

Stand Management



Thinning to Prevent Mountain Pine Beetles in Lodgepole and Ponderosa Pine

Devastating outbreaks of mountain pine beetle occur periodically throughout the lodgepole and ponderosa pine forests of western North America. Individual outbreaks last up to two decades, killing as much as 60 percent of the trees and 80 percent of the stand volume.

During 1981 in Oregon, beetles reached epidemic levels in the many stands of lodgepole and second-growth ponderosa pine. Losses occurred for the most part in unmanaged stands—those that have received little attention except for fire suppression and selective harvesting of the larger trees.

Since beetles emerge from dead trees over a several-week period in midsummer, immediately fly to live trees, and burrow under the bark, chemical control is not an option, except on individual high-value trees. Once the beetles are under the bark, death of trees occurs in two ways: The beetles introduce a fungus that stains the wood blue, and beetle larvae girdle the tree. The staining and girdling stop vital moisture and nutrient movement within the tree.

What, then, can landowners do to reduce losses from bark beetles? Thinning susceptible stands will improve tree vigor, and vigorously growing trees tend to ward off beetle

attacks. This circular will help landowners determine the need for thinning their stands and offer suggestions on thinning.

The harvesting option

Beetles usually attack stands that are 60 years or older, with an average diameter at breast height greater than 6 inches. Breast height diameter or dbh, is measured at 4½ feet from the base. Many of the pine stands in south-central Oregon are in these susceptible categories. In very active outbreaks, considerably smaller trees will be killed.

Both lodgepole pine and ponderosa pine require relatively high amounts of sunlight and begin to suffer from shading as stands grow and the canopy closes. Even slight competition for light prevents trees from growing vigorously. If they are large enough, these trees are susceptible to mountain pine beetle attack.

The primary management practice up to now has been to harvest a stand when it reaches about 70 to 80 years and the average dbh is 7 to 8 inches or greater. But this practice does not promote natural regeneration, so it may mean that costly hand planting will be necessary later.

A selective cut of the larger trees, (6 to 8 inches) will prevent a mountain pine beetle buildup, but this relatively early harvest rules out the production of saw logs (12 inches dbh or greater), which would require a total of 120 to 140 years of growth. Improper selective harvesting can result in a stand that is genetically inferior because of the removal of the better growing, superior trees.

Salvage logging of dead and dying trees during the first or second year after they are attacked is a common practice. This permits some economic recovery, but salvage of beetle-killed trees has little impact on the outbreak—a new generation of beetles has most likely emerged to attack other live trees.

The thinning option

Recent studies show that young (50 years) to mature (120 years) lodgepole pine stands show increased vigor when thinned. The remaining vigorously growing trees tend to reject burrowing beetles. The degree of resistance is proportional to the extent of the thinning. Stands that have been heavily thinned, leaving widely spaced trees, are generally more vigorous and less susceptible to the beetle than stands where

trees are overcrowded and growing slowly. (Figure 1 illustrates the marked difference in a stand that has been thinned.) Similar relationships have been found in thinning studies with ponderosa pine.

Guidelines for thinning lodgepole pines

Many lodgepole pine and ponderosa pine stands, especially in south-central Oregon, are unmanaged and could benefit from thinning. Figure 2 can help you determine whether a particular stand needs to be thinned, and shows how to determine which trees to cut and which to save if thinning is necessary. Think about your stand as you read through this guide, and remember:

There is no improvement in tree vigor during the first year after thinning, so to obtain maximum stand improvement and protection, finish the thinning in 1 year. Also, remember that the objective of thinning is to improve the stand. Therefore, cut the smaller or poorly formed trees and leave the larger, "superior" trees to grow into saw logs.

To determine optimum spacing of "leave" trees (those remaining after thinning), you need to know the average dbh of those trees. Here's how it works. First, determine the average dbh of all the trees in the area to be thinned. Do this by adding the diameters of several "typical" trees and dividing by the number of trees measured.

Then, for first thinnings, multiply that average diameter by 1.5 (this accounts for the larger average dbh of the leave trees over that of the trees you measured).

Then multiply by 1.8 to estimate minimum spacing; and by 2.6 for maximum spacing. That gives you the distance, in feet, between leave trees. Each leave tree should be separated by at least this minimum distance. These leave trees will be the larger trees in most cases; they should have the best form and appear the "healthiest."

The spacing criteria in table 1 simplify this method. To use it to determine maximum or minimum spacing (table 1a or 1b), follow the

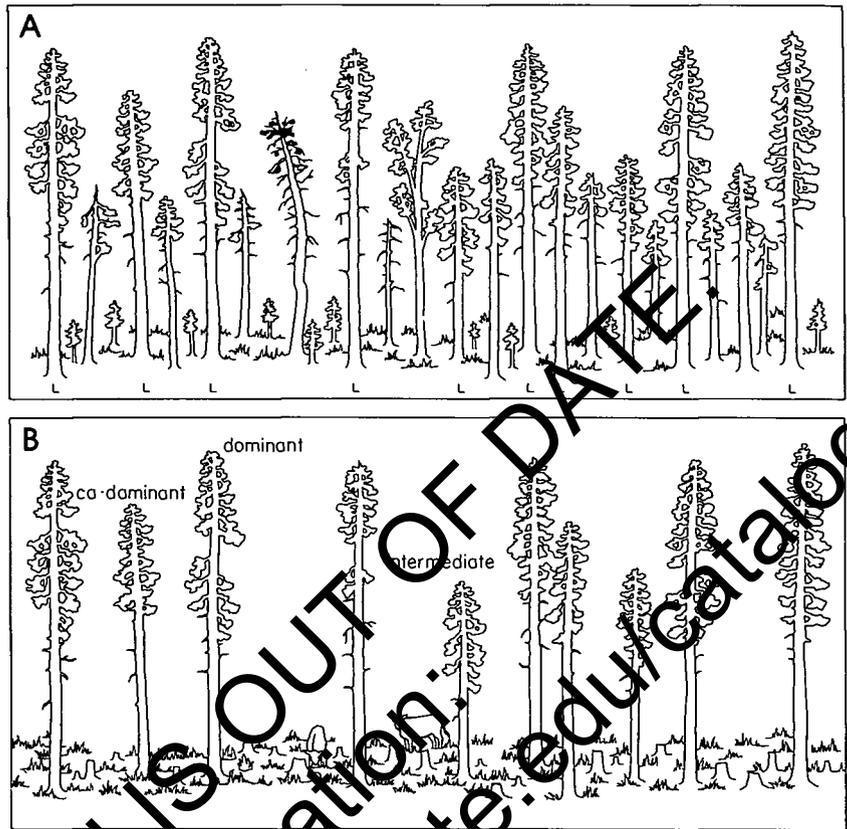


Fig. 2. Diagram of the way a pine stand might look before thinning (A) and how it would appear after thinning (B). The L's below the trees in (A) signify "leave trees," which are the superior trees and are recommended distances. Those without an L have been removed by thinning.

same steps as above, but do not use the constant multiplier 2.6 or 1.8). Instead, take the number you arrived at, after multiplying by 1.5 (the factor that accounts for the increase in average dbh) and match it to the closest dbh in the left-hand column of table 1a or 1b.

For example, you chose a maximum spacing and your average dbh before thinning is 7.2 inches. To adjust for the increase in average diameter after thinning, you multiply by 1.5, obtaining 10.8. This is closest to 11, which requires a spacing between trees of 29 feet to

Table 1a. Spacing criteria for thinning lodgepole pine: the maximum-distance option

DBH (inches) after thinning	Distance (feet)	DBH (inches) when additional thinning is necessary		Years of protection
		DBH (inches)	Years of protection	
5	13	8	25	
6	16	10	25	
7	18	11	25	
8	20	12	25	
9	23	12.5	20	
10	25	13	15	
11	20	14	15	

Table 1b. Spacing criteria for thinning lodgepole pine: the minimum-distance option.

DBH (inches) after thinning	Distance (feet)	DBH (inches) when additional thinning is necessary		Years of protection
		DBH (inches)	Years of protection	
5	9	6	15	
6	11	8	15	
7	13	9	15	
8	15	10	15	
9	16	10.5	10	
10	18	11	8	
11	20	12	5	

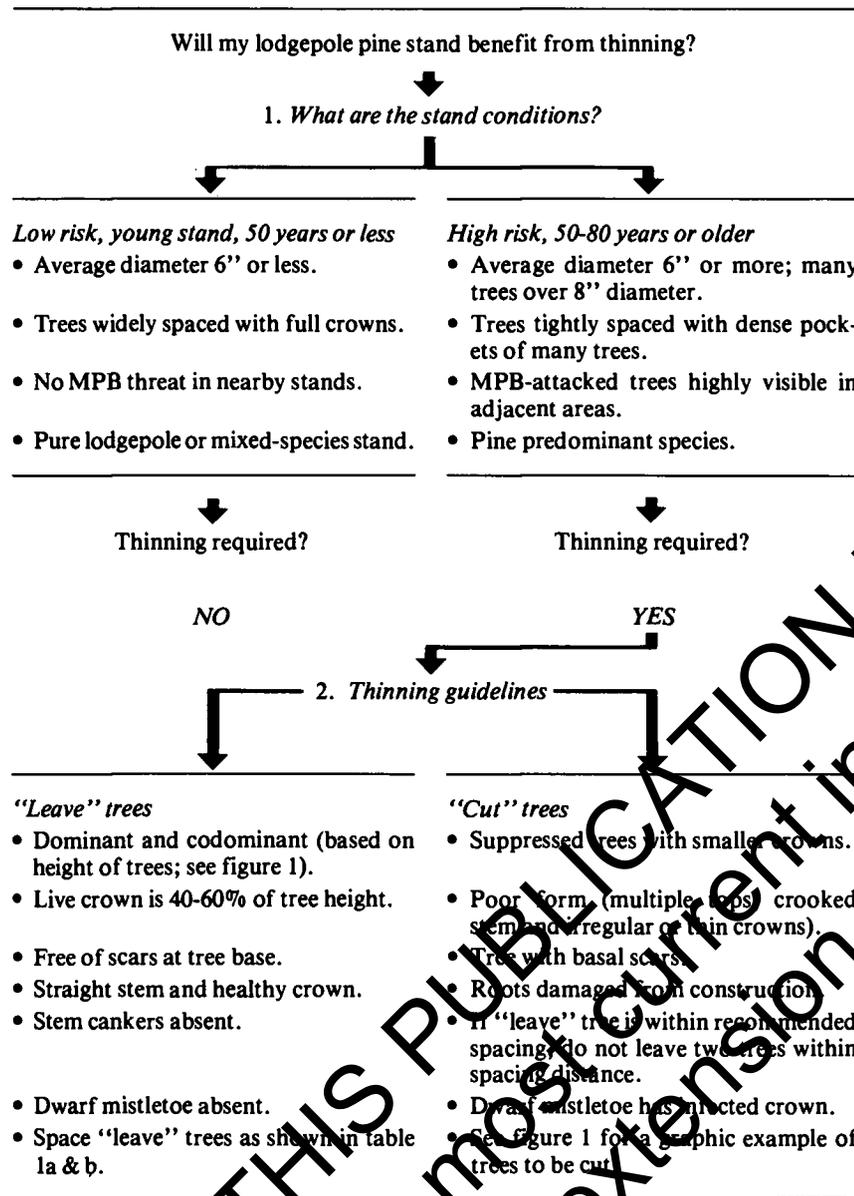


Figure 2. Flow chart for evaluating decision to thin lodgepole pine.

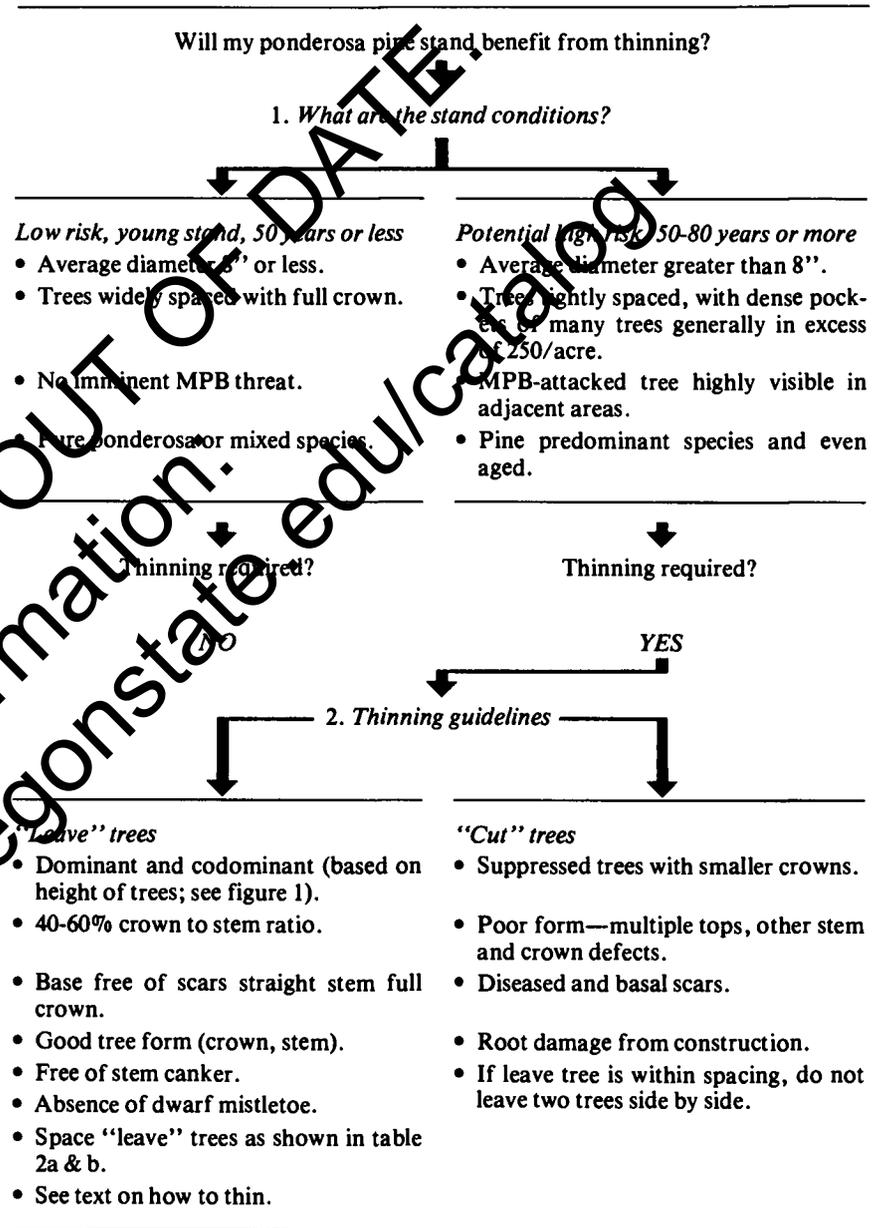


Figure 3. Flow chart for evaluating decision to thin ponderosa pine.

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get a maximum protection period of 15 years. That same 11-inch dbh would require a spacing of 20 feet to obtain the minimum protection period (5 years).

You can also use these spacing criteria to determine when a second thinning or final harvest will be required to avoid mountain pine beetle problems. They show at what dbh thinning will be necessary, based on whether your first thinning was at maximum or minimum spacing.

In the example above, you had a dbh (after thinning) of 11 inches. If you thinned at the maximum of 29 feet, you'll need to thin again (or harvest) when the dbh is 14 inches (third column, table 1a). If you thinned at the minimum of 20 feet, you'll need to thin again (or harvest) when the dbh is 12 inches (third column, table 1b).

The time between the first and second thinnings is estimated for you in both parts of table 1, in the fourth column, headed "Years of Protection." Following the 11-inch dbh in table 1a (maximum spacing), you'll need to thin the second time after 15 years. That same 11-inch dbh in table 1b (minimum spacing) indicates you'll need to thin the second time after 5 years. These projections are estimates; the times will vary with the quality of the site.

Guidelines for thinning ponderosa pines

The same considerations are applicable for thinning ponderosa pine (figure 3). The guidelines for thinning ponderosa are given in table 2. As with lodgepole, plan your spacing so that no leave tree is within the minimum distance. Here, too, complete the thinning within 1 year, preferably in the late summer or fall (thinning after July 15 should be safe).

Avoid thinning in late winter and spring because of the ips, or pine engraver, beetle. This insect can build up in ponderosa slash, then emerge to kill small-diameter trees or the tops of larger trees. If you thin during late winter or spring, burn the slash or have it removed or chipped.

Table 2a. Spacing criteria for thinning ponderosa pine: the maximum-distance option.*

DBH (inches) after thinning	Distance (feet)
4	8
6	11
8	14
10	17
12	20
14	23
16	26
18	29

* Spacing criteria is based on even, not average, spacing.

Table 2b. Spacing criteria for thinning ponderosa pine: the minimum-distance option.*

DBH (inches) after thinning	Distance (feet)
4	6
6	8
8	11
10	13
12	16
14	18
16	20
18	22

* Spacing criteria is based on even, not average, spacing.

Some final notes

Thinning to recommended levels will generally give protection for the specified period. Stands with trees that are below diameter sizes that the beetles prefer (smaller than 6 inches) will, after light thinning, increase in growth and diameter, and rapidly reach the preferred size.

As they reach this preferred size, crown growth will cut off sunlight, reducing growth and suppressing vigor. Stands that are thinned less than recommended levels will reach high susceptibility states in periods appreciably less than 15 to 20 years.

You are required to have an approved plan and appropriate permits before you begin harvesting,

thinning, or slash treatment. Contact your nearest Oregon Department of Forestry office and ask how to obtain approval.

Other related management activities include the use of fertilizer to increase tree vigor and interplanting of grass for forage production in thinned stands. For more information on these options, contact your nearest forestry professional who is informed about the methods discussed (Extension forestry agent, private consultant, company forester, or service forester of the State Department of Forestry). Locate the OSU Extension Service under "County Government" in the telephone directory.

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