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MANAGING EASTERN REDCEDAR

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Eastern redcedar *(Juniperus virginiana* L.) is the most widely distributed conifer of tree size in the Eastern United States (48). Its range also extends into southeastern Canada. The wood was once favored for domestic use and export because of its exceptional cutting qualities, durability, rich color, and aroma. It has now lost much of its popularity because of limited supply. The magnificent stands of redcedar so often mentioned by early explorers have been cut, and for a number of years redcedar has been primarily confined to fence rows, abandoned fields, and submarginal lands where it often grows poorly.

The species ranks among the top five for Christmas trees *(40),* and is an important constituent of shelterbelt plantings in the Great Plains (48). The fruits are eaten by many wildlife species, including birds, rabbits, foxes, raccoons, skunks, and coyotes. The foliage is eaten by deer when nther food is scarce (13).

Most redcedar is cut from small farms, where its management should be encouraged. It generally occupies sites which are too rough or rocky for agricultural crops, and salable products are small enough to be handled with ordinary farm equipment. This paper presents information on growing and managing redcedar. It is a compendium of published knowledge on the species, supplemented by current research results from northern Arkansas.

Tree Characteristics

Eastern redcedar grows slowly, and long rotations are required to produce conventional saw logs. Trees 20 to 30 years old are generally 18 to 26 feet tall and 2¼ to 3 inches in diameter (9). Mature trees are small to medium sized, usually 40 to 50 feet tall with a short bole 12 to 24 inches in diameter. On good sites they may reach 120 feet tall and 4 feet in diameter (7). On dry sites in the. prairie region, trees 110 years old are often less than 20 feet tall (48).

Tiny evergreen leaves are borne in two forms. Those on seedlings and vigorous twigs are sharp pointed and awl shaped. On less vigorous stems, closely overlapping scale-like leaves fit tightly against the twig in opposite pairs (fig. 1). Scale-like leaves are usually about 1/16-inch long and dark blue-green; they turn russet or yellow-brown during the winter. From February to May small inconspicuous male and female flowers appear-almost always on separate trees.

The fruit is a berry-like cone which is fleshy, dark blue, and highly aromatic. Cones mature in one season. They contain two (rarely three or four) small seeds, which number 17,600 to 59,000 to the pound (46).

Distribution

The species occurs in every State east of the 100th meridian (fig. 2). It also appears in southern Ontario, the southern tip of Quebec *(48),* and in some parts of New Brunswick and Nova Scotia (47). Throughout its range the species grows under diverse conditions-in deep and shallow soils, on ridgetops, and in bottoms.

Eastern redcedar sawtimber volume in the United States was estimated to be 490 million board feet in 1953 (47). The largest remaining stands are in the mountains of Arkansas, Missouri, Tennessee, and Kentucky. Substantial amounts are also found in the Carolinas and Virginia.

Fiigure 1.—
Awl-shaped leaves on vigorous twig (left); *fruit* and scale-like leaves on mature twig (right).

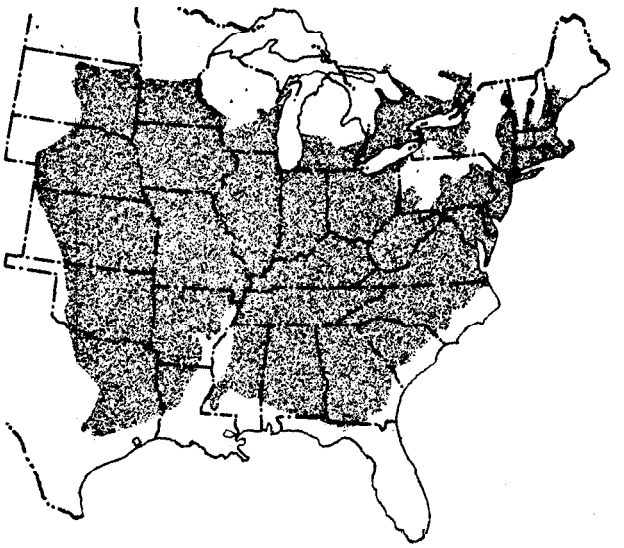


Figure 2.—*Range* of eastern redcedar.

In Arkansas, **redcedar** is the dominant commercial species on about 600,000 acres, according to the most recent forest survey report (41). Most of this acreage is in the Ozarks. The area supports 28 million cubic feet of growing stock and 43 million board feet of sawtimbcr. Another half million poorly stocked acres might be better suited for **redcedar** than the species now present. Adjacent areas in Missouri have roughly 500,000 acres stocked with or suitable for **redcedar** (23). The latest survey in Missouri (16) showed a growing-stock volume of 17 million cubic feet and a sawtimber volume of 6.6 million board feet.

Redcedar is the dominant species on 600,000 acres in Tennessee *(42),* with 66 million cubic feet of growing stock and 105 million board feet of sawtimber. Kentucky contains over 500,000 acres of **redcedar** type, approximately 53 million cubic feet of growing stock, and 91 million board feet of sawtimber (14, *17, 18).*

In the Southeastern United States most **redcedar** volume is scattered in types other than cedar. Virginia has 120,000 acres of cedar type, 50 million cubic feet of **redcedar** growing stock, and 65 million board feet of sawtimber (25). The type covers 77,000 acres in the Piedmont region of South Carolina, which contains growing stock and sawtimber volumes of 37 million cubic feet and 40 million board feet (21, 27). Approximately 28,000 acres of cedar type are found in North Carolina. The State contains 36 million cubic feet of growing stock and 57 million board feet of sawtimber (24). Relatively small amounts of commercial **redcedar** occur in other sections **of the species' range.**

Site Requirements

The species is so frequently associated with limestone ledges that it is commonly believed to grow only on dry, rocky soils. Like most tree species however, **redcedar** grows best on deep, moist, well-drained alluvial sites, where its height may reach 55 to 60 feet at 50 years of age. It rarely becomes dominant on such sites because of competition from other species.

It also grows well on deep, upland soils, particularly abandoned farmland. A l-acre plantation established in the Arkansas Ozarks with transplanted wildlings on a 6 by 6 foot spacing yielded a basal area of 163 square feet and an estimated 2,800 cubic feet of merchantable volume in 44 years (4) (fig. 3) .

Figure 3.— *44-year-old redcedar plantation* in *northern Arkansas.*

The species is now generally confined to glades-areas of thin rocky soil with intermittent rock outcrops. Estimating soil depth is difficult, because soil-filled fissures must be included. Very poor sites contain few fissures in the parent material; their soils are generally less than 12 inches deep. Such sites produce short-bodied trees whose merchantable length rarely exceeds one 6½-foot post.

Medium and good glade sites have large crevices. Soil depth on medium sites is usually less than 2 feet; good sites have deeper soil. Figure 4 shows a stand on a good site. Unfortunately, hardwoods usually quickly crowd out the cedar on such areas.

Redcedar grows surprisingly well in soils with high rock content. The authors exposed a portion of the roots of a desirable crop tree and found that limestone rocks comprised over 52 percent of the total soil volume (fig. 5). Root development was greatly influenced by the size of the soil-filled fissures.

The species establishes itself on adverse hardwood sites, and hastens soil changes (5, *11).* High soil acidity does not seem to deter its establishment. Arend and Collins (7) inferred that neutral to alkaline soils are a result rather than a cause of redcedar's presence on certain sites. The high calcium content of its foliage (over 2 percent) tends to change soils from acid to alkaline in a comparatively short time, perhaps less than 15 years (11, *12).* Read and Walker (39) reported that redcedar

Figure 4.-*Natural stand of eastern redcedar on the Koen Experimental* Forest in *Arkansas.*

Figure 5.—*Rocks occupied' 53 percent of the volume around* the *roots* of this *tree. The* soil *was removed and rocks were replaced* **in** approximately their original positions.

litter, through its influence on calcium content and pH of the surface soil, improves the environment for earthworms. Earthworm activity increases organic-matter content through litter incorporation, lowers volume weight, and increases pore volume, air capacity, and infiltration rate. Broadfoot (12) found striking differences between the soil under eastern redcedar trees and that under other herbaceous cover. He found that the A, horizon was thicker under cedar and had twice the organic matter and available calcium. He attributed superior qualities of the soil under redcedar to the influence of litter, and recommended the species for soil rehabilitation.

The growth and character of 91 natural stands of eastern redcedar were studied throughout the Ozarks by Arend and Collins (7). For each stand the soil type, soil depth, topographic position, and direction and degree of slope were classified. Composite soil samples for pH determinations were taken at depths of 0 to 3 and 3 to 6 inches. In each stand, 30 to 40 individual trees were selected for measurement of total height, merchantable height, age, diameter at breast height, diameter growth during the past 10 years, bark thickness, stem taper, and length and width of crown.

Depth of soil was the principal site factor affecting growth and character on upland soils. Soil acidity within the pH range of 4.7 to 7.8 had little effect on growth. Four site classes for eastern redcedar in the Ozarks were recommended (table 1).

Table 1.--Site *classes for natural redcedar stands* in *northern Arkansas*

Site class	Soil character	Soil depth	Site index [1]	
			Open stand	Closed stand
		Inches	--Feet--	
1	Alluvial	24 +	55	60
II	Upland	24 +	45	50
III	Upland	12-23	35	40
IV	Upland	Less than 12	25	30

[1] Adjusted to age 50 (7).

Aspect influences the character of stands bu not their total growth and yield (7). On nortl and east slopes there were generally fewe redcedar trees because of hardwood competi tion, but those that did occur were slight1 taller than trees on south and west slope: Topographic position was related to depth c soil, with lower slopes tending to produce talle trees because of greater soil depth.

Arend and Collins (7) report that: "As the trees grow older, the quality of the site has a more significant effect on height growth. Although stand density normally has little effect on height growth of most forest species, open grown redcedar trees in the region do not grow as tall as when found in dense stands."

Natural Regeneration

Good seed crops occur every 2 or 3 years, with light crops in the intervening years. Seed dispersion depends heavily upon birds and small mammals (5, 34, 36, 46). The best seed-bearing age is between 25 and 75 years, although some trees will bear at 10 years, and some after passing the century mark.

Seeds usually germinate in early spring of the second year after dispersal; a few germinate the first and third years. Delayed germination is caused by embryo dormancy and possibly by an impermeable seedcoat *(46)*. Passage through an animal's digestive tract speeds seed germination (36).

Intensive site preparation is usually not needed, but seedling establishment is improved by removing litter. The seedlings are intolerant, and survival is better under open than closed canopies (37).

Established seedlings withstand drought well, perhaps because of their deep, penetrating taproot and relatively small leaf surface. During the first year, seedlings do not develop large tops, but they produce a long fibrous root system. On very dry sites most seedlings are found in protected places, such as cracks in limestone, where the microclimate is most favorable for germination (3).

Eastern redcedar is among the first tree species to invade old fields (5). Beilmann and Brenner (8) attribute its vigorous encroachment to the control of indiscriminate burning. On deep soils, associate invasion species, such as persimmon *(Diospyros virginiana* L.) and sassafras *(Sassafras albidum* (Nutt.) Nees) may soon crowd out the redcedar. Although it occurs occasionally in almost pure stands on glades, redcedar is frequently associated with winged elm *(Ulmus alata* Michx.) and blackjack oak *(Quercus marilandica* Muenchh.) (39). Post oak (Q. stellata Wangenh.), white ash *(Fraxinus americana* L.), and xerophytic shrubs are also found with redcedar in Missouri (26). Such consociations may eventually be replaced by climax hardwood species, including sugar maple *(Acer saccharum* Marsh.) and white oak *(Q. alba* L.) (43).

Planting and Seeding

For such a well-known species, there is little information on the planting of redcedar. Gruschow *(20)* reported a test of seven methods of planting in the Virginia Piedmont; survival ranged from 27 to 41 percent after 4 years. He concluded that factors other than planting methods were influencing survival. Maple *(28)* found survivals of planted 1-O redcedar ranging from 0 to 44 percent in the Arkansas Ozarks, but attributed poor success to low vigor of the planting stock.

In contrast, Moore *(35)* achieved 99 percent survival in Alabama, and Meade (29) describes a g-year-old plantation in Arkansas with 90 percent survival. Arend *(4)* reports 84 percent survival in a 44-year-old plantation in Arkansas established from hand-pulled wildlings.

It is obvious that redcedar plantations can be successful. The failures reported indicate that site and competition need to be carefully considered. Afanasiev (2) summed the problem up when he said, "Both seed and seedling are very exacting in site requirements and need constant care."

Experience in northern Arkansas indicates that mowing or spraying with chemicals to control competing vegetation may maintain satisfactory survival.

There is little literature on techniques for direct-seeding eastern redcedar. Afanasiev (1) reported two abortive attempts in Oklahoma. In both cases, the seeds were stratified in late fall and were considered to be completely after-ripened when they were sowed.

Pilot studies of machine and hand direct-seeding on the Piedmont were conducted by Minckler and Downs (33). Both hand and furrow seeding were successful. Stratified seeds were sown at the rate of 1.2 pounds per acre (18,000 seeds per pound). The machine method resulted in 2,500 seedlings per acre with a stocking percent of 86 on 8.5- by 8.5-foot quadrats.

Seedling catch and survival are improved by removing litter and either thinning or removing the overstory *(37).*

To insure maximum germination in minimum time, seeds must be cleaned, treated to increase seedcoat permeability, and stratified in a moist medium for up to 4 months at 35 to 41° F. (44, 46). If immediate stratification or sowing is not planned, the cleaned seed should be dried to a moisture content of 7 percent and stored at 20° F. (46).

Protection

The thin bark of eastern redcedar offers little protection against fire. Fortunately, the foliage does not burn readily, and litter accumulation is limited under stands on thin soils. Thus, the lack of fuel protects many stands in areas where fire occurrence rate is high.

On deep soils, competing species produce enough litter to support fire. Sufficient flash fuels to carry fire are usually available on grasslands and old fields, which are aggressively invaded by redcedar. Beilmann and Brenner *(8)* point out that the beginning of successful invasion by redcedar on these areas coincides with the reduced burning of grasslands. Single fires usually kill trees (fig. 6). Such fire-killed stands must be regenerated artificially, for redcedar does not sprout.

Herbs and native grasses are relatively abundant on cedar glades, which are grazed extensively. Like wildfire, cattle grazing damages the shallow soil by increasing compaction, surface runoff, and erosion. Redcedar roots are injured by sharp hooves, and seedling and sapling height growth is practically erased by browsing (38).

Most authorities agree that redcedar foliage, although not a preferred deer food, carries deer populations through periods when more desirable plants are in short supply. During such times, browse lines develop on old trees and younger ones become hedged. Most reproduction is destroyed (13).

Insects usually do not seriously damage eastern redcedar. Boring insects sometimes feed on living and dead trees, and bagworms (Thy*ridopteryx* ephemeraeformis (Haw.)) occasionally completely defoliate a tree. Redcedar aphids *(Cinara sabinae* Gill.) may cluster on twigs and smaller branches, occasionally kill-

Figure 6.—Single fires usually kill redcedar because the thin bark offers little ***protection from the heat.***

ing the infested portions, and sometimes the whole stem (15).

The trees are especially susceptible to a disease commonly known as cedar-apple rust *(Gymnosporangium juniperi-virginianae* Schw.). Fungi of this genus are also responsible for witches'-broom and spindle-shaped swelling of trunks and branches of large trees (10). Apple, pear, quince, mountain-ash, hawthorn, and serviceberry are some of the common alternate hosts. Though rarely fatal to redcedar, these diseases are damaging to apples. In some States, complete eradication of all cedars and junipers within a mile of an apple orchard is required by law *(10).*

Cubical rot fungi *(Fomes* subroseus (Weir) Overh. and *Daedalea juniperina* Murr.) and juniper pocket rot fungus *(F. juniperinus* (V. Schr.) Sacc. & Syd.) enter through dead branch stubs and attack the heartwood of eastern redcedar *(10,* 45) (fig. 7). Hence, pruning is usually not recommended. Tight knots are not classed as defects. Where it is necessary, pruning should leave 8- to lo-inch branch stubs to minimize fungal attack *(22).*

Figure 7.-Daedalea juniperina *causes heart rot in redcedar.*

A root rot *(Fomes annosus* (Fr.) Karst.) sometimes extends into the sapwood above the rootcollar of suppressed trees. The pathogen can kill weakened trees *(10).* Miller (32) suggested reducing or eliminating competition for light to reduce losses to this disease.

Competition Control

Eastern redcedar is an aggressive pioneer species that invades old fields and pastures *(6).* It is classed as very intolerant in New York and New England, and intolerant in the Southeastern United States (48).

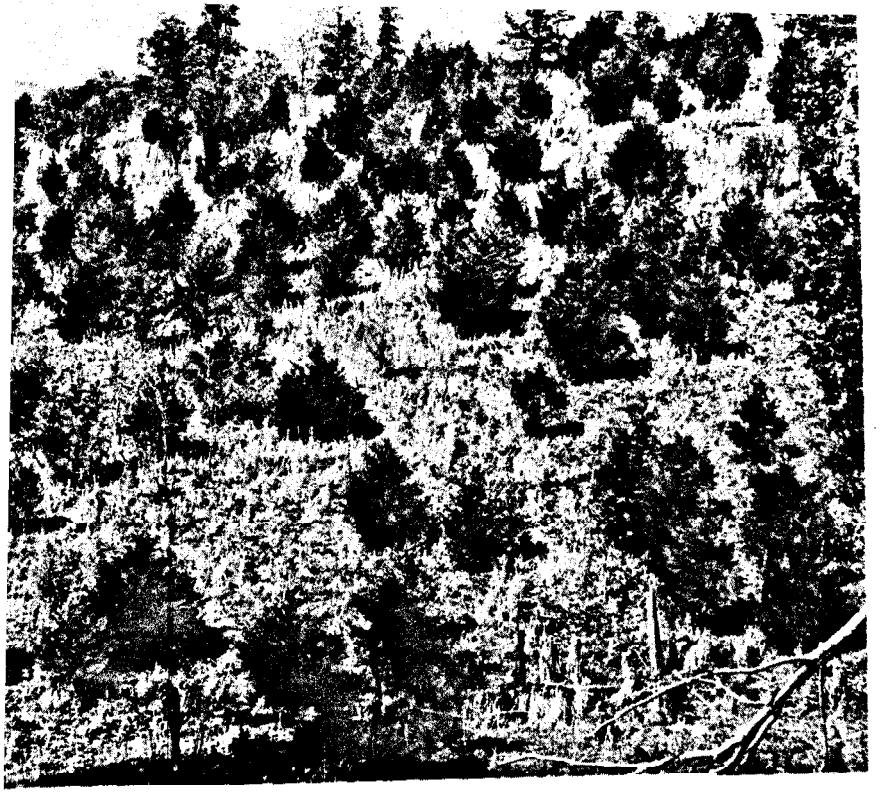
On deep soils, it is usually crowded out by vigorous hardwoods and pine after a single rotation. On shallow soils, redcedar competes more successfully, because hardwood growth is sparser and less vigorous.

Meade (30) attempted to convert low-grade hardwood stands to redcedar by planting beneath hardwood overstories ranging from 0 to 56 square feet per acre (stems 0.5 inch d.b.h. and larger). Redcedar was unable to compete with the residual hardwoods and sprouts. Meade (30) concluded that it is not suitable for underplanting where the overstory is removed by cutting or girdling, since prolific sprouting results. With more effective methods of hardwood control, such as injecting or spraying with 2,4,5-T, the results might have been different.

Eastern redcedar is relatively insensitive to foliar application of 2,4,5-T and 2,4-D at the concentrations normally used to control undesirable broadleaf vegetation. This "immunity" has resulted in the accidental conversion of quite a few acres of hardwood brush to almost pure cedar in the Arkansas-Oklahoma-Missouri junction area (fig. 8). Ranchers desiring to eliminate woody species and convert to grass indiscriminately spray with 2,4,5-T. Most hardwoods are killed back, and the redcedar thrives with release and becomes dominant.

Aerial spraying can help to perpetuate the redcedar type. On glade soils it should succeed with modest outlays. On better soils, several successive applications may be required to provide maximum release for cedar growth, and periodic treatment may be needed during the rotation.

Whether chemicals or a combination of machines and chemicals are used, it is essential to control competing vegetation in redcedar management. Complete hardwood removal is recommended.



F'igure 8.— *Redcedar* invades grasslands sprayed with herbicide to control *broadleaf vegetation.*

Growth and Yield

Growth studies in northern Arkansas indicate that even-aged management is suitable for eastern redcedar. Although growth is relatively slow on glade sites, small sizes of products and large latitude in acceptable defects make short rotations possible. A cutting cycle of 6 to 10 years is suggested. Observations indicate that 20 to 30 years will be required for posts, and 40 to 60 years for sawtimber. Greatest yields will probably accrue from sawtimber rotations with intermediate cuttings for posts, although post rotations appeal to many farmers.

Arend and Collins *(7)* provided some of the earliest data on diameter growth by site class in natural redcedar stands (table 2). The classes mentioned below are those described in table 1. Sophisticated analyses of Arend and Collins' (7) data yield the equations:

Site class	Total height	R^2
II	$\overline{439.46 \text{ (age)} - 178.6}$	0.908 [1]
III	$\overline{J27.75 \text{ [age)} - 133.4}$	.733 [1]

Table 3 shows the height-age relationships computed from the equations.

[1] Statistically significant at the 0.01 level.

Table *2.-Average annual* diameter growth *of* dominant trees, by site class and *stand density* [1]

Site class	Understocked	Well stocked	Overstocked
		Inches	
I	0.30	..	...
II	.32	0.32	0.15
III	.18	.17	.10
IV	.14	.12	.07

[1] Based on increment core measurements of 456 trees *(7).*

Table 3.—*Total tree* height, by age and site

Ring-count [1]	Total height	
	Site II	Site III
	Feet	
10	15	12
15	18	17
20	25	20
25	28	24
30	32	26
35	35	29
40	37	31
45	40	33
50	42	35

[1] False rings make accurate age determination difficult. Age is therefore computed from the total number of growth rings.

Height of dominant and codominant trees on the sample plots was related to d.b.h. by Meyer's method (31). The relationship between age and d.b.h. is tempered by stocking. Data were pooled for age and site classes, and equations were compiled :

Stocking	Total height	R^2
Closed	$4.5 + 76.5\,[1-e^{-0.084\ d.b.h.}]$	0.986 [1]
Dense	$4.5 + 57.7\,[1-e^{-0.09\ d.b.h.}]$	.985 [1]
Open	$4.5 + 50.0\,[1-e^{-0.08\ d.b.h.}]$	.839 [1]

where e is the base for natural logarithms.

Height growth, a reflection of soil depth and fertility, increases with stocking density (fig. 9).

Several other studies on growth and yield of eastern redcedar have been conducted in northern Arkansas. In one, improvement cuttings and partial release from hardwoods left an understocked 40-year-old stand. After 6 years, residual stocking rose from 13.5 square feet to over 24 square feet of basal area per acre. Volume growth was 160 cubic feet, inside bark, per acre on an initial stocking of about 190 cubic feet. During the study period, the areas supported an additional 6 square feet of scattered desirable hardwood basal area.

In another study, plots were established in 45-year-old redcedar stands on glades derived from alternating beds of dolomite and sandstone. These even-aged stands averaged about 5 inches d.b.h. and were considered to be well stocked for an intermediate site. The stands occupied all aspects of the upper slopes in a small drainage area. Soil depth varied from 12 to 30 inches on benches between rock ledges. Before cutting, stocking of redcedar 0.6 inch and larger ranged from 33 to 48 square feet of basal area per acre. Treatments compared heavy and light cuts with no cutting. Competing hardwoods were cut on half the plots.

Response to hardwood control was pronounced (fig. 10). The residual redcedar overstory suppressed hardwood sprout competition, even though herbicides were not used. Highest redcedar volume growth was obtained on the unthinned areas from which hardwoods had been removed. These plots yielded 28 cubic feet per acre per year during the 14-year period--double the increment where hardwoods were left. Growth on partially cut areas was 24 cubic feet on released and 13 cubic feet on unreleased plots. Heavily cut areas grew least-14 and 9 cubic feet per acre per year on released and unreleased plots.

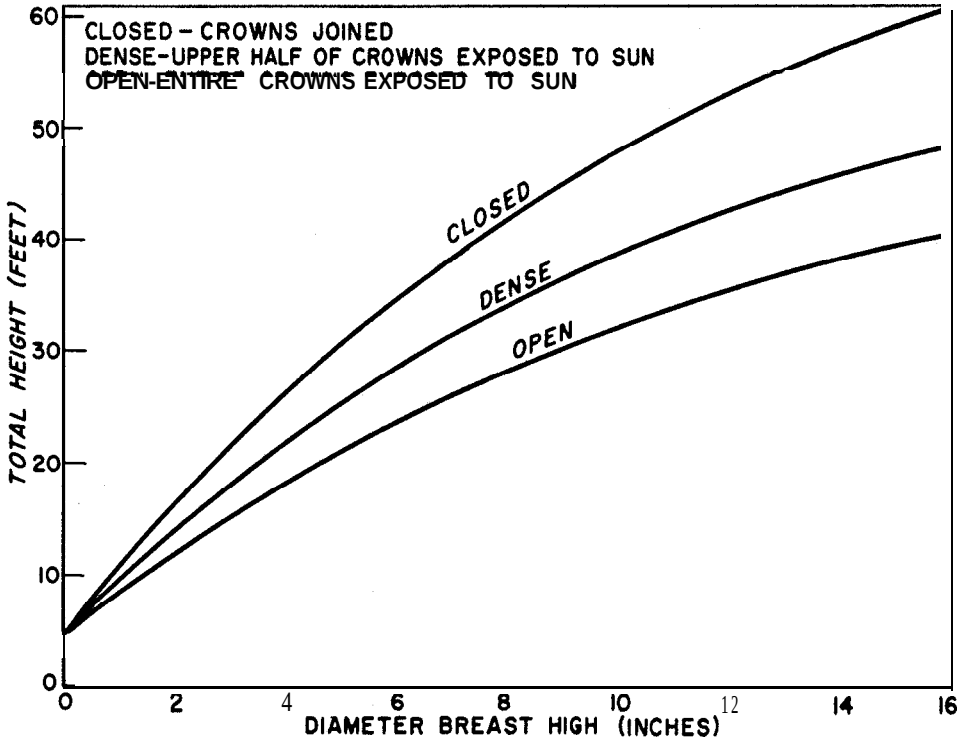


Figure 9.-Relation of height to *d.b.h.*, by stocking class.

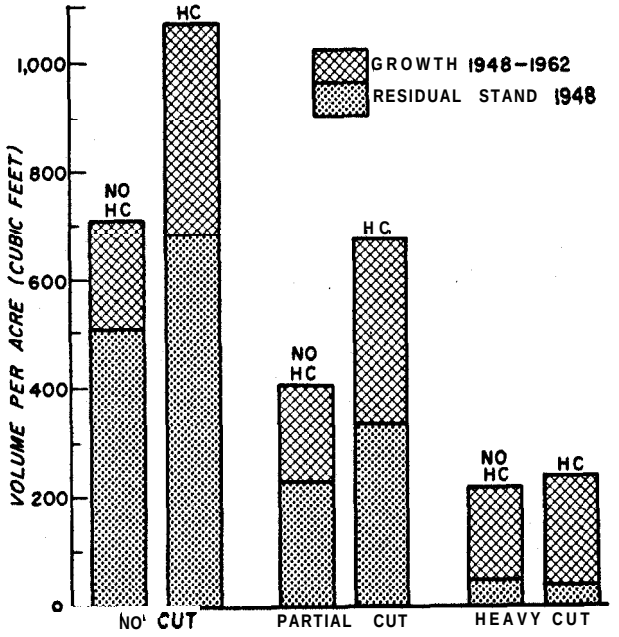


Figure 10 *(HC) and* residual **volume influence** *growth.*

The value of release in well-stocked stands of eastern **redcedar** and associated hardwoods is demonstrated in figure **11.** A stocking of 175 crop trees, 3.0 inches d.b.h. and larger, with 80 percent of the competing vegetation removed had about the same **14-year** total growth as 440 trees which had not been released.

Over a lo-year period in northern Arkansas, completely released plots averaged higher d.b.h., basal area, and volume growth than plots where only crown competition was removed. Table 4 shows that the greatest mean diameter increase occurred with the lightest stocking, 50 crop trees per acre; as stocking increased, mean d.b.h. growth decreased. The greatest basal area increase was on plots stocked with 400 crop trees per acre, and as stocking decreased basal area and volume growth decreased.

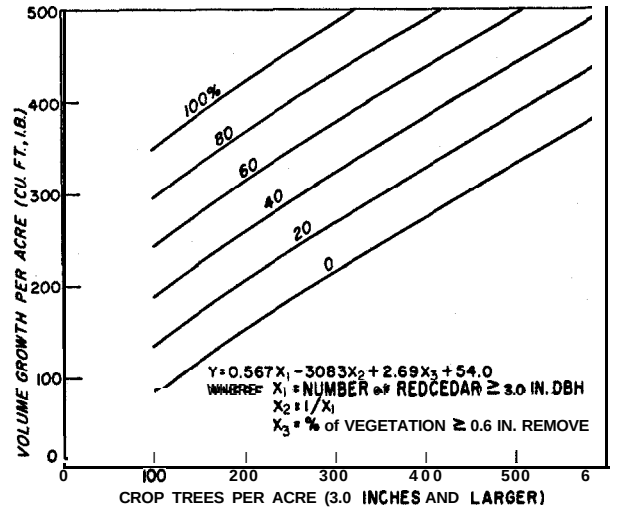


Figure 11.—Relation *of volume growth to stocking and percent of release.*

Table 4.—*Growth* of *eastern redcedar crop trees* **after release, 1955-l 964**

Stocking (crop trees per acre)	Release	D.b.h.	Basal area	Volume [1]
		Inches	sq. *ft.* per acre	*Bd.* ft. per acre
400	Complete [2]	1.8	32.7	2,180
	Partial [3]	1.3	24.9	1,570
175	Complete	2.2	21.1	2,340
	Partial	1.8	16.1	1,760
50	Complete	2.5	7.9	940
	Partial	2.4	7.1	720

[1] **International ¼-inch rule, revised.**
[2] **Removal of all woody competition.**
[3] **Removal of trees overtopping or competing with crop-tree crowns.**

An initial stocking of 400 eastern **redcedar** crop trees per acre, averaging about 3 inches d.b.h., produced over 2,000 board feet per acre (International **¼-inch** rule, revised) in 10 years. A stocking of 175 **4-inch** redcedars produced slightly more board-foot volume on similar sites in the same period.

Post production is maximized by maintaining relatively dense stands. Sawtimber production can be hastened, possibly at some expense in total yield, by thinning one or more times before the harvest cut. The ideal density for growing saw logs is not known, but drastic thinning must be avoided to prevent excessive formation of **sapwood.**

Marketing the Crop

For a variety of reasons, many farmers harvest **redcedar** themselves. Their equipment is usually large enough to handle typical logs, and posts are often needed on the farm. Wages from logging are good, and the **redcedar** volume on most farm **woodlots** is not large enough to attract a logging contractor. In harvesting,

it is usually most profitable to cut as many logs as possible, then convert the remaining material into posts.

Saw logs are generally bucked into lengths of 8 feet 3 inches, including a trim allowance of 3 inches. Grade specifications permit sound knots, white streaks, and tight, firm pitch, but wood must be sound. Lumber grades are based on the proportion of a board that will yield sound cuttings, with certain limits of length, width, and proportion of sapwood. Variations in thickness are permitted, and odd lengths are admitted without limit.

Redcedar grades allow shorter and narrower boards than are provided by standard log rules, and special rules have been developed to furnish estimates of log scale. A rule that comes close to mill tally is the revised International ¼-inch rule prepared by Grosenbaugh and Arend (19) and compiled in table 5.

The merchantable portion of cedar trees is not affected by number of limbs, and thus, trees can be worked into products to a fixed minimum top diameter-5.6 inches for saw logs and 2.6 inches for posts. Tree taper is influenced primarily by stand density; it is greatest in open-grown trees. Estimates of log taper are shown in table 6, which was compiled from dense redcedar stands on the Koen Experimental Forest in Newton County, Arkansas.

Standard length of a post is 6 feet 8 inches, including a 2-inch trim allowance. Value is governed by the diameter at the small end, if round, and by perimeter at the small end, if split. Split posts have a greater value than round posts of the same perimeter, because they have more decay-resistant heartwood exposed. Post values are not proportional to cubic- or board-foot contents, and hence, estimates must be made in terms of pieces. Round

Table 5.—*Volume of 8-foot logs* to *nearest board foot, by scaling diameter (i. b.),* revised International ¼ -inch rule [1]

Diameter (inches)	Diameter (tenths of inches)									
	.O	.1	.2	.3	.4	.5	.6	.7	.8	.9
	Board feet									
5	8	a	9	9	9	10	10	11	11	11
6	12	12	13	13	14	14	15	15	15	16
7	16	17	18	18	19	19	20	20	21	21
8	22	23	23	24	24	25	26	26	27	28
9	28	29	30	30	31	32	32	33	34	35
10	35	36	37	38	38	39	40	41	42	42
11	43	44	45	46	47	47	48	49	50	51
12	52	53	53	54	56	57	57	58	59	60
13	61	62	63	64	65	66	67	68	69	70
14	72	73	74	75	76	77	78	79	80	82

[1] $0.40D^2 - 0.52D + 0.53$ for 8-foot section from Grosenbaugh and Arend (19).

Table 6.—*Average* diameter (Lb.), at the *small end, of 8-foot saw logs cut from* trees on *the Koen* Experimental Forest, Newton County, Arkansas

D. b. h., o. b. (inches)	l-log trees	2-log trees		3-log trees		
		1st log	2nd log	1st log	2nd log	3rd log
	Inches					
7	6.0	6.2	5.6	...	.	.
8	6.5	6.8	5.7	6.8	6.4	6.0
9	7.1	7.6	6.0	7.6	6.9	6.1
10	7.8	a.4	6.2	a.4	7.4	6.2
11	a.5	9.2	6.5	9.2	8.0	6.4
12	9.1	10.0	6.8	10.0	8.5	6.5
13	9.9	10.8	7.1	lo.8	9.0	6.6
14	10.6	11.5	7.3	11.5	9.5	6.7

posts larger than 5 inches at the small end are generally split to increase yield and value. Table 7 indicates the typical yield of split posts from round bolts. Table 8 shows the average post output of trees, by d.b.h. and merchantable height, on the Koen Experimental Forest.

Table 7.—*Number* of split posts and perimeter of posts to be expected from *redcedar* bolts, by diameter

Top d. i. b. (inches)	Split posts	Perimeter
	Number	*Inches*
6	2	9-12
7	2	9-12
8	4	14
9	4	15.5
9	6	12
10	4	17
10	6	13
11	4	14
12	6	12
13	6	17.5
13	8	14
14	8	16
15	8.	17

Table *B.-Average* number of split and round red-*cedar posts* obtainable per tree, by d.b.h. and merchantable height, Koen Experimental Forest

D. b. h. (inches)	Merchantable height [1]			
	6'8"	13'4"	20'0"	26'8"
	- - - - - Number - - - - -			
4	1	2		
5	1	2	3	
6	1	2	3	4
7	2	3	4	5
8	3	4	5	7
9	3	4	5	7
10	4	5	6	8
11	4	5	6	8
12	6	7	8	10

[1] To minimum top d. i. b. of 2.6 inches.

In northern Arkansas, the prevailing price for **redcedar** saw logs delivered to a mill is about $80 per thousand board feet. For small volumes, most mills pay per piece, rather than per board foot. Representative prices for logs 8 feet 3 inches long in 1968 were:

Top diameter (inches)	Price
6	$0.80
8	1.45
10	1.90
12	2.60
14	3.60

Many communities do not have buyers for both saw logs and posts, but it is usually possible to find several prospective buyers for delivered wood in surrounding communities. Particularly when a large volume is being sold, comparing the offers of all possible purchases is worthwhile.

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