

Date 4/2/96
Amount 351-4
Sheet 48
Inv 41069

The Woodland Workbook

Stand Management



Managing Red Alder

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Although softwoods get most of the attention, red alder is a major wood product of the coastal Northwest. Under certain conditions, you should consider alder as an alternative forest crop on your property. When young, it can grow faster and outproduce any Northwest conifer. Its wood has uses in almost every part of the forest products industry. In addition, alder can improve site fertility by adding nitrogen to soils deficient in nitrogen.

This publication answers some important questions about red alder management. It should help you make better decisions about alder in your forest.

This publication is arranged so that you first can answer the question of *when to manage alder* by examining some of the critical decisions in alder management. This will help you focus on specific management activities appropriate to your property. Next comes a section on *how and where alder grows*. This information forms the base for management recommendations. Understanding alder ecology will help you adapt the last section, *management activities*, to your needs on your property.

A word of caution. These management recommendations represent

our current understanding of alder. Where statements seem vague, you should understand that the information needed to be more precise is not available yet. The interest in and study of alder is relatively recent. Over the next several decades, our understanding should improve greatly.

When to Manage Alder

Under what circumstances would you choose to manage alder? We have tried to simplify your decision-making by placing your situation in one of three possible starting conditions. Begin with a review of what vegetation currently is growing on the site where you are considering alder management.

There are three likely conditions: bare ground (or an existing stand about to be harvested), a young alder stand, or a mature alder stand. The following sections will lead you through the decisions associated with each starting condition.

Bare ground

If you have bare ground or are about to harvest a stand, planting red

alder is one of your regeneration options. There are a variety of reasons you might do so.

First, because alder grows so fast when young, you can expect to harvest trees in 30 years. For many small forest land owners, the ability to plant, tend, and harvest a stand in a lifetime is very attractive as well as financially important.

Second, some forest land is infected with the fungus *Phellinus weirri* (laminated root rot), making conifer management risky. This fungus lives in the stumps and roots of infected conifer trees after they die or are cut. All hardwoods are immune to the laminated root rot.

Before planting in areas infected with laminated root rot, identify the area of infection (see your State forester or the June 1984 *Journal of Forestry*). Then plant throughout this area and on an additional 50 feet in every direction. Since alder is immune to the root rot, you can expect to return to managing conifers after 30 to 60 years—when the infected stumps have rotted away.

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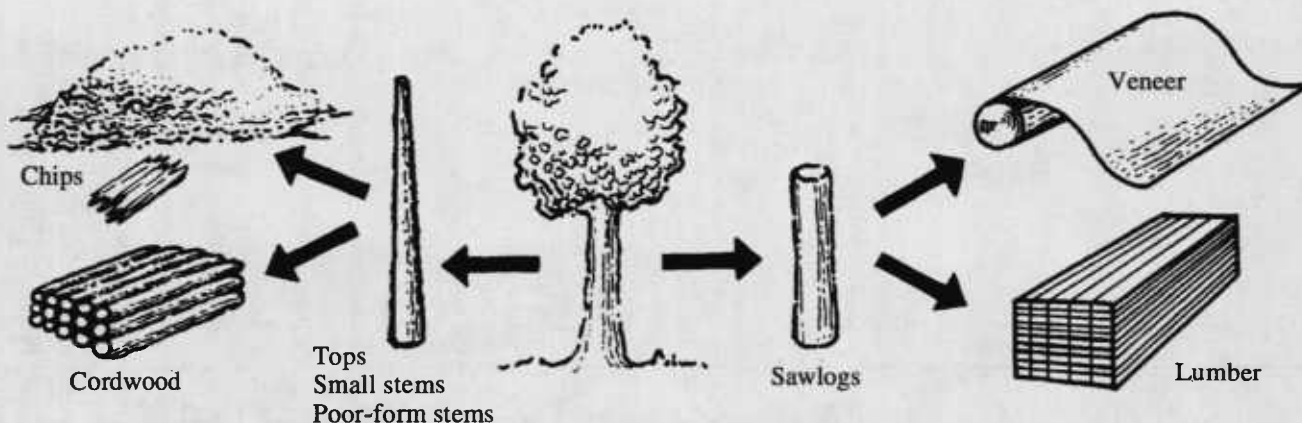


Figure 1.—Alder products.

On most sites in the Coast Range, alder is the best choice among hardwoods for reforestation. Some conifers have a degree of resistance to the root rot, but their presence will maintain the fungus on the site.

Third, alder planting may be desirable on upland sites too wet for Douglas-fir and hemlock. These are upland sites where you can see standing water for up to several weeks in the winter, and the soil does not have much clay in it. Redcedar also can be grown, although more slowly than alder, on some of these sites. Base your choice on local markets and desired rotation lengths.

There are a variety of other reasons to manage red alder, ranging from aesthetics to soil fertility management to wildlife habitat. All are good reasons to try your hand at red alder.

Young alder stands

Where young alder is established and growing, you may wish to accept what you have and manage it. The age of the alder, your financial goals, and local market conditions are all factors critical to deciding what to do.

The decision to be made with young stands is whether to keep and manage them to maturity, or remove them and replace them with conifers. Replacement is called *conversion* (see EC 1186, *Converting Western Oregon Red Alder to Productive Conifer Forests*).

Most of the reasons to keep and manage young red alder are the same as those for planting red alder, as discussed above. In addition, converting to conifers costs money. You may have concluded that planting red alder

is not a good investment for you. However, if you add the costs of conversion into the analysis, you may decide that keeping and managing the alder is the best strategy.

If you do decide to keep your alder then you should manage it. Management activities like thinning can correct uneven spacing and speed up the growth of the remaining stand. Your trees will get bigger faster, and this will pay you back in two ways:

1. The trees will reach harvestable size sooner.
2. A board foot in a large diameter tree is worth more than the same board foot in a small tree because harvest costs are reduced and quality is higher.

Thinning is discussed in more detail later.

Mature alder stands

These are trees ready to harvest. To determine what size of tree is considered mature, contact your local alder buyers. They can tell you what size tree they want and how price varies with size. The discussion in the next section of some of the products, and conversion factors between products, will help you decide.

Markets

In western Oregon, alder is chipped for pulp, peeled as veneer for plywood core stock and face veneer, sawn for lumber, and burned to heat homes (Figure 1). For most landowners, both sawlog and chip markets will be available.

Smaller trees—less than 8 to 10 inches in diameter at breast height (d.b.h., 4.5 feet above the ground)—usually are chipped for pulp or cut for fuelwood. Trees of this size may come from thinning a stand or harvesting a whole stand when it is young. Alder veneer mills accept a wide diameter range, from 6 to 24 inches for 4- or 8-foot bolts. Quality is important. Logs must be reasonably straight, and knots should not be rotten or loose.

Sawmill operators prefer logs at least 22 feet long and at least 6 inches in diameter at the small end. Again, quality is important. The value to the sawmill is in the number of long, relatively knot-free boards they can cut. They make little or no money on boards suitable only for making into shipping pallets.

When you have a choice of markets for your alder, you may receive price quotes that are difficult to compare. Chips and chip logs may be sold by the green (wet) ton, the bone dry unit, and the cunit; sawlogs by the thousand board feet (MBF), the cubic foot, and the cunit; and fuelwood by the cord, the green (wet) ton, and the cunit.

References to Other Publications

When you are referred to another OSU Extension Service publication, or to one from another publisher, you will find additional information in "For Further Reading," page 8.

Obviously, it can be confusing to decide whether \$40 per green ton or \$400 per thousand board feet (MBF) will return you more money. Table 2 gives some rules for converting one type of measurement into another. For example, since there are about 150 board feet per green ton, \$40 per green ton is equivalent to getting about \$267 per MBF ($\$40 \div 0.15$ MBF per ton). So \$400 per MBF is the better deal.

Some of these conversion factors are approximate. For more information, see EC 1127, *Measuring Timber Products Harvested from Your Woodland*.

How Alder Grows

Red alder grows along the Pacific coast from Alaska to central California. In Oregon, it is found in the Coast Range and on the west side of the Cascade Range below about 2,500 feet elevation. Within this range, it is found almost everywhere the soil has been disturbed recently.

Red alder frequently is seen growing along stream banks and in river bottoms. From this observation, many people have concluded that alder prefers these wet sites. It's true that alder can tolerate fairly wet soils, but its occurrence along water courses largely is caused by the regular soil disturbance there. Alder will grow best on well-drained soils with a good moisture supply. Away from the coast, south-facing slopes or shallow soils may be too dry to grow alder.

A good alder site is not the same as a good Douglas-fir site. Alder grows best on land with a Douglas-fir site class of II or III. However, not all site II and III land is good alder land. Alder seems to grow best on soils with slightly restricted drainage. In part, the reason for the poor relationship between alder and Douglas-fir site classes may be that alder growth does not depend on soil nitrogen levels. Alder has the ability to convert nitrogen from the air into a biologically useful form.

The seed of alder is small and light. An ounce of seed could produce enough seedlings to plant 120 acres. Because the seed is so light, it is carried several hundred yards by the wind. Disturbed sites generally are seeded by alder within a couple of years. Alder seeds require a mineral

Total height (feet)

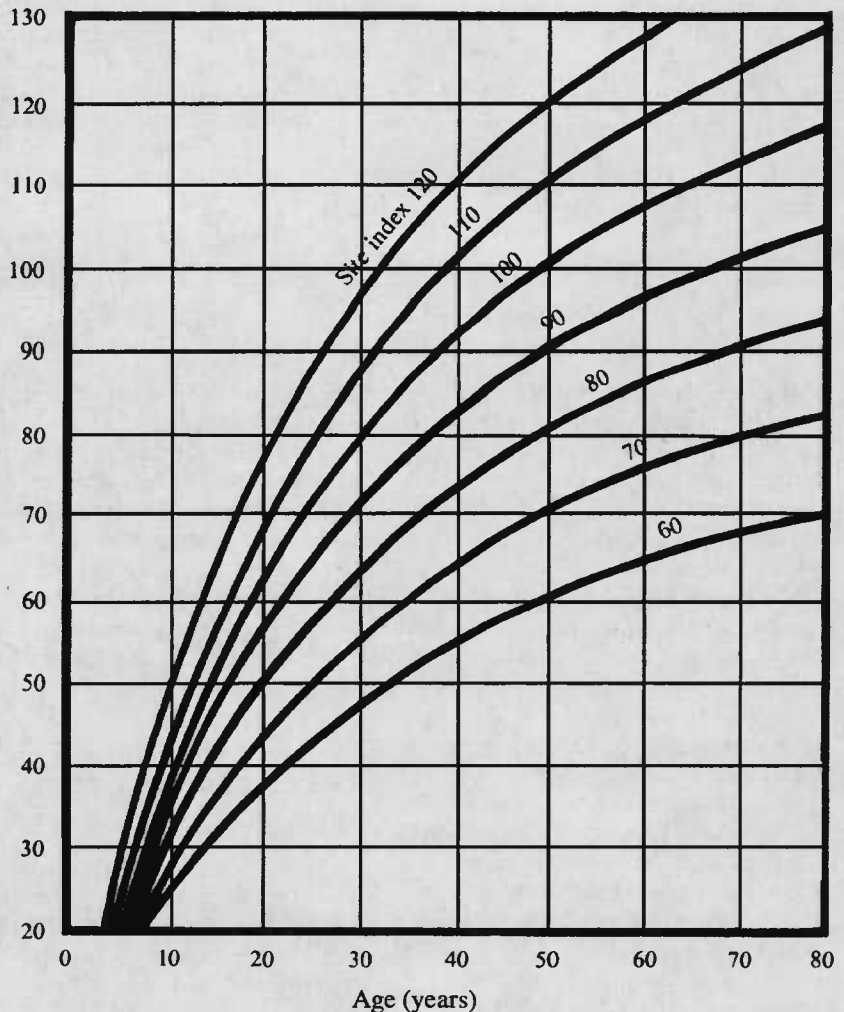


Figure 2.—Site index curves, showing height growth of red alder on sites of different quality (adapted from Worthington and others, 1960; see "For Further Reading," page 8).

Table 2.—Conversion factors for volume and weight of red alder. (D - Definition; R - Range; E - Estimate) Note: most of these figures are approximate.

Unit	Source	Conversion factor
Cord	D	a 4 x 4 x 8 foot pile of logs
Cord	R	80 to 90 cubic feet of solid wood
Cord	R	about 3,500 to 5,000 pounds of wet (green) wood
Cord	E	about 2,000 pounds of dry wood
Unit	D	200 cubic feet of chips
Unit	R	70 to 80 cubic feet of wood
Cunit	D	100 cubic feet of solid wood
Green ton	D	2,000 pounds of wet wood or chips
Green ton	R	about 120 to 180 board feet
1,000 board feet	R	about 5 to 8 wet tons
1 pound of wet alder	R	about 0.5 to 0.6 pounds of dry alder
1 cubic foot of wood	R	3.5 to 5.5 board feet of wood
1 cubic foot of wet alder	R	38 to 50 pounds of wet alder
1 cubic foot of dry alder	D	23 pounds of dry alder

Table 1.—Normal yields for red alder, cubic feet per acre (adapted from Worthington and others, 1960; see "For Further Reading," page 8).

Age (years)	Site index (feet)				
	80	90	100	110	120
10	—	120	240	350	470
20	1,320	1,620	1,930	2,240	2,540
30	2,430	2,930	3,420	3,920	4,410
40	3,350	4,030	4,720	5,400	6,080
50	4,060	4,940	5,810	6,680	7,560

soil to grow a seedling that will survive the first summer. Seedlings do poorly in undisturbed leaf, needle, and twig litter.

Full sunlight is required for good growth. Even a little shade can reduce growth considerably. Alder trees also tend to grow toward the light. If spacing of trees is uneven or simply if the trees are on a steep slope, they will not grow straight. This reduces tree value.

When young, red alder can grow incredibly fast. On an average growing site, a 10-year-old tree may be 35 feet tall (Figure 2). On the best sites, it can be 50 feet tall. This is much faster growth than seen in Douglas-fir, Sitka spruce, or hemlock at this age.

But alder cannot keep up this growth rate. At age 10, it already is slowing down. By age 25 on an average site, the rate of height growth is less than half of what it was at 10 years. This can give shade-tolerant conifers like hemlock and Sitka spruce a chance to catch up. By age 80, alder is beginning to show the infirmities of old age.

The wood yield of a stand is determined by both site quality and age. You can find the site quality (site index) of your alder stand by measuring its age and height and selecting the nearest site index line in Figure 2. For example, if your stand is 20 years old and 70 feet tall, the site index is about 110.

You also can use this information to predict how much wood is in your stand. Table 1 is a yield table. That is, it will tell you how much wood your stand can yield at a given age if it's

fully stocked. You know your stand is fully stocked if some trees are suppressed and dying. Following the example used above, at 20 years old and a site index of 110, you would expect to have about 2,240 cubic feet (28 cords) of wood per acre. This figure can vary a lot from stand to stand, depending on starting tree density, damage and disease, and management practices.

Regeneration and Stand Management

The publication, *Red Alder: Guidelines for Successful Regeneration*, provides good guidance on site selection, seedling stock quality, establishment, and competition control.

Natural regeneration

Examples of the natural regeneration of alder can be seen almost everywhere in western Oregon. It appears as if every time a vehicle or log scratched the ground, alder magically appeared. We know that the disturbance actually opened up a mineral seedbed for alder, the seed blew in, and the seedlings grew.

While this process seems to have been so easily accomplished by accident, few people have had experience in deliberately establishing natural alder regeneration. Two factors seem to be critical:

1. A *nearby seed source*. Seeds probably travel several hundred yards in the direction of the prevailing winds.

2. A *mineral seedbed*. This can be produced in the course of logging operations by normal traffic and logs dragging over the site. Scarification (disturbing the soil surface) with a brush blade or rock ripper also can be conducted separately if necessary. To produce straight trees, this mineral seedbed must be evenly distributed over the site.

Planting

Alder planting is done in mid-March to mid-April. Seedling care and planting requirements are similar to those of other tree seedlings (see EC 1095, *Seedling Care and Handling*, and *Red Alder: Guidelines for Successful Regeneration*).

Space seedlings as evenly as possible. Plant 400 (10 x 10 foot) to 540 (9 x 9 foot) seedlings per acre.

There are a growing number of commercial sources of alder seedlings. Wild seedlings transplant well if you carefully pull or dig them from a recently cut bank or fill area. Be sure to obtain permission from the landowner before removing seedlings.

Spacing

Dense natural alder stands should be spaced between age 1 and 4. That is, you can remove a portion of the trees to provide a larger and more uniform spacing of the remaining trees. Leave about 400 trees per acre. Too few trees will reduce the natural pruning of branches. Uneven spacing will result in crooked trees.

Trees to be removed can be cut near the ground and left. Stumps will

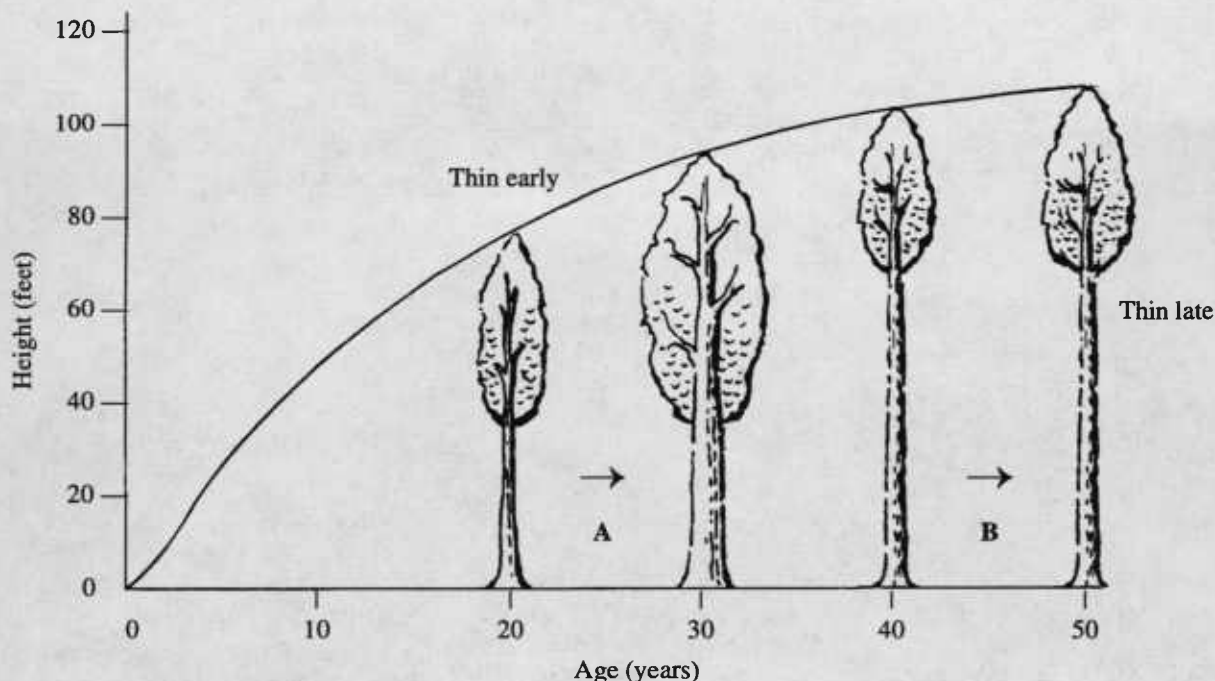


Figure 3.—Red alder thinning response, showing that early thinnings (tree A) produce greater crown and diameter-growth effects than later thinnings (tree B).

sprout but will die in a few years for lack of sufficient light.

Thinning

Thinning in alder and other hardwoods can greatly increase the value return from a stand. A thinning removes some of the trees to increase the amount of light, moisture, and nutrients available to the remaining trees. These trees develop larger crowns and so grow more rapidly in diameter. The trees left after a thinning, then, should be of the best quality so that additional growth will produce wood of high value. *Thinning: An Important Timber Management Tool* (PNW 184) will give you more information on the general principles of thinning. *Density Management Guide for Red Alder* will give you specific guidelines for red alder.

When alder is crowded together, the lower, shaded branches die. This improves stem quality by getting rid of branches while the stem is still small. In the long run, however, crowding produces a tree with a small tuft of a crown at the top of a long

thin stem. These trees have a long branchless bole (good) but little diameter (not so good). Another choice is thinning early to allow early crown expansion, to increase stem diameter, and to slow or stop the branch-pruning process. This results in large diameter (good) but short boles (bad).

The proper strategy in hardwood management is to delay the first thinning until a sufficient length of branchless stem is produced and then thin to accelerate diameter growth. While the first thinning should be delayed, do it early enough to leave trees that have not slowed too much in height growth (Figure 3, tree A). These trees can increase their crown size by growing up as well as out. The crown of an older tree that is released by a thinning can grow out, but it is much slower to develop additional crown depth (Figure 3, tree B).

Because it's growing faster in height, the small tree will develop a larger crown, and so it increases its diameter growth faster and to a greater degree (for more discussion of hardwood management, see EC 1183, *Managing Hardwood Stands for Timber Production*).

So the first thinning must come before height growth slows too much. It should be delayed, however, until the trees have at least 22 feet of branchless stem (merchantable height). On a site index 90, this occurs between age 15 and 20. On higher quality sites (faster growing), a thinning might be done sooner. Talk with your local sawmill buyer to learn just what merchantable height you should be aiming for. Most mills pay more for logs over a certain length.

Thinnings in alder probably will be precommercial. That is, they will cost you money. The size and volume of wood to be removed typically are small and of low value. It's difficult to make a profit in this situation.

Thinning level

The number of trees you want to leave in a stand depends on how big they are. You will need to measure the stem diameter at breast height (d.b.h.) of several trees to get an estimate of average stand d.b.h. When you choose trees to measure, select those that are *part of* the main canopy, not trees that are below the canopy.

Table 4.—Desired stand density after thinning, based on average tree volume.

Average tree diameter (inches)	Density after thinning			
	Maximum		Minimum	
	Density (trees per acre)	Spacing (feet)	Density (trees per acre)	Spacing (feet)
3	1,300	5.8	760	7.6
4	850	7.2	470	9.6
5	570	8.7	310	11.9
6	450	9.8	250	13.2
7	330	11.5	190	15.4
8	280	12.5	160	16.5
9	230	13.8	130	18.3
10	200	14.8	110	19.9
12	150	15.2	—	—
15	110	17.7	—	—

Next, go to Table 4 and find your average tree diameter in the left column. Read across to find how many trees you should have for this tree size. For example, your 5-inch average tree corresponds to about 310 trees per acre. If you have as many or more trees than the maximum listed, then a thinning is needed. If you have fewer, let the stand grow.

To be practical, you do not go into a stand every year to remove a tree or two to maintain the required density. In practice, figure on thinning your stand every 10 to 15 years.

You may prefer to thin your stand only once between planting and harvest. The timing of this single thinning will vary with site quality and product goals, but will range between 8 and 20 years of age. The earliest thinning probably is when the trees have 22 feet to the bottom of the live crown.

The spacing of this single thinning will vary with target diameter. For example, if your target diameter is 12 inches, thin to 150 trees per acre (Table 4).

Because alder tends to grow toward the light, you must space the remaining trees evenly. If you do not, trees will become crooked as they grow toward the spots with more light.

Remove trees that are crooked, forked, damaged, or small-crowned (Figure 4). In our earlier example, where the goal is 310 trees per acre, the first priority would be to remove all the crooked trees, then the forked, then the damaged, then the small-crowned. Using this priority list, you

will remove trees until there are 310 left. You may leave some of these less than desirable trees to keep your total at 310 and your spacing even. By your next thinning, they will make even bigger firewood or other useful product.

Thinning techniques

Thinnings may be done mechanically or chemically. If the stand is young (with hundreds of small stems), a tool like a brush saw is the most efficient method. In older stands, to cut large stems with a chain saw

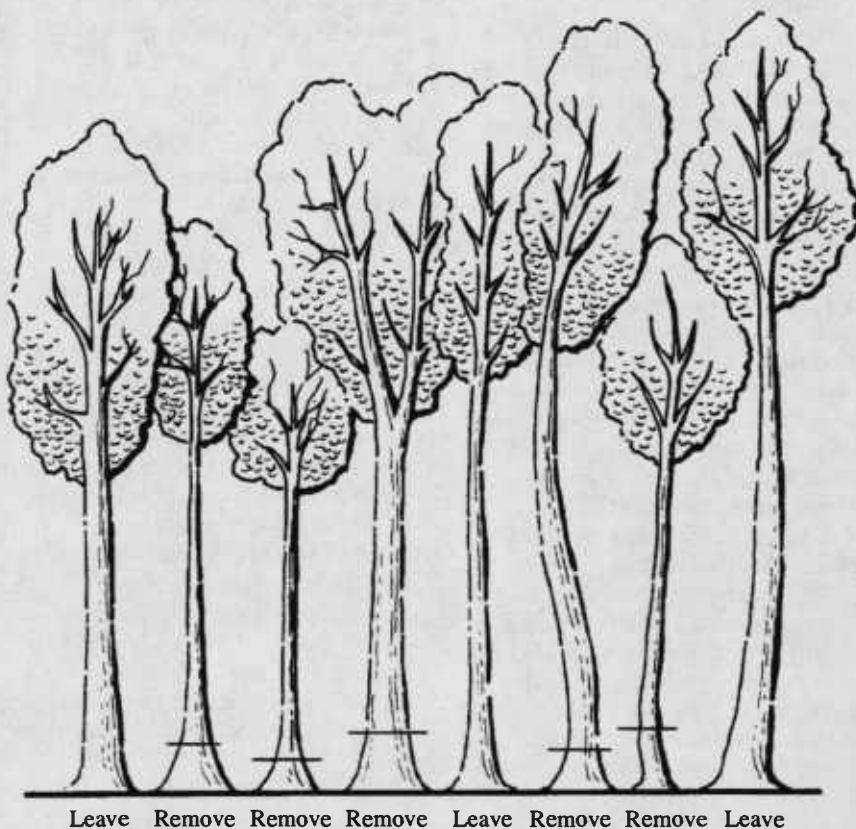


Figure 4.—Leave trees should be spaced evenly. Remove crooked, forked, damaged, or small-crowned trees.

requires more labor than chemical injection. Alder can be killed by placing $\frac{1}{4}$ teaspoon of half strength 2,4-D in axe cuts made every 3 to 6 inches around the stem. Treat in June or July for best results. (The 1986 Oregon Forest Practices Act requires you to make an application for use to the Oregon Department of Forestry at least 15 days before your intended use.)

Do not treat trees within 4 feet of an alder tree that is to be left after the thinning. Injecting trees close to your crop trees can result in flashback, a situation where the herbicide can be taken up by untreated trees through root grafts. Any tree you plan to remove that is less than 4 feet from a leave tree must be killed by cutting or girdling. A great advantage of chemical injection or girdling over cutting down larger trees is your ease of movement within the residual stand. Injected and girdled trees die and fall slowly.

Take great care when you are thinning in alder to prevent damage to any tree to be left. It's very easy to injure or remove pieces of bark, and these damaged spots provide an entry for decay fungi. Winter is the best time to thin with a chain saw because that is when the bark is toughest.

Use Herbicides Safely

- **Wear** protective clothing and safety devices as recommended on the label. **Bathe or shower** after each use.
 - **Read** the herbicide label—even if you've used the herbicide before. **Follow closely** the instructions on the label (and any other directions you have).
 - **Be cautious** when you apply herbicides—and other pesticides. **Know** your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.
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Pruning

Wood quality (and so value) of hardwoods is determined by the size and number of knots in a board. Pruning branches from a tree when its diameter is still small can greatly reduce the size and number of branches on the trunk and so produce a tree of greater value.

Pruning can remove both dead and live branches. Removing dead branches never reduces tree growth. Removing too many live branches can.

A simple pruning guideline would be to (1) remove all dead branches up to the base of the tree crown, and (2) remove live branches at the base of the live crown up to the midpoint of the tree. However, you always want to leave at least the top half of the tree in live crown.

Pruning should aim to remove the branches from a section of trunk when its diameter is about 3 to 4 inches. You can return as often as every 2–3 years to do additional pruning. As the tree grows taller, you can remove more from the bottom of the crown.

Not all trees in a stand need to be pruned. Generally, only the 100 to 150 best trees per acre that you will keep until the end of the rotation will be pruned.

Many tools are available for pruning. Clippers and long-handled loppers are useful for small or lower branches. Saws are used for larger and hard-to-reach branches. Some saws come on long poles.

Managing Mixed Alder-Conifer Stands

Research has shown that alder and Douglas-fir can be successfully mixed on sites that are naturally low in soil nitrogen. In one stand in the southern Washington Cascades, for example, volume growth in the mixed stand was twice that of unmixed stands of either species. On the other hand, on nitrogen-rich soils, mixing can actually reduce production.

The benefit of mixing alder with conifers comes from alder's ability to fix nitrogen; its roots have the ability to convert atmospheric nitrogen (N_2) to ammonia (NH_3). Alder can fix 50 to 200 pounds of nitrogen per acre per year. The plant uses this nitrogen

within itself to grow new leaves, stems, roots, etc. When a leaf or root dies, the nitrogen it contains goes into the soil, where it can be used by other plants.

When alder is grown in soils that are nitrogen-deficient, it eventually contributes most of the nitrogen it fixes to the soil and other plants. This greatly improves their growth. On the other hand, on already nitrogen-rich soils, all the plants are already growing well, and additional nitrogen will not substantially improve their growth.

Many other nitrogen-fixing plants can be mixed in a conifer stand. Examples include clover, Scotch broom, and the shrubby Sitka alder. These species do not present the competition problem that red alder does. On the other hand, they do not fix as much nitrogen as red alder because they soon are shaded out, and they do not return an economically salable product.

Successfully mixing alder and conifers can be a tricky business. When young, alder can grow so fast that it overtops and suppresses the conifer. A management goal should be to maintain approximately equal tree heights. This is less critical with shade-tolerant conifers like hemlock and Sitka spruce, which can slowly grow up through an alder stand. They do, however, suffer a considerable growth loss when they are shaded.

To establish a mixed alder-conifer plantation, select your desired conifer seedling density (300 to 500 per acre) and leave 25 to 50 conifer planting spaces per acre empty. After a delay of 2 or 3 years to allow the conifers to become well established, put alder seedlings in these empty planting spaces. The practice of delaying alder planting helps ensure that the conifer does not become overtopped by the alder.

Space the alder evenly throughout the plantation. Spot spraying with an herbicide or scalping a 10-foot-square area with the planting tool before alder planting will be necessary to help alder establishment. You can harvest the alder as part of a commercial thinning around age 25 to 35.

For Further Reading

OSU Extension Service publications

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We offer discounts on orders of 100 or more copies of a single title. Please call (541) 737-2513 for price quotes.

Bondi, Michael C., and William H. Emmingham, *Converting Western Oregon Red Alder to Productive Conifer Forests*, EC 1186 (Oregon State University, Corvallis, reprinted 1993). \$2.00

Cleary, Brian D., and David R. DeYoe, *Seedling Care and Handling*, EC 1095 (Oregon State University, Corvallis, reprinted 1995). 75¢

Emmingham, William H., and Norman E. Elwood, *Thinning: An Important Timber Management Tool*, PNW 184 (Oregon State University, Corvallis, reprinted 1995). 50¢

Hibbs, David E., *Managing Hardwood Stands for Timber Production*, EC 1183 (Oregon State University, Corvallis, revised 1995). \$1.25

Oester, Paul, *Measuring Timber Products Harvested from Your Woodland*, EC 1127 (Oregon State University, Corvallis, reprinted 1996). \$2.00

Other publications

Ahrens, Glenn R., Alex Dobkowski, and David E. Hibbs, *Red Alder: Guidelines for Successful Regeneration*, OSU College of Forestry, Forestry Research Laboratory, Special Publication 24 (1992).

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Puettmann, Klaus J., Dean S. DeBell, and David E. Hibbs, *Density Management Guide for Red Alder*, OSU College of Forestry, Forestry Research Laboratory, Research Contribution 2 (1993).

Thies, Walter, "Laminated Root Rot—The Quest for Control," *Journal of Forestry*, July 1984, 82:345–356.

Worthington, N.P., and others, *Normal Yield Tables for Red Alder*, USDA Forest Service Research Paper PNW-36 (1960). *Out of print; may be available in some libraries.*



The Woodland Workbook is a collection of publications prepared by the Oregon State University Extension Service specifically for owners and managers of private, nonindustrial woodlands. The Workbook is organized into separate sections, containing information of long-range and day-to-day value for anyone interested in wise management, conservation, and use of woodland properties. It's available in a 3-ring binder with tabbed dividers for each section.

For information about how to order, and for a current list of titles and prices, inquire at the office of the OSU Extension Service that serves your county.

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties.

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