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The Woodland Workbook

Stand Management

Mapping and Managing Poorly Stocked Douglas-fir Stands

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A poorly stocked forest is one that doesn't have an adequate number of desired commercial trees, for its age and size, to produce maximum volume and value. In other words, these areas could be growing and yielding more timber.

Landowners sometimes find themselves with areas of forest land that grow mostly grass, brush, and deciduous trees (those that aren't evergreen). The timber production from these lands will be low, and the trees will tend to have large limbs and other quality defects that reduce their value for lumber or plywood.

Poor stocking may be the result of haphazard logging and inadequate reforestation efforts—or it may follow the failure of seemingly well-planned reforestation operation. In either case, the landowner faces a lower-than-usual potential profit and may want to consider corrective management actions.

This publication discusses how to identify and choose a management strategy for poorly stocked stands. First you'll learn how to map forest stands and describe them so you can determine if your forest property has poorly stocked areas. The mapping technique explained here will be useful in other forest management and inventory applications, too.

Second, a decision table ranks, for each of 16 types of forest stands, the 5 management options that managers commonly apply to poorly stocked Douglas-fir stands.

These options are what we consider to be the most feasible management choices—both biologically and economically—for the woodland owner. The option you choose is largely a matter of personal preference and finances. How to implement a particular option is covered in other Extension publications (see "For Further Reading," pages 7–8).

The options we outline here should help you examine poorly stocked lands with an eye to choosing among possible alternatives for management while eliminating poor choices. These are not simple, cut-and-dried choices. Many forest stands will *not* fit well into the decision table because ages or stocking levels or tree sizes may be different on your lands. For help with these situations, always consult a professional forester.

Mapping Forest Stands

The first step in deciding what to do with your forest is to map your forest areas into *types*. These are forest *stands* or groups of trees that differ from one another by their species composition, age, or number of trees per acre (stocking). For instance, a densely stocked area of 50-year-old Douglas-fir would be a different type than an adjacent densely stocked stand of 50-year-old alder or another stand of widely spaced, 50-year-old Douglas-fir.

You also can distinguish *degrees* of poor stocking. For instance, you might separate a brush patch with some scattered, 20-year-old Douglas-fir from a brush patch with no Douglas-fir. It's easy to separate distinctly different types. However, many forests are mixed together without obvious separation of different ages, species, or stocking. In these situations, the boundaries between types are indistinct. Nevertheless, you usually can separate even mixed-up stands if you look carefully.

Large landowners often won't separate types of less than 5 or 10 acres. Small landowners may be concerned

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about types of less than 1 acre. The general rule is to consider the area to be a separate type if it's different from what is around it and large enough for you to plant, thin, or log separately from the adjacent types.

In other words, if an area is too small for you to manage by itself, lump it together with an adjacent type.

There are several ways to develop a type map of your forest:

1. You can see many type boundaries quite easily on aerial photos. By double checking what you see in the photos with what is actually on the ground, you can develop a good type map. Aerial photos are available from county assessors, the Agriculture Stabilization and Conservation Service (ASCS), the Oregon Department of Forestry, timber companies, and other sources.
2. Existing type maps may be available that cover your forest. The Oregon Department of Revenue has old type maps of almost all forest land in Oregon. Did previous owners of your property make type maps or management plans? You need to be aware of changes since the type map was made, but the basic information may still be usable.
3. The Oregon Department of Forestry, the USDA Natural Resources Conservation Service, and most timber companies provide assistance to landowners. Much of this assistance is free. Contact your OSU Extension Service office or Oregon Department of Forestry office to see whether any local assistance programs could help you develop a type map.
4. A technique called *strip mapping* is especially useful where the forest is mixed in age, size, or species and is not easily separated into types from aerial photos.

Strip mapping involves making sketch maps of narrow strips of the property and then joining the strips to form a rough map of the property.

Figure 1 illustrates a strip map plan, an example of notes, and a sketch map. The strips are 200 feet wide. As "mapper," you would stand in the middle of the strip and make the sketch map from that point. You then would move ahead a measured distance, usually 100 feet, and continue the sketch map. The distance between sketch mapping points is usually the only measured distance. To increase your speed, estimate all other distances. A second person to help you measure will speed it up also.

At each sketch mapping point, make note of the site, species, and relative stocking density of the trees. Pay particular attention to changes in the forest that may be boundaries between different types. Because strip mapping often is done in areas with indistinct type differences, these changes between types may be subtle and hard to recognize. Also record and sketch other items that may be useful—roads, streams, bluffs, fences, buildings, etc.

Measuring Forest Types

Once you have mapped the types, it's important to describe them accurately. A description is important in planning any management activity, but the information needed in the description varies with each activity. For managing poorly stocked stands, the descriptive terms are *stocking, age, diameter,* and *species.*

Stocking is measured in average number of acceptable trees per acre. Age usually is rounded to the nearest 10 years. Diameter or "d.b.h." is measured at "breast height," which is 4.5 feet above the ground on the uphill side. You may lump species into evergreen or deciduous, but it's more useful to record them by individual species.

Measuring stocking, age, d.b.h., and species composition of a large forest type is not as straightforward as you might assume. On a bigger type, you probably cannot count all the trees. You must make some samples. One procedure for taking a sample is described here. You could easily substitute other procedures, but some *unbiased* sample is required.

An unbiased sample is one where you don't have any choice about where to locate a plot. It's simply human nature that if you're able to choose where a sample will be taken, you'll unconsciously choose more of one kind of area than another. This bias in timber stands usually means that you sample only the better stocked areas. The easiest way to avoid a bias is to choose sample plots on a systematic, predetermined basis.

The size and number of sample plots is something that professionals would tailor to the specific stand and their information needs. That technology is beyond the scope of this publication. The sample plan discussed below is a reliable rule of thumb that should produce good results.

Use $\frac{1}{100}$-acre circular plots (11-foot, 9-inch radius) and sample three plots per acre. On types smaller than 4 acres, sample at least 10 plots. Arrange the plots on a map before going into the field. A pattern that has plots close together in a row and rows fairly far apart is most efficient.

Make sure that the sampling plan is easy to accomplish in the woods, and that the type is well covered by plots. Don't worry if some of the plots fall in openings. That's to be expected.

It's best to use a compass and a tape measure to follow the sampling plan. A helper will make the job easier. Figure 2 on page 4 shows an aerial photograph of a typical woodland property (95 acres) with several forest types and a sampling plan prepared for that acreage.

At each sample point do the following:

1. Mark the center of the plot or have your assistant stand on it.
2. Enter the appropriate plot number (Plot #1, #2, etc.) on the note form for stand inventory (Figure 3, page 5).
3. Measure out 11 feet, 9 inches around in a circle (a string of that length is a useful tool). Record by species the trees that you encounter.
4. For each tree, measure the d.b.h. to the nearest inch. For seedlings or saplings under 4.5 feet tall, record a d.b.h. of 0. Estimate ages to the nearest 10 years, if possible. You can estimate ages by counting limb whorls or by counting annual rings on a cut stump. Use an increment borer to count annual rings if you don't want to cut a tree.
5. For each tree, record whether or not the tree is overtopped with brush or other trees and whether or not it is damaged in any way.

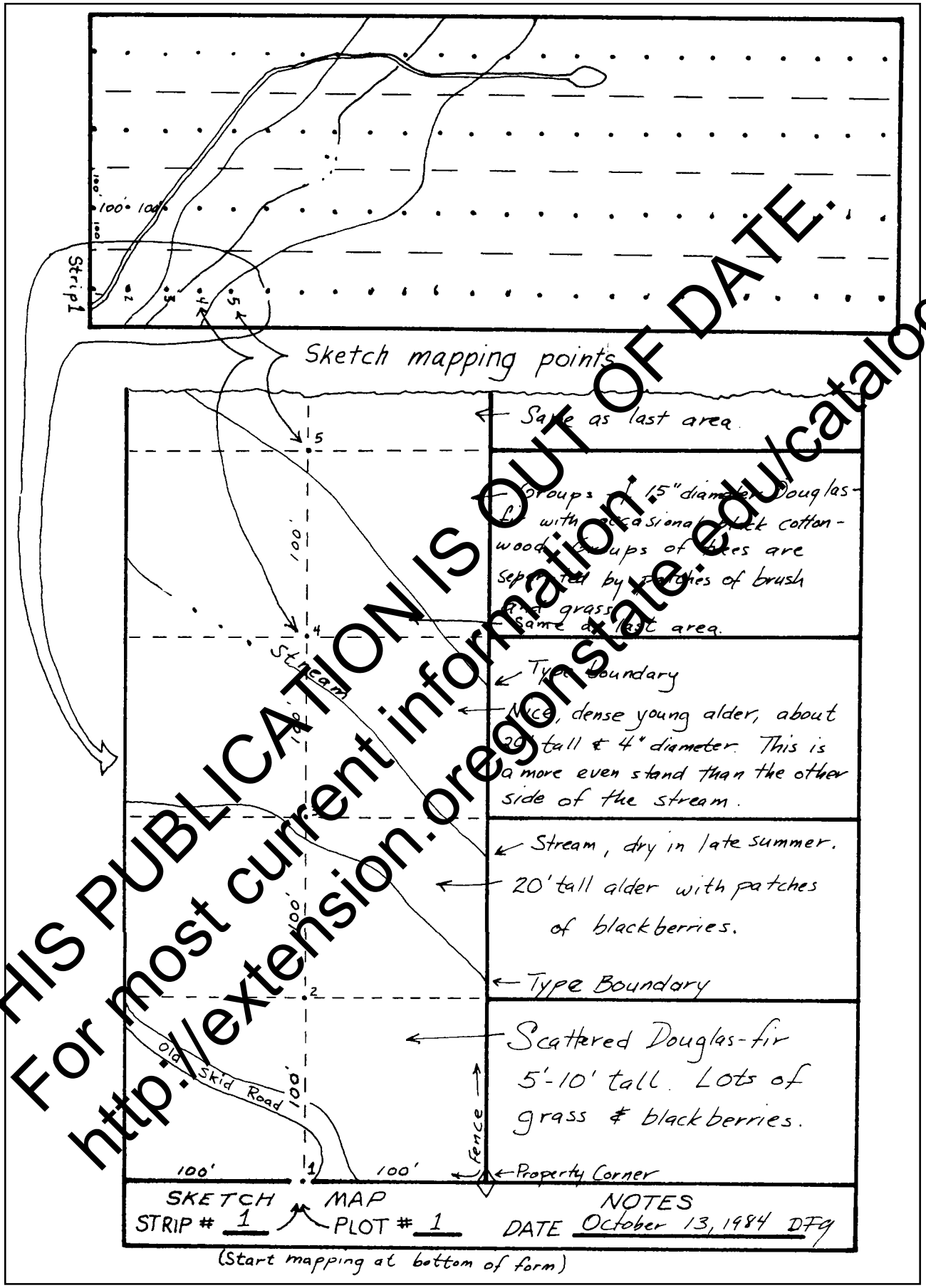
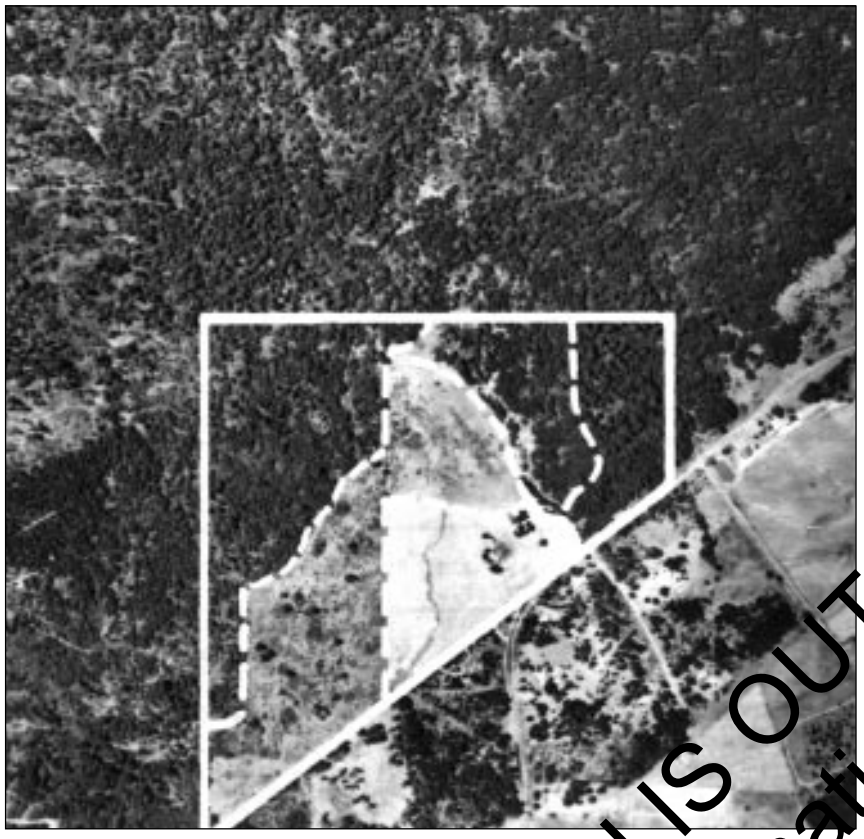


Figure 1.—*Example of a strip mapping plan and notes.*



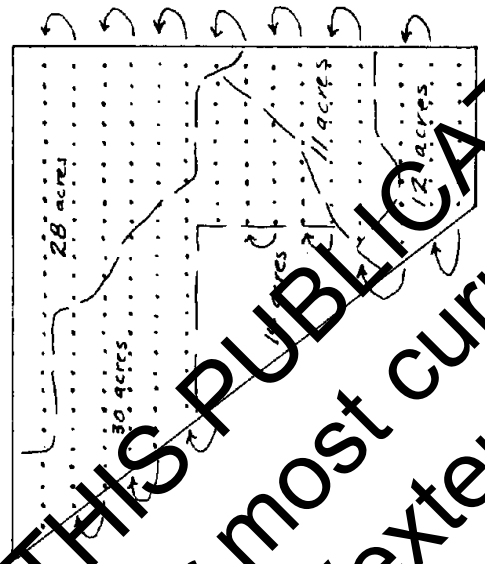


Figure 2. The aerial photograph (above) shows property boundaries in solid line and forest type boundaries in dashes. The sampling plan (left) was based on this airlift. This sampling plan gives good coverage of the four types, with rows 150 feet apart and plots every 100 feet within the row. An alternative plan might have rows 200 feet apart and plots every 75 feet within the row. This would mean less walking, since there are 25 percent fewer rows, but you might have slightly less reliable results. Both plans result in three plots per acre. Irregularly shaped types may require sampling plans that don't have parallel rows of plots. A sampling plan is likely to result in good information when it has preselected, random plots; is easy to accomplish in the woods; and adequately covers each type.

Describing Forest Types

Before you summarize your field measurements, you may need to make some adjustments. If there are some plots with many trees and some with few, the average count per plot will be deceptive. A rule of thumb is to ignore any extra stocking on a plot representing more than 400 trees per acre since this number normally is considered as maximum desirable stocking. On a ¼-acre plot, this would mean adjusting a tree count of 6 or 7 or more down to 4. Similarly, don't count any trees that are overtopped by more desirable trees, are severely damaged, or for any reason are not vigorous, healthy trees of a commercial species. Here is a list of unacceptable trees for determining stocking:

- Dead trees
- Broken, rotten, or severely damaged trees
- Overtopped, suppressed trees
- Deciduous trees (often but not always unacceptable)
- Crooked, double-topped, or excessively limbed trees (sometimes treated as unacceptable)

If you must adjust many plot counts, the area may be overstocked and in need of a thinning. Several Extension publications describe thinning (see "For Further Reading," pages 7–8).

Once you adjust data for overstocked plots and unacceptable trees, calculate the average tree count per plot in each stand type. Expand the average trees per plot to a trees-per-acre figure. When using 1/100-acre plots, multiply the average tree count by 100 to get the average number of "acceptable" trees per acre. Using only the acceptable trees, calculate average diameter and average age for each stand type.

Averaging measurements does not properly describe some stands. If a type is composed of 10-year-old trees mixed with 40-year-old trees, averaging their ages or diameters will only confuse matters. Sometimes, one of the age groups is much more common than the other. If so, your averages should use only the trees of the most common age.

Plot #	Diameter at 4.5′ (d.b.h.)	Age	Species						Condition					
			Douglas-fir	Hemlock	Cedar	Other conifer	Alder	Other hardwood	Good condition	Damaged	Deformed	Stunted	Overtopped	Extra large

Figure 3.—*Note form for stand inventory.*

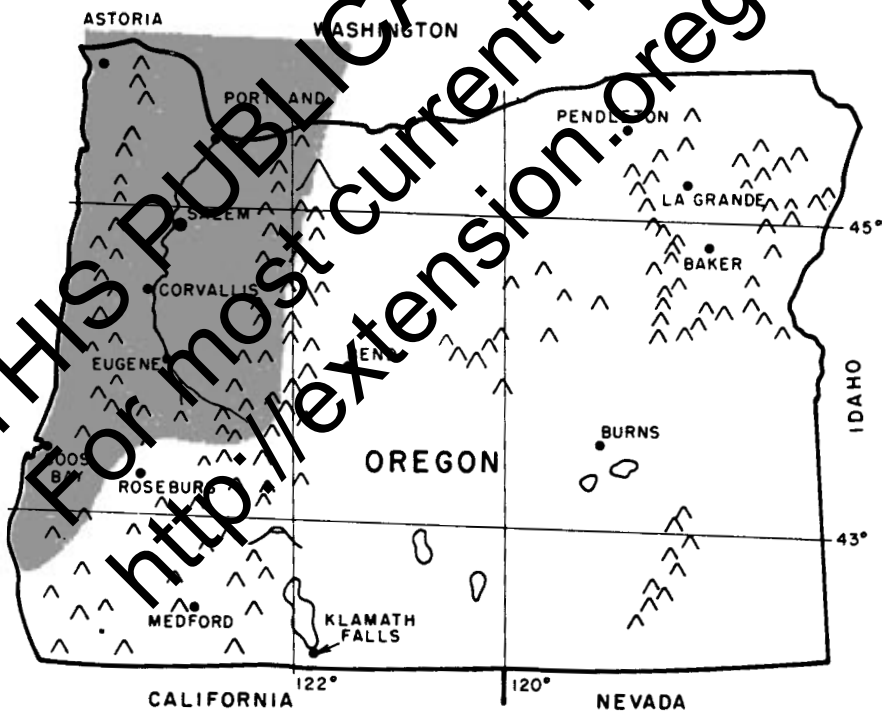


Figure 4.—*Primary area where management options may apply.*

Trees per acre should include *all* ages of acceptable trees, however. If neither age group is more numerous, temper the following management options with professional advice from an experienced forester.

How trees are distributed throughout a type can be important also. If the trees in a type are spaced evenly, the same management options likely will apply to the whole type. If trees are clumped together and the clumps are scattered throughout the type, each management option may apply to only part of the type. If possible, try to separate a clumpy type into two or more homogeneous types.

Management Options

There are five management options discussed in this publication. They apply to the areas of western Oregon shown in figure 4. They *do not apply* to areas above 2,500 feet elevation, to areas near the coast, or to many areas south of Lane County, Oregon. Even in areas where these options would otherwise be appropriate, local situations such as swampy ground or drought soils might make growing Douglas-fir infeasible.

These management options assume you have a forest that is mixed evergreen trees and deciduous trees or brush. If your stand is purely deciduous trees, you should seek professional advice rather than follow this publication. Also, publications on how to manage alder are available. Publications are not currently available for other hardwood species.

Option 1: Plant Douglas-fir

This is the simple situation where you can plant Douglas-fir in the nonstocked areas in the type (holes). Considerable brush or grass control will be necessary unless recent logging has cleared the area. Since Douglas-fir trees need direct sunlight, this option is most feasible where "holes" are at least ½ acre in size or where holes are smaller, but adjacent trees are quite young. Stocking should be brought up to 200 to 400 trees per acre.

Remember that the chances of improving poor stocking by simply planting more trees are poor. Action

almost certainly is needed to correct whatever problem has caused the poor stocking.

This probably means controlling brush and grass—and deer, rabbits, mountain beaver, or other pests. Information on brush and animal control, and on planting Douglas-fir, is available in other Extension publications (see pages 7–8).

Option 2: Encourage tolerant seedlings

This option involves techniques that encourage the growth of species that grow in partial shade, such as western hemlock, western redcedar, and grand fir. These species are referred to as *shade-tolerant.* Logging, spraying, or brush clearing creates small openings in the forest or brush canopy. These openings allow enough light to reach the forest floor to sustain the growth of shade-tolerant trees. Openings of 30 feet in diameter usually are large enough. Shade-tolerant seedlings often are established by natural seed fall or may be planted.

Option 3: Convert

Conversion refers to changing one plant community to another. In this option, the existing plant community is assumed to be mostly unmarketable-sized trees, brush, and grasses. Conversion of this type community could involve one or more of the following activities: cutting trees, piling brush, spraying weeds and stumps, and burning. The entire area is cleared, and Douglas-fir trees are planted. See "For Further Reading," pages 7–8, for information on conversion and replanting.

Option 4: Log and convert

This option is identical to option 3, except that having marketable timber is quite common and offers economics worth emphasizing. Timber sold from even sparsely stocked stands can be worth several hundred dollars per acre. Also, some desirable brush control can be expected during logging. Your logger might do additional brush control work at a price below what it would cost to bring in another contractor.

Option 5: Do nothing

This option always exists and is sometimes a good choice. The decision to do nothing is most appropriate in stands that are growing well, are nearing or just entering commercial sizes, and are stocked at or near full stocking for their age.

Ranking the Options

Table 1 shows the relative ranking of up to 4 of these options for each of 16 combinations of stocking and tree size. A table of this type can help a landowner understand which options are reasonable and which are not. Although these rankings are based on years of forestry experience, they will not be appropriate for everyone.

For instance, landowners who have steep ground may find the costs of conversion prohibitive. Landowners who object to the visual disruption that conversion causes may not want to consider it. It's a good idea to adjust the ranking of these options to account for your land and your personal objectives and constraints.

Landowners should be aware that the cost of reforestation can be substantially defrayed by several Federal subsidy and tax credit programs. Refer to appropriate Extension publications (pages 7–8) or contact local Extension or state forestry offices for more details.

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. **Know** your legal responsibility as an herbicide applicator. You may be liable for injury or damage resulting from herbicide use.

Here are two examples to show how you can use Table 1:

Example 1. You have a 20-year-old stand with about 35 scattered Douglas-fir trees per acre. What management alternatives should you consider? Table 1 shows that the first priority management alternative for this stand is to plant Douglas-fir, filling in as many "holes" as possible. The stand is still young enough and will grow for long enough until harvest that some additional stocking is recommended. (You should learn about reforestation before beginning the task.)

A second priority option is to convert the stand to a fully stocked Douglas-fir type. This possibly would mean sacrificing what growth has already occurred in order to improve future returns. You would have to make a decision here, based on your objectives or goals, money available, etc. In addition, you would need to learn about reforestation before beginning.

A third possibility is to encourage any tolerant species associated with the current stand. You would do this by releasing tolerant trees from competitors and brush, and by planting. Again, a higher level of stocking is the goal.

A fourth option—doing nothing—is not listed in this cell. Stands 20 years old, with 35 trees per acre, will lose too much potential growth and value over the next 20 to 40 years to allow this condition to continue.

Example 2. You have a 30-year-old stand with 50 Douglas-fir trees per acre scattered in small clumps. This situation is difficult to interpret using Table 1. It falls at the corner of four cells, and each cell has a different ranking of management options. Which choice is best?

Look for other stand characteristics that might favor one cell over another. Is the average diameter 10 inches or less? If so, use the column in Table 1 for the 6- to 10-inch diameter and 20 years of age.

Are the trees grouped more in one part of the type than another? If so, perhaps you should split the type in two. The more heavily stocked area would likely fall in the 51- to 75-trees-per-acre stocking or even in a more dense stocking and would be treated as such.

Table 1.—*Management options and their priority for poorly-stocked Douglas-fir stands by stocking and age or diameter*[a]

Stocking (trees/acre)	Age of Timber: 10 years	20 years	40 years	60 years
0-25	Convert Plant Douglas-fir	Plant Douglas-fir Convert Encourage tolerant species	Log & convert Do nothing Encourage tolerant species Plant Douglas-fir	Log & convert Encourage tolerant species Plant Douglas-fir
26-50	Convert Plant Douglas-fir	Plant Douglas-fir Convert Encourage tolerant species	Log & convert Do nothing* Encourage tolerant species*	Log & convert Encourage tolerant species
51-75	Convert Plant Douglas-fir Do nothing	Encourage tolerant species Plant Douglas-fir Convert* Do nothing*	Do nothing Encourage tolerant species Log & convert	*Approaching adequate stocking* Encourage tolerant species* Log & convert* Do nothing
76-100	Plant Douglas-fir Do nothing Convert	Encourage tolerant species Plant Douglas-fir Do nothing Convert	*Approaching adequate stocking* Do nothing Encourage tolerant species Log & convert	*Adequately stocked* Encourage tolerant species* Log & convert* Do nothing*
Diameter of timber d.b.h.	0-5 inches	6-10 inches	11-15 inches	more than 15 inches

[a]In each cell, the management options are listed in priority order with the highest priority first. Asterisks indicate equal priority. If one or more options are not listed, they were judged to be biologically or economically infeasible. Priorities are based on the authors' judgment, not on economic models. Management options are described more fully in the text. State law may require you to reforest property that has been logged since 1973. Contact the Oregon Department of Forestry for more information.

The less heavily stocked area would likely also fall into a more obviously appropriate cell. Once you choose an appropriate cell, your options are similar to those shown in Example 1. If the character of the stand does not allow shifting into an appropriate cell, consult a forester.

Summary

Managing poorly stocked forest land in the Douglas-fir region is largely a matter of stocking, age, or diameter—and personal choice and commitment. When an owner of poorly stocked stands in this region acts on one of the management options discussed in this publication, he or she can expect significant, long-term increases in the value and quantity of forest production. Consultation with a professional forester is wise in order to fine-tune these general recommendations for a specific situation.

For Further Reading

To order copies of the following publications, send the publication's complete title and series number, along with a check or money order for the amount listed, to:

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Bondi, Michael C., and Chal G. Landgren, *Management Planning: Why and How*, EC 1125 (Oregon State University, Corvallis, reprinted 1992). $1.00

DeYoe, David R., *Seedling Care and Handling*, EC 1095 (Oregon State University, Corvallis, revised 1996). 75¢

Emmingham, William H., and Michael C. Bondi, *Managing Woodlands in the Coastal Fog Belt*, EC 1131 (Oregon State University, Corvallis, reprinted 1993). $1.00

Emmingham, William H., and Norman E. Waldo, *Thinning: An Introduction to a Timber Management Tool*, PNW 184 (Oregon State University, Corvallis, reprinted 1996). 50¢

Emmingham, William H., and Dan Green, *Thinning Systems for Western Oregon Douglas-fir Stands: What Is Best for You?*, EC 1132 (Oregon State University, Corvallis, reprinted 1993). $1.00

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Garland, John J., *Logging Woodland Properties: A Worksheet for Landowners,* EC 956 (Oregon State University, Corvallis, reprinted 1992). 75¢

Garland, John J., *Timber Harvesting Options,* EC 858 (Oregon State University, Corvallis, revised 1996). Single copy, no charge.

Landgren, Chal G., and Michael C. Bondi, *Management Planning for Woodland Owners: An Example,* EC 1126 (Oregon State University, Corvallis, reprinted 1995). $1.00

Landgren, Chal G., Michael C. Bondi, and William H. Emmingham, *Growing and Harvesting Douglas-fir Poles,* EC 1134 (Oregon State University, Corvallis, reprinted 1994). 75¢

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

Shearer, Martha, and Richard Fletcher, *Technical Assistance in Forestry,* EC 1120 (Oregon State University, Corvallis, reprinted 1992). 75¢

Starkey, Scott, and Norman E. Waldo, *Log Exports and the Nonindustrial Private Forest Owner: An Overview of Operations and Markets,* EC 1141 (Oregon State University, Corvallis, revised 1993). $1.00

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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.

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