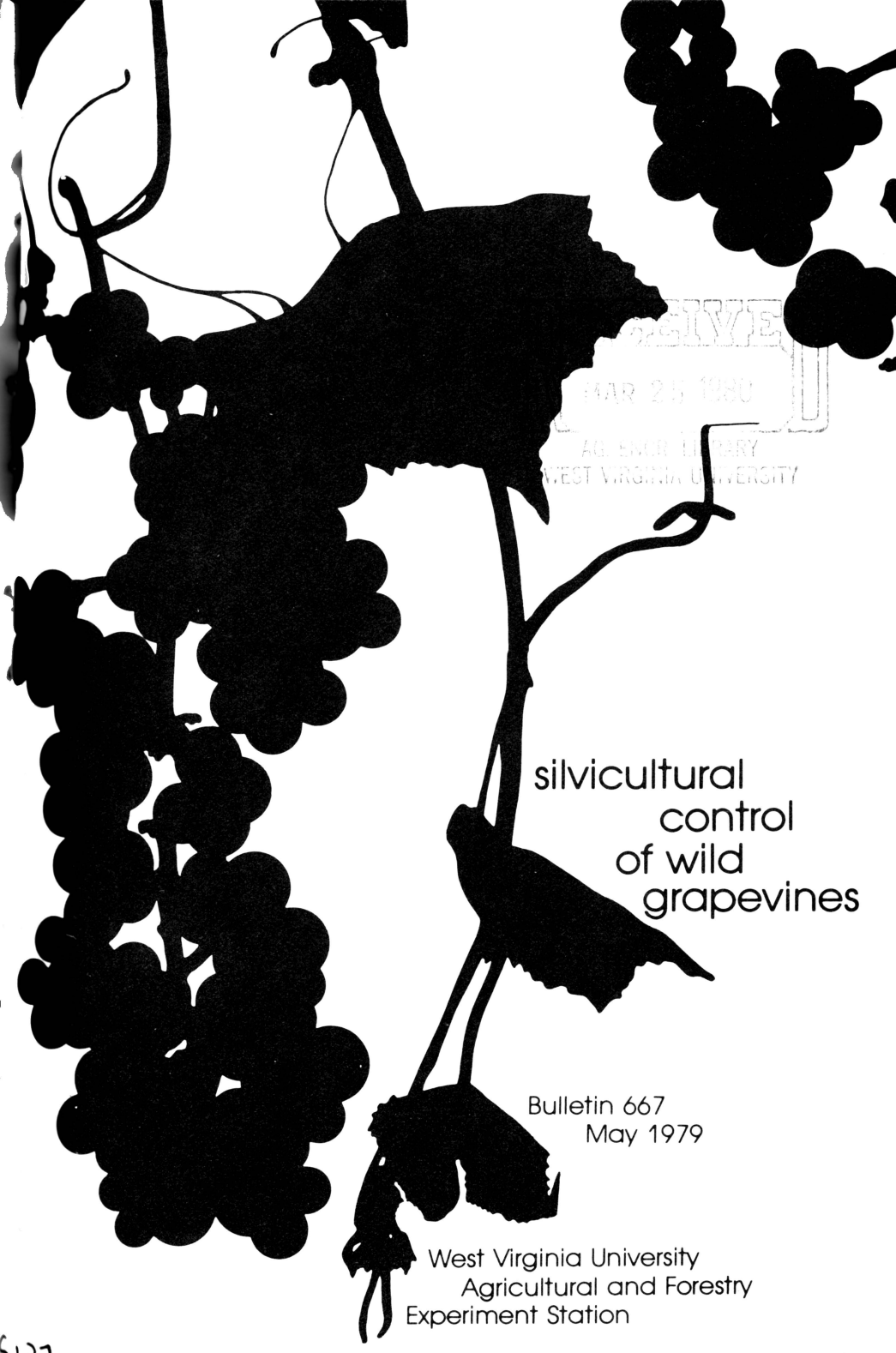

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silvicultural control of wild grapevines

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Silvicultural Control of Wild Grapevines

G. R. Trimble, Jr. and E. H. Tryon

INTRODUCTION

"One man's meat is another man's poison" is a maxim particularly appropriate to wild grapevines in central Appalachian hardwoods. To the wildlife biologist, the bird lover, and the hunter, they are a boon because their fruit is highly esteemed food for a great variety of wild creatures. To the forester and to the timber grower, they are a bane because they damage and sometimes kill standing trees.

It is not the purpose of this bulletin to discuss the pros and cons of the two viewpoints nor to suggest a multiple-use compromise. We are largely concerned here with describing methods of silvicultural control of grapevines to reduce or eliminate the damage they do to trees. It is up to the manager of the stand involved to decide whether to favor wildlife or timber.

The material drawn on for this bulletin comes mostly from the published observations and research results of several investigators and from recent studies made by the authors.

The wild grapes we are reporting on are *Vitis aestivalis* Mich. (summer grape) and its variety *argentifolia* Munson (silverleaf grape). According to Strausbaugh and Core (1952), these are the two most abundant wild grapes in West Virginia; and according to Shutts (1969), they also are abundant in Virginia. Fernald (1950) gives their range from New Hampshire south to Florida and westward to Kansas and Texas, but they are uncommon in the northern limit of their range (Shutts 1974). Because their growth habits are similar, our findings can be applied to either the summer grape or the silverleaf grape. Even the experts find it difficult to distinguish between the two (personal communication from E. L. Core, West Virginia University, Morgantown, W. Va.).

HOW GRAPEVINES DAMAGE TREES

H. L. Featherly (1940) showed that in hardwood stands in Oklahoma, trees that had heavy grapevine concentrations in their crowns grew slower than trees without grapevines and suffered greater mortality. He said: "As the trees reached maturity and ceased or slowed up height growth, the grapevines continued to grow and spread out over the tree tops, shutting off light from the trees below. The trees were thus not able to synthesize food as rapidly as before, so that growth was reduced to a very slow rate. This condition, followed by the drought years of 1934, 1935, and 1936, was more than the trees could withstand; hence they perished."

H. L. Lutz (1943) observed over many years that bittersweet (*Celastrus scandens* L.) and grape (*Vitis aestivalis* Mich., *V. vulpina* L., *V. labrusca* L., and *V. bicolor* LeConte — also known as *V. aestivalis* variety *argentifolia*

Munson) cause distinct injuries to the stems and branches of young trees. The most serious injury from grapevines, he said, is the deformation and shading of tree crowns. He added that substantial damage to seedlings and middle-aged trees is commonly seen. He also observed that hardwoods are more commonly damaged than conifers.

Grapevine damage is often heavy in small forest openings, where the luxuriant growth of vines contrasts strikingly with their poor development under nearby high forest canopy.

Grapevines often grow profusely at the edges of forest stands. If the stands are young enough (or the trees short enough), the vines work their way into the canopy and spread from tree crown to tree crown deeper into the stand.

On the Fernow Experimental Forest, near Parsons, West Virginia, we have been observing grapevine damage for many years. We have observed that vines damage trees in the following ways: (a) breaking tops and limbs (Figure 1), (b) twisting and bending the main stem (Figure 2), (c) submerging the tree foliage in large masses of grape leaves and thus interfering with photosynthesis (Figure 3), and (d) augmenting ice, snow, and wind damage (Figure 4).

Grapevines climb by means of tendrils (Figure 5), which they use to secure themselves to stems and twigs of vegetation within their reach. Observations are that they usually grow up with the trees. This suggests that the grapevine in the crown of an 80-year-old tree is also apt to be 80 years old.

Figure 1. Grapevines have broken off the limbs and tops of these trees.

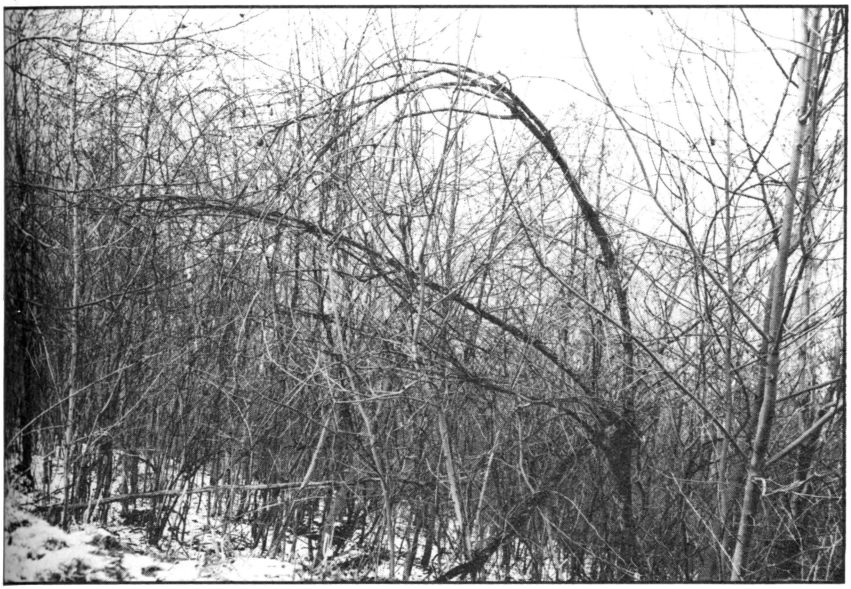

Figure 2. The main stem of this tree has been twisted and bent over.

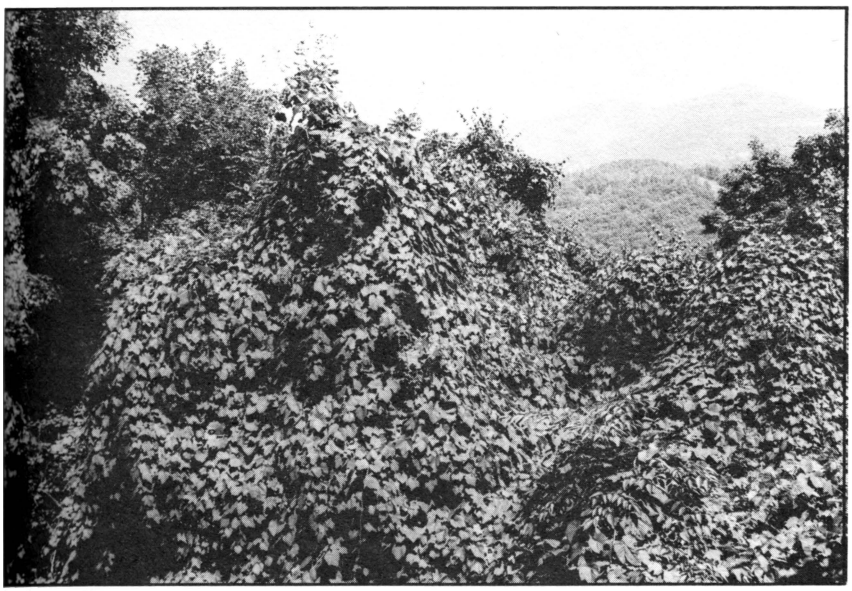

Figure 3. The tops of these trees have been completely submerged in grapevine foliage.

Figure 4. Snowfall has added to the weight of the grapevines in the crowns of this young stand and helped bend them down.

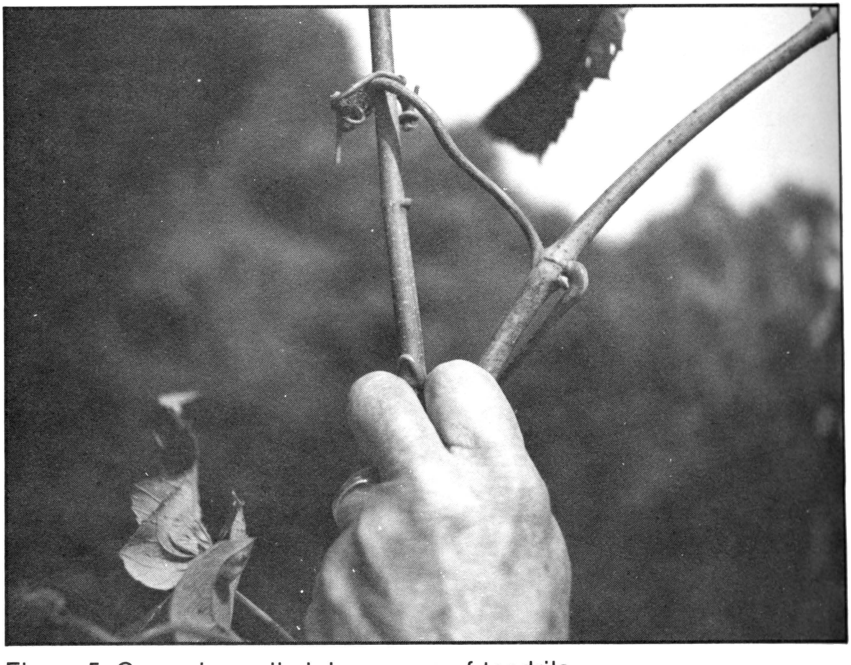

Figure 5. Grapevines climb by means of tendrils.

SOME BIOLOGICAL FACTS ABOUT GRAPEVINES

It is difficult in most cases to determine the age of ring-porous stems of grapevines because the vines usually grow slowly in diameter (Figure 6).

Wild grapevines reproduce naturally by seed or by sprouts. Both the summer grape and the silverleaf grape have either male or female flowers. The plants also may bear perfect flowers, so that even "male" plants may be capable of bearing seed (Strausbaugh and Core 1952).

From a study underway on the Fernow Experimental Forest, we know that wild grape seeds can lie dormant for as long as eight years before germinating (Wendel 1977). Sprouting, including layering from the roots, originates from vegetative buds and has been observed to be profuse.

We know that grapevine sprouts grow very fast (Figure 7); we have observed some with annual growth of 15 feet or more. But grape seedlings grow slowly at first — slower than many, if not most tree seedlings, stump sprouts, and other vegetation they compete with after clearcutting.

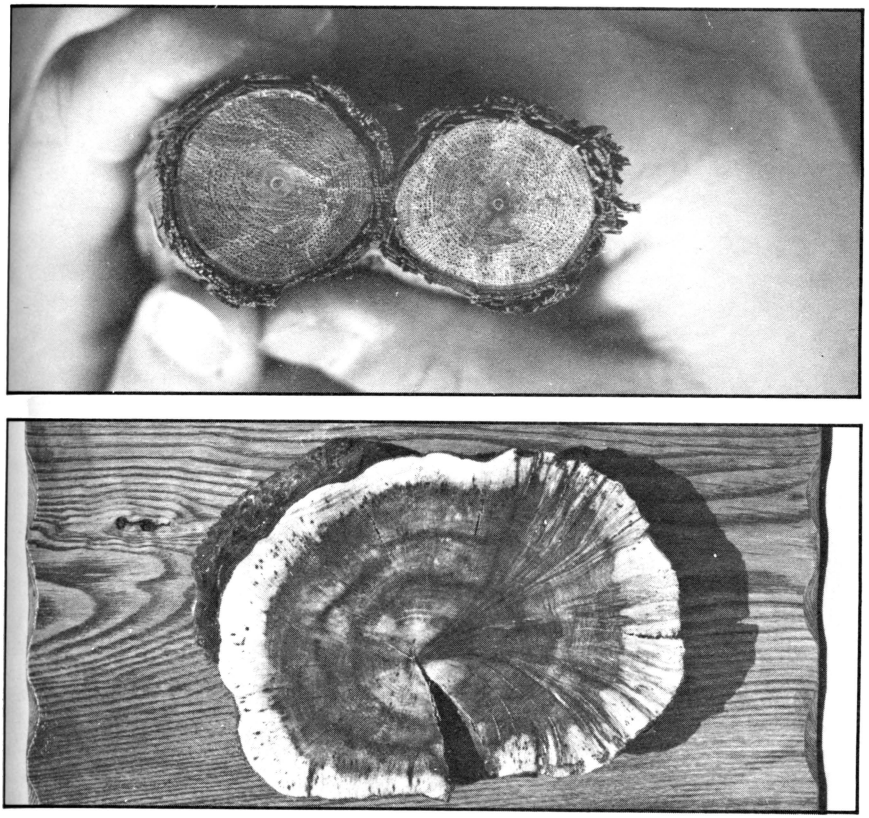

Figure 6A. Grapevine stems about 1 inch in diameter. Growth is so slow that individual rings are difficult to identify. Age probably exceeds 20 years. 6B. Unusually large grape stem, about 70 years old and over 9 inches in diameter.

Figure 7. Grapevine sprouts grow very fast.

To illustrate this relatively slow early growth, we contrasted the height of grape seedlings with the height of yellow-poplar (*Liriodendron tulipifera* L.) and black cherry (*Prunus serotina Ehrh.*) seedlings after two growing seasons (Trimble and Tryon 1974).

Species	Height after two growing seasons
	(Feet)
Grape	0.51
Yellow-poplar	1.11
Black cherry	2.21

Actually, the grape seedlings grew about as fast as the yellow-poplar (but not as fast as the black cherry) during the first growing season; but the grape tops winter-killed badly, and from then on they lost out in the race for sunlight. Much other vegetation, such as blackberry, outgrew them from the beginning.

In this study of seedling grapevine growth, we found 70,000 grape seedlings per acre the first year after clearcutting; no old grapevines were present to produce sprouts. Five years later, only 1,975 vines had survived the competition of other plants. Of these, 139 were climbing onto woody stems and briars, but were, as yet, doing no damage to trees. Three years after that, they were still not damaging the trees. Thus it seems that grapevine seedlings grow so slowly in early life that the few that do attain tree crowns in the young evenaged stands are not seriously damaging to the stands before the trees reach large sapling or small pole-timber size.

All of our experience indicates that grapevines are intolerant of shade. In several studies in which grapevines that grew under forest canopies were severed, the grape sprouts died within three years. In other areas, where the overstory was completely removed, grapevines thrived. But where individual tree selection cutting was practiced, cut grapevines did not often grow back up into the canopy, thus indicating they were shade intolerant. Another indication of intolerance is that although numerous grape seeds are present throughout the forest floor — as witnessed by the great number of new seedling grapes that spring up immediately after clearcutting — grape seedlings are seldom seen beneath closed stands.

The presence of grapevines — at least on the Fernow Experimental Forest and on the nearby Monongahela National Forest — seems to be positively correlated with site quality; in general, grapevines are more numerous on the good and better sites than on the fair and poorer sites. On the Fernow Forest, nine 12-acre areas were examined for grapevine occurrence 12 to 15 years after clearcutting for sawtimber and pulpwood (Smith and Lamson 1975). Six of the areas were on good to excellent sites — site indexes for oak of 70 and 80 feet. Three were fair-site areas, with site indexes of 60 feet. The six better-site areas had an average of about 1,000 trees per acre with grapevines in their crowns; by areas, they ranged from a low of 20 percent of the stems with grapevines to 94 percent. The three fair-site areas had an average of 44 stems per acre with grapevines; the range was from a low of 0.2 percent to a high of 4 percent of the trees with vines. Observation in the general area bears out this relationship between grapevine incidence and site quality.

Shutts in Virginia (1968) made a comprehensive study of the autecology and fruit production of the two grape species under discussion. Although much of his work is not pertinent to the theme of this bulletin, we felt that some of his findings would give readers a better understanding of the grapevine problem, and we credit him with the following information.

> Records from the U.S. Fish and Wildlife Service indicate that at least 80 species of birds and a large number of animals eat grapes. The grape plant supplies both food and cover for wildlife.
>
> The grapes of this area (Virginia) include 11 species and 3 varieties. Of these, summer grape and silverleaf grape are the most abundant and the most important to game.
>
> Ripe grapes were found on the vines from mid-August through mid-March. The peak abundance of fallen grapes available for game was November 1 to 15. The number of bunches per vine was positively correlated in a straight line relationship with grapevine diameter. Thus from the game food viewpoint, it pays to grow big old vines.
>
> A large number of the grape fruits examined in the Virginia study were affected by black rot fungus (*Guignardia bidwelli*) — 42 percent.

Within the three equal-sized study areas chosen by Shutts, the number of grapevines was significantly correlated with site index of oak: 37 vines per

acre on plots with a site index of 58 feet; 186 on plots with a site index of 68; and 234 on plots with a site index of 71.

GRAPEVINE CONTROL STUDIES

Although the best methods of controlling grapevines have not been determined for all stand conditions, the results of recent studies indicate that severing vines growing in well-stocked stands is an effective and inexpensive way of eliminating them. This method works because grapevines are shade intolerant; under the shade of a forest canopy, the sprouts from grapevine stumps will not develop and climb up into the tree crowns.

In Mature Stands

One study was made in two unmanaged well-stocked 70-year-old stands of Appalachian mixed hardwoods on excellent sites (Trimble and Tryon 1977). In November 1971, in each of the two stands, we severed ten large grapevines that were climbing into the crowns of big trees (Figure 8). We cut these vines a foot or two above the ground (Figure 9). We measured sprouts from the stumps following the growing seasons of 1972, 1973, 1974, and 1975.

At the end of the first growing season (1972) all 20 of the severed stems had sprouted; most of them had several sprouts. A few of these sprouts exceeded 12 feet in length, and some were climbing into small understory trees. Sprouting from the vine stumps originated both above and below ground. All sprouts were spindly, with weak connections to the old stump, and they had unhealthy looking leaves. Many had been nipped by deer.

At the end of the second growing season, most of the first-year sprouts were dead. Sprouting also occurred the second year; these sprouts were few, short, and very weak; and many of them were dead in December when the observations were made.

After a third growing season, we found no third-year sprouts, and all sprouts from previous years were dead. Moreover, all grapevine stumps were dead above ground.

The last set of observations was made after the fourth growing season. We found no sprouts, and all stumps were dead and rotting, both above and below ground. We excavated several of the vine roots to the extent of penetration by the large root; in most cases, we only went down far enough to establish that the main roots were completely rotten. Most small feeder roots had disintegrated.

In Thinned and Unthinned Sapling Stands

We made another study in young hardwood stands to determine how tall the trees had to be before grapevines cut out of them would fail to regrow into their crowns under both thinned and unthinned conditions (Trimble and Tryon 1976). We selected two even-aged stands growing on high-quality sites on the Fernow Experimental Forest. The younger stand was 12 years old, the older 18. Most trees in both stands had grapevines growing in them.

We then numbered 40 trees in each stand and, at random, designated 20 of them for thinning and 20 to be left unthinned (Table 1). All selected trees were of the type that would qualify as crop trees. All of them had at least one grapevine in their crowns; and one tree in the 12-year-old stand had 12.

Figure 8. Grapevine climbing into the crowns of large trees.

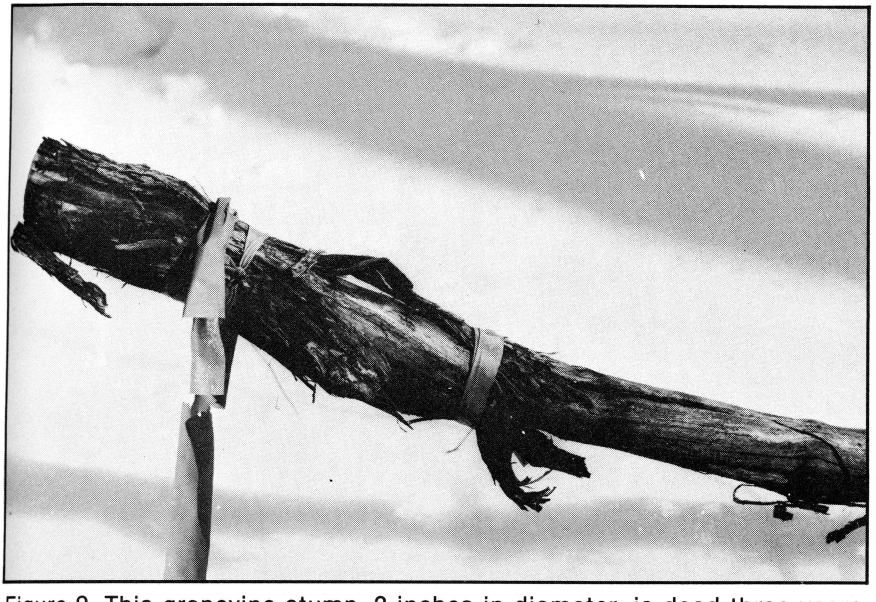

Figure 9. This grapevine stump, 2 inches in diameter, is dead three years after cutting. The flagging was for identification purposes.

Table 1.
Tree characteristics and treatment data for the two young even-aged stands

	Release trees	Non-release trees	Release trees	Non-release trees
Stand Age (yr.)	12.0	12.0	18.0	18.0
Sample trees (No.)	20.0	20.0	17.0[a]	18.0[a]
Avg. dbh (in.)	3.3	3.7	7.4	7.3
Avg. tree height (ft.)	27.0	30.0	53.0	51.0
Avg. basal area[b] around tree (sq. ft.)	12.0	44.0	60.0	109.0
Avg. vines cut/tree (No.)	4.0	4.2	3.0	2.4
Avg. diam. vines cut (in.)	0.5	0.5	1.1	1.3

[a]Blowdowns reduced the number of sample trees below 20.

[b]Taken after thinning for release trees; includes stems 1 inch dbh and larger.

Next we released the crop trees marked for thinning by cutting the trees that competed with them. We cut all stems whose crowns touched or overlapped any parts of the crowns of the crop trees. We cut no stems around the crop trees in the unthinned spots.

Then, a foot or two above the ground line, we cut all grapevines that were climbing into the designated trees, both thinned and unthinned. In addition, we cut all grapevines from adjacent trees to prevent their growth into the designated trees. Annually, for three years, we measured the sprouting from the grapevine stumps cut around the designated trees.

In both the 12- and 18-year-old stands, and under both thinned and unthinned conditions, at the end of three years all grapevine stumps were dead above ground, and all sprouts were dead (except one lone vine that was almost dead). During the three-year study period, not one grapevine sprout had climbed into a tree crown (Table 2).

In both stands, under thinned and unthinned conditions, the severed vines had sprouted heavily the first growing season, less heavily the second, and not at all the third (Table 2). No discernible differences in grapevine sprouting trends appeared between stands or between thinned and unthinned conditions.

From the results of this study we concluded that grapevines can be eliminated on high-quality sites by cutting them out of stands as young as 12 years. More meaningful than stand age limitations would be height limitations. The crop trees in the 12-year-old stand averaged 28 feet tall; those in the 18-year-old stand averaged 52 feet (Table 1). We could then conclude that a stand of trees 28 feet tall was tall enough to permit successful grapevine elimination under both thinned and unthinned conditions.

The thinnings we made were fairly heavy; they left all crop trees in clearly dominant positions and greatly reduced surrounding basal areas (Table 1). We feel that, in stands like these, thinnings heavy enough to allow regrowth of grapevine sprouts would rarely be made.

In Young *Stands with Crop Tree Release*

Observations of grapevine occurrence were made in another 12-year-old even-aged hardwood stand on an excellent site where a crop-tree release study was being made. Crop trees had been released when the stand was seven years old, and at the same time unreleased comparison trees had been designated and measured as controls. Grapevine occurrence and damage were noted at the five-year remeasurement — when the trees were 12 years old (Trimble 1973).

Three categories of grapevine occurrence were recorded: no grapevines present, grapevines present, and grapevine damage severe (a subjective appraisal). Unfortunately, although grapevines were cut out of release trees in the seven-year-old stand, their presence was not recorded at the time for either the release or control stems. However, crop-tree height was recorded; it averaged about 9½ feet.

Five years after the release operation, about two thirds of the sample trees had grapevines in their crowns. The situation was the same for both release and control stems, indicating that in most cases the vines had regrown into the release trees after their elimination five years previously.

Table 2.
Summary of annual measurements for stands

Growing season after treatment	Trees with sprouting vines	Total sprouts from cut vines	Sprouts dead	Sprouts alive but not in tree crowns	Sprouts alive and climbing in tree crowns
Area 1 (12-year-old stand)					
Release Trees					
1	20	80	1	79	0
2	20	80	75	5	0
3	5	25	25[a]	0	0
Non-Release Trees					
1	20	81	3	78	0
2	20	87	80	7	0
3	5	12	11[a]	1[b]	0

Growing season after treatment	Trees with sprouting vines	Total sprouts from cut vines	Sprouts dead	Sprouts alive but not in tree crowns	Sprouts alive and climbing in tree crowns
		Area 2 (18-year-old stand)			
1	17	51	9	42	0
2[c]	—	—	—	—	—
3	3	17	17[d]	0	0
		Non-Release Trees			
1	18	42	3	39	0
2[c]	—	—	—	—	—
3	5	22	22[d]	0	0

[a]Previous year's sprouts.
[b]Almost dead — sprout origin below ground.
[c]Observations not taken.
[d]Previous year's sprouts.

Severe grapevine damage was recorded for about one fourth of all sample trees, with a slightly higher incidence for the control stems — from which the grapevines had not been temporarily eliminated.

With such a high incidence of grapevine damage, it would seem that both height and diameter growth would be affected; and an attempt was made to determine if this were in fact the case. For each class of trees — species crown-class treatment group — five-year height and d.b.h. data were compiled separately for trees with and without severe grapevine damage. There were 11 such groups of trees. Eight of these groups had greater growth rates — both height and diameter — for the stems without severe grapevine damage, indicating that this damage adversely affects growth.

In view of the high incidence of grapevines in crop trees — 66 percent — we can probably anticipate that crop tree damage will accelerate in the future. The study results also indicate that when thinnings are made in stands with trees only 9 to 10 feet tall, grapevines cut out of these trees will send sprouts back up into the tree crowns.

In a Five-Year-Old Stand

Another study was made to determine the development pattern of grapevine sprouts from stumps of vines cut out of trees in a five-year-old even-aged hardwood stand on an excellent site. We cut the vines out of 20 trees chosen at random from a population of dominant and codominant saplings that had grapevines growing in their crowns. We made annual measurements of grapevine regrowth two years following treatment.

At the time of installation — when the stand was five years old — the 20 sample trees exhibited the following parameters: average height — 15.65 feet; average d.b.h. — 1.56 inches; 9 stems were dominant, 11 were codominant; trees had from 1 to 4 vines in their crowns; a total of 49 vines were cut out of the sample trees.

At the end of the first growing season following study installation, we tallied a total of 96 sprouts from the vine stumps. Fifty-seven of these sprouts were dead; 8 were climbing into low vegetation; and 31 were up in tree crowns.

After the second growing season, all but nine of the stump sprouts were dead. Though all of these were in tree crowns, two were almost dead. The remaining seven appeared vigorous and healthy; presumably they will persist and eventually damage crop trees. One tree had four of these vines, another had two, and a third tree had one. No new sprouts had developed during the second growing season.

The results of this study show that cutting vines out of trees of the heights studied here is less than completely effective, or put another way, grapevine cutting should have been delayed a few years.

Treatment Time Study

A time study was made to get some estimate of the costs of cutting grapevines on a practical basis in an uncut sawtimber stand (Smith and Smithson 1975). Grapevines were cut by a three-man crew of woods workers in a 117-acre stand of 70-year-old hardwoods located on a steep slope. The tool used in severing the vines is known as a Woodsman's Pal (Figure 10). Grapevine density averaged about 21 vines per acre. Average rate of treatment was about 32 stems or about an acre and a half per man hour.

Figure 10. Woodsman's Pal.

GRAPEVINE CONTROL RECOMMENDATIONS

Studies and observations have provided information on how to control grapevines in many situations by severing the vines. This biological control has two advantages: it does not involve the use of chemical and thus escapes some criticism, and it is inexpensive. The disadvantage is that it is not effective under all conditions.

Severing the vines works as a control measure when it is done under a forest canopy that does not have big holes in it and is made up of trees of minimum heights of about 25 feet when the vines are cut at the time of thinning and about 18 feet when no thinning is done.

In an old stand that is approaching maturity and a clear-cutting harvest (i.e., a stand under even-age management), grapevines should be cut at least 4 years before harvest.

For the most effective control in stands where selection cutting is practiced, the vines should preferably be cut several years before the end of the cutting cycle but, if this is impractical, they can be cut at the time the individual tree harvest is made.

An attempt should be made to cut all grapevines in all tree crowns, not only those in crop trees. The reason for doing this in *young stands* is that grapevines travel from one tree crown to another — they spread through the canopy. In *old stands,* the obvious objective is to eliminate all vines so that their sprouts will not damage the new trees that emerge after clearcutting.

DISCUSSION

It should be mentioned that in those young stands where grapevines are abundant, finding and cutting every vine in a control operation is almost impossible. Thus some vines will most surely be missed, and future stands will continue to have grapevines in them — but if the control job is done right, they will not be frequent enough to be damaging, and those missed vines can be cut in later thinning operations.

Situations are encountered where cutting the grapevines will not adequately control them. Typical of such situations is the young stand so heavily overgrown with grapevine sprouts that the young trees cannot establish a canopy — they are submerged in grapevine foliage almost from the beginning. This condition frequently occurs where an old stand heavily infested with grapevines has been clearcut. If the vines are cut at the time the old stand is removed, or later, control will not be effective because the stumps of cut vines will sprout. Treatment with herbicides would seem to offer the best solution for control.

Some work has been done with herbicide testing. Carvell and Tryon (1955) sprayed the cut stumps and the lower stems of uncut vines with 2,4,5-T. Observations made one year after treatment showed better success with basal spraying than with spraying the cut stump.

Smith (1976) tested 2,4-D and Tordon 101 with a mistblower. All grapevine foliage (and other vegetation foliage as well) that was reached by the spray was killed. He also broadcast 10K pellets of Tordon. These pellets were the most effective treatment, killing all vegetation on the area treated, including trees as large as 22 inches d.b.h.

There is practically no way of treating young stands heavily infected with grapevines with a herbicide that will not kill the hardwood trees also. Grape seed can remain dormant for years and then germinate. Thus the herbicide, which kills the stems and roots of all vegetation, favors those species, like grape, whose seeds remain viable for years. For such young stands, we need research to develop methods of herbicide treatment that do not favor grape.

No discussion of grapevines would be complete that did not raise the question as to why some forest stands on good sites are plagued by grapevines and other stands on similar sites are not. In many cases the stand histories are similar, as far as we can determine. Is it only happenstance that is involved, or does some unknown variable of stand history account for the difference? If we knew, that knowledge might offer a clue to better control of the vines.

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