Making a good beginning

Precommercial thinning (PCT) is the first of several thinnings you might undertake. PCT takes a stand like the one on the left, reduces the density of crowded trees, and gives the young remaining trees more room to grow.

Ten years later (right), we see a more vigorous stand, with more usable wood production: (1) it’s now less susceptible to insect and disease attack; (2) individual trees become larger faster; (3) more forage is produced; and (4) your thinned forest is more pleasant to look at. Turn the page for more information...
Contents

How to Precommercially Thin ............................................. 3
Determining how much to thin ........................................ 3
  Use target diameters to determine leave tree spacing ...... 3
  Wide vs. narrow spacing ........................................... 4
Selecting leave trees ....................................................... 5
PCT factors .................................................................... 5
  Clumps .................................................................... 5
  Topography ............................................................. 5
  Ingrowth .................................................................. 5
  Planting spacing ...................................................... 5
Mechanical PCT .............................................................. 6
Chemical PCT ................................................................. 6
Late PCT Problems ........................................................... 6
Cost ............................................................................. 6
Do biological benefits justify the cost? ............................... 6
Damage potential ............................................................ 6
Forest Pests and PCT ........................................................ 7
Insects .......................................................................... 7
  Bark beetles and wood borers ..................................... 7
  Pine engraver beetles .................................................. 7
  Mountain pine beetles ................................................ 7
  Defoliators .................................................................. 7
Diseases .......................................................................... 7
  Root rots ................................................................... 7
  Black stain root disease ............................................. 8
  Dwarf mistletoes ...................................................... 8
Slash Disposal ................................................................ 9
  Pile and burning ..................................................... 9
  Under burning .......................................................... 9
  Lop and scatter .......................................................... 9
  Western Oregon practices .......................................... 9
  PCT factors ............................................................... 9
  Slash release purposes ................................................ 9
  Connecting PCT ......................................................... 9
Setting Priorities ............................................................. 10
Examples ....................................................................... 10
Final Comments ............................................................. 10
Highlights of PCT .......................................................... 10
Operational considerations ............................................. 10
For More Information .................................................... 12

References to other publications

When you’re referred to another OSU Extension Service publication, you’ll find ordering instructions in “For More Information,” page 12.

Precommercial thinning (PCT) is an important timber management practice in the Pacific Northwest. You should consider it as soon as a young stand has been established:

- PCT controls stand density by removing trees that will die or crowd crop trees before commercial harvesting can begin.
- PCT opens up young stands so individual trees grow faster.
- PCT leaves more growing space for each tree and usually stimulates forage production for a few years.

Precommercial thinning is just the first of several possible thinnings. Consider it part of your overall management program. You need to understand the basics of thinning to carry out the most from this publication. First, you should read Thinning: An Important Timber Management Tool. It helps you understand how individual trees grow, how stands grow, how stands are classified, what the terms mean, and how stands respond to thinning. A second useful publication is Thinning Systems for Western Oregon Douglas-fir Stands: What Is Best for You?

Our goal is to help you understand and carry out precommercial thinning in your young stands. We’ll discuss:

1. What stands to precommercially thin
2. How to thin them
3. What techniques and equipment to use
4. How major pests affect PCT
5. How to treat the slash caused by thinning
6. How to set priorities for stands if several need thinning

The methods described here are useful for most even-aged stands in the Pacific Northwest. The table of contents provides an outline of our presentation and will help you refer to specific information.

Too many trees per acre is a common problem in Oregon forests. Foresters consistently find investments in precommercial thinning yield good dollar returns—often better than other forest management investments.

For example, under current economic conditions (1997), investing $110/acre in precommercially thinning a moderate-to-good site Douglas-fir stand can lead to a $201/acre gain (in present-value terms). Slash disposal following thinning will increase costs and reduce projected gains.

Paul T. Oester, Extension agent, Union, Wallowa, and Umatilla counties; and William H. Emmingham, Extension silviculture specialist; Oregon State University.
If you want more forage, then money spent for thinning dense, slow-growing ponderosa pine forests is like purchasing extra acres. After PCT, the land produces more usable wood fiber and more forage.

A major disadvantage is that PCT costs you money or time and labor. The Forestry Incentives Program and Agricultural Conservation Program, managed through the Agricultural Stabilization and Conservation Service, provide financial incentives by sharing the cost of precommercial thinning with landowners.

For more information on cost share assistance programs, read Cost Sharing and Woodland Management, or contact a local office of the Oregon Department of Forestry.

How to Precommercially Thin

Most young forest stands will need precommercial thinning to decrease time to the first commercial thinning and maximize commercial timber production. Both naturally reseeded and planted stands may have clumps or patches that are too dense. Table 1 shows the steps you will need to take for success.

You should plan for PCT at the most beneficial and cost-effective time. The best rule of thumb is to thin early in stand development when trees are 10 to 20 inches in height and 1 to 4 inches in diameter. At this stage, they're relatively easy and inexpensive to cut; the slash load is low, and the trees left respond quickly with increased growth.

The strategy in PCT is to give each merchantable target size, toward the end of the growth period leaves room for most of the site resources, so you can create potential thinning areas by a simple walk-through, by looking at aerial photos, or by referring to the section of your management plan that identifies potential PCT areas. Collect information for operational planning on potential thinning sites by taking a series of systematic plots within distinct “stands.”

Stands are areas uniform enough in composition (species), age, and arrangement to be distinguishable from adjoining plantations. For an explanation of how to evaluate them, see “Mapping and Managing Poorly Stocked Douglas-fir Stands.”

Once you’ve collected this information, set your objectives for the stand. Will you manage the thinning area primarily for timber, or do you wish to combine timber with other values, such as wildlife, livestock, or recreation?

Once you select a stand for precommercial thinning, you need to decide how to space your trees out, which trees to take and leave, how to thin clumps, and how to treat the slash. We’ll discuss each of these, and more, in detail below.

Determining how much to thin

Spacing of leave trees depends on the species you are thinning, your harvest or management objectives, and thinning costs. Refer to Table 2 for general spacing guidelines, which are based on thinning at an optimum age or height and a target stand of 10 inches average d.b.h. for first commercial harvest. The numbers given are for maximum wood production and for the maximum number of trees.

Use the table as a general guide for planning PCT operations. If your objective is a larger diameter for a target stand (for example, 12-inch d.b.h.), be aware that you’ll need to space trees wider.

<table>
<thead>
<tr>
<th>Species</th>
<th>Age (years)</th>
<th>Height (ft)</th>
<th>Optimum thinning (ft)</th>
<th>Potential problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa pine</td>
<td>10-25</td>
<td>10-20</td>
<td>260</td>
<td>Low</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>10-20</td>
<td>15-20</td>
<td>360</td>
<td>High</td>
</tr>
<tr>
<td>Western hemlock</td>
<td>15-25</td>
<td>15-25</td>
<td>430</td>
<td>Moderate</td>
</tr>
<tr>
<td>Western larch</td>
<td>10-25</td>
<td>15-20</td>
<td>360</td>
<td>Low</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>10-15</td>
<td>10-15</td>
<td>360</td>
<td>High</td>
</tr>
</tbody>
</table>

Thinning that first commercial thinning occurs when average stand diameter is 10” d.b.h.

Table 1.—Seven steps to a successful PCT.

<table>
<thead>
<tr>
<th>Step</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify stands for thinning.</td>
<td>• Walk through stands; use aerial photos and management plan.</td>
</tr>
<tr>
<td>2. Collect stand information.</td>
<td>• Systematically take plot data on trees per acre, species, diameter, and slope. Roughly estimate tree age and average height, and note insect and disease problems.</td>
</tr>
<tr>
<td>3. Determine objectives.</td>
<td>• Options include timber, range, wildlife, recreation, watershed, esthetics, combinations.</td>
</tr>
<tr>
<td>4. Decide on leave tree spacing.</td>
<td>• Plan on a product size—estimate target diameter.</td>
</tr>
<tr>
<td>5. Define leave tree characteristics.</td>
<td>• Use spacing guidelines.</td>
</tr>
<tr>
<td>6. Consider slash disposal.</td>
<td>• Make adjustments for insects, diseases, and objectives.</td>
</tr>
<tr>
<td>7. Evaluate results.</td>
<td>• Consider size, health, form, crown ratio, species.</td>
</tr>
</tbody>
</table>

Table 2.—Precommercial thinning guidelines for important Pacific Northwest species.

### How to Precommercially Thin

Most young forest stands will need precommercial thinning to decrease time to the first commercial thinning and maximize commercial timber production. Both naturally reseeded and planted stands may have clumps or patches that are too dense. Table 1 shows the steps you will need to take for success. You should plan for PCT at the most beneficial and cost-effective time. The best rule of thumb is to thin early in stand development when trees are 10 to 20 inches in height and 1 to 4 inches in diameter. At this stage, they're relatively easy and inexpensive to cut; the slash load is low, and the trees left respond quickly with increased growth. The strategy in PCT is to give each merchantable target size, toward the end of the growth period leaves room for most of the site resources, so you can create potential thinning areas by a simple walk-through, by looking at aerial photos, or by referring to the section of your management plan that identifies potential PCT areas. Collect information for operational planning on potential thinning sites by taking a series of systematic plots within distinct “stands.”

Stands are areas uniform enough in composition (species), age, and arrangement to be distinguishable from adjoining plantations. For an explanation of how to evaluate them, see “Mapping and Managing Poorly Stocked Douglas-fir Stands.”

Once you’ve collected this information, set your objectives for the stand. Will you manage the thinning area primarily for timber, or do you wish to combine timber with other values, such as wildlife, livestock, or recreation?

Once you select a stand for precommercial thinning, you need to decide how to space your trees out, which trees to take and leave, how to thin clumps, and how to treat the slash. We’ll discuss each of these, and more, in detail below.

Determining how much to thin

Spacing of leave trees depends on the species you are thinning, your harvest or management objectives, and thinning costs. Refer to Table 2 for general spacing guidelines, which are based on thinning at an optimum age or height and a target stand of 10 inches average d.b.h. for first commercial harvest. The numbers given are for maximum wood production and for the maximum number of trees. Use the table as a general guide for planning PCT operations. If your objective is a larger diameter for a target stand (for example, 12-inch d.b.h.), be aware that you’ll need to space trees wider. Harvest methods and market conditions also influence spacing. Therefore, if maximizing wood yield is your objective and if ground-based logging is economical, you can plan a number of commercial thinnings—and you should begin with a narrow PCT.
Space trees wider if you plan few or no commercial thinnings, if forage production is important, or if markets for small logs are poor. Threat of insect pests, such as mountain pine beetle in east side pine, generally argues for leaving fewer trees per acre—to maintain tree vigor and resistance to beetle attack until trees reach marketable size.

Leaving too many trees is a common problem because we value each tree, it’s work to remove trees, and it’s not easy to decide which trees to remove if you have many good-looking candidates. Too many trees left will reduce the growth rate of crop trees, and may mean additional delays of up to 20 years before a commercial thinning.

Shade-tolerant species, such as western hemlock and grand fir, can efficiently use lower light intensities. Closer spacings of these trees will mean greater wood production per acre.

Shade-intolerant species such as ponderosa pine need more light (that is, wider spacing) for maximum growth. Furthermore, droughty conditions typical of pine sites warrant wider spacing.

Use target diameters to determine leave tree spacing. Table 3 is a spacing (or stocking) guide for precommercial thinning based on target diameter objectives for a first commercial harvest. Let’s try an example with Douglas-fir.

If you plan for a target diameter of 12 inches, leave an average of 260 trees per acre (1350 per spacing) after thinning. When the stand grows to an average diameter of 12 inches, a commercial thinning should take place. If you want a larger target diameter, use wider spacing.

Note: Spacing guidelines are not meant as strict rules. Your objective is not an exact spacing between trees, but an overall average.

Table 3 doesn’t tell you how long it will take for your trees to reach the target diameter. The time to the first commercial thinning primarily on the productivity of the site. Stands on good sites will take less time to reach a target diameter than stands on poorer sites.

For example, if leave trees grow at a rate of 5 rings per last inch of growth, it will take 20 years to grow from 4- to 12-inch d.b.h. At 10 rings per inch, 40 years would be required.

If you allow stands to grow past their target diameter, tree growth will slow, and mortality from suppression will increase. For ponderosa and lodgepole pine, thinning delays can mean an increased risk from mountain pine beetle attack.

The target diameters in Table 3 are designed to estimate future average tree size for stands in a common thinning system, the trees removed are generally among the lower crown classes.

However, you must adjust the results from the table when you plan to remove trees in from the upper crown classes. For instance, if you plan to cut poles,

Removal of larger trees will increase target diameter after thinning. Therefore, select a lower target diameter than the one in Table 3. The relationships between target diameter objectives and pole sizes are described in Growing and Harvesting Douglas-fir Poles.

Wide vs. narrow spacing. If you have a reliable market for 8- to 12-inch saw logs, you may want to thin to an 18-inch target diameter. Plan on a similar or narrower spacing where a good firewood market exists.

Early commercial thinning of small trees has been impractical in areas where:

1. There are poor markets for small logs
2. Steep terrain means you must use expensive cable yarding systems
3. You’ll have high road-building costs

So, in the face of high logging costs and poor markets for small logs, a 16-inch target (fewer trees per acre) is more desirable. If commercial thinning isn’t economical, thinner even wider to anticipate a larger target diameter at time of final harvest.

Wide initial spacing in small-diameter stands sacrifices early volume growth, but it shortens the time your trees need to reach a larger commercial size.

For landowners interested in forage for livestock or big game, greater space between trees is an advantage because of the increased grass, forbs, and shrubs that will occur before trees reach marketable size. Forage yields often are doubled following PCT, but this is highly variable.

As an example of a wide spacing strategy, suppose you have a dense 20-year-old ponderosa pine stand on a good producing site, and you want to combine income from both livestock and timber from the area. Trees are from 15 to 30 feet high, and forage production is just about shaded out.

Thinning the stand to an 18-foot space between trees (135 trees per acre) will open up the area for forage production and provide for rapid tree growth. In about 40 years, the stand will grow to an average diameter of 14 inches.

A commercial thinning at that time could remove 70 trees per acre and leave 60 to grow. At this spacing (about 27 feet), the stand should grow to a diameter of up to 30 inches without danger of beetle attack.

---

**Table 3.** Minimum spacing (in feet) required between leave trees to obtain a stand with selected target diameter.

<table>
<thead>
<tr>
<th>Target diameter (inches)</th>
<th>Western hemlock (site class 2)</th>
<th>Grand fir*</th>
<th>Douglas-fir</th>
<th>Ponderosa pine</th>
<th>Lodgepole pine</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>12</td>
<td>11</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>16</td>
<td>15</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

*These spacings are for grand fir stands east of the summit of the Cascade Mountains.
Selecting leave trees

If production of large, high quality logs is your long-term objective, then select leave trees that:

1. Are in a dominant or codominant position
2. Have at least 30 percent of their total height in crown
3. Have small branches, straight boles, and little taper
4. Lack broken, forked, or damaged tops
5. Have few or no disease problems

Remove trees that are suppressed, poorly formed, sickly, dominant heavy-limbed “wolf” trees, or those competing with selected leave trees. If you’re managing stands with several tree species, retain a mix of species that:

1. Have high market value
2. Have good growth potential
3. Are well adapted to the site
4. Are either nonhosts or more resistant to local insect or disease problems
5. Cause less than full site occupancy or future. Loose attention to spacing governs what log values will be in the trees is extremely important because it causes less than full site occupancy or future. Loose attention to spacing governs what log values will be in the

Topography. Local topography should give you clues for potential weather damage. Stands in areas that experience high winds—sites near the coast or on exposed ridges—can suffer serious damage after thinning. In this case, thinning early in the life of the stand is best, so that trees develop wind-resistant qualities.

Because slope has such an influence on logging costs, stands on steep slopes (40 percent and greater) should be thinned with wider spacing to grow larger trees that are less expensive to log and more valuable. On very steep slopes (over 60 percent) where expensive cable yarding is required, PCT to final crop-tree spacing because commercial thinning likely will not be feasible.

Points from roads are a critical factor in cable operations. If a stand is accessible only by using cable yarding, precommercial thinning to final crop-tree spacing

Ingrowth occurs when small trees begin to grow between standing leave trees soon after precommercial thinning. This gives the potential to compete with these trees, stealing the benefits of thinning.

This indicates which species own this trait. If your stand has a few vigorous, smaller (nonleave) trees, delay thinning until the stand is a little taller. This gives thinned trees an added “jump” in height over ingrowth. Waiting causes a delay in commercial harvest, but delayed PCT can improve wood quality because it helps in natural pruning.

Prescribed fire can be a tool to take out ingrowth as long as the leave trees have thick bark to resist heat damage. If you minimize ground disturbance during slash-disposal operations, you’ll reduce the seedbed that’s suitable for natural reproduction, lessening your ingrowth problem. It’s also important to cut PCT trees below the lowest live branch so these branches don’t survive to compete with leave trees.

Planting spacing. The number of trees you plant should depend on anticipated mortality and your objectives for future management. Plant fewer trees if you expect low rates of mortality and if you plan no precommercial thinning. If natural seeding is common on your site, plant fewer seedlings.

In western Oregon, plant 300 to 400 trees per acre (10 to 12 feet) if you anticipate little mortality and if you plan a PCT. Thinning will help weed out poorly formed, diseased, or slow-growing trees.

In eastern Oregon, trees normally are planted at wider spacings. 225 to 300 trees per acre (12 to 16 feet). If thinning is not desired, plant 250 to 300 trees per acre on the west side (200 east side) unless you expect mortality in the first decade to exceed 20 percent.

Remember: Wider spacing means, first, fewer opportunities to harvest small trees early in the stand rotation, and second, little room for unexpected mortality or stand damage.

Wide spacing early in stand development can result in large limbs and poor log quality unless you plan to prune crop trees. Pruning can be a reasonable option, where crop trees are growing on good sites and trees are pruned early in the rotation.

Avoid overplanting—it will increase your PCT costs or stifle growth.

Mechanical PCT

Standard equipment for PCT is the chain saw. A minimum length of 20 inches for standard bars reduces bending over and fatigue by the cutter. For very small trees (less than 1-inch diameter), machetes, axes, or shears are acceptable alternatives to chain saws.

Remember: If a PCT takes place, a permit to operate power-driven machinery on private lands in Oregon is required from the Oregon Department of Forestry. Essential safety equipment includes a hard hat, gloves, leg protection, heavy leather boots, caulk boots for steep or wet slopes, ear plugs, and eye-protecting goggles or glasses.
Chemical PCT

Tree-killing chemicals are alternatives to mechanical PCT. With the “hack and squirt” technique, a hatchet is used to chop around the tree at regular intervals and a small amount of herbicide is squirted into each cut. With this method, the trees die standing, and they gradually decompose and fall apart from the top down. The major advantages include:
1. Slash accumulates slowly as standing dead trees break down
2. Access through the site is still possible
3. Dead standing trees provide some shade and support (during windstorms)
4. Fewer accidents
5. Use of certain chemicals will not enhance bark beetle activity

The major drawbacks include:
1. The difficulty in seeing which trees already have been treated
2. The difficulty of selecting crop trees if others have not been felled near them.

Attention to safety, application timing, and herbicide rates improves the success of your chemical thinning.

Late PCT Problems

When proper spacing is obtained by timely PCT, trees grow efficiently to commercial size. If PCT is delayed or forgotten, stands remain overdense, tree growth slows down, crop trees reach commercial size very slowly—and you’ll be delayed many years before a commercial thinning is feasible. Should you do a late PCT? The answer is not easy, so experienced foresters try to avoid it. The three main problems with late PCT are:

1. It’s a risky investment and can be expensive (bigger trees are harder to cut).
2. Individual trees take longer to respond and grow.
3. Afterwards, stands sometimes become sunscalded or windthrown.

The following sections should help you decide whether to wait and allow the stand to slowly reach marketable size or to do a late PCT.

Cost

PCT in older stands can be expensive. There are several reasons:
1. Trees are generally larger, yet they are just as many in acreage.
2. Thiners have difficulty getting trees down on the ground, they get hung up easily.
3. Slash accumulations are greater because of increased fire hazards and decreasing access.

To justify these costs, you need to know that the time to your first commercial thinning will be significantly shortened. Estimate the costs, returns, and time saved to a first commercial thinning before you thin. If the costs are high and if the time saved is short (say 5 to 6 years), a late PCT probably is not justified.

Do biological benefits justify the cost?

You’ll need to consider the biological benefits of a late PCT. The rate and amount of bole-growth response from thinning is largely a function of a tree’s crown length in relation to its height (crown ratio).

Trees with crown ratios of less than 30 percent take much longer to respond and may suffer thinning shock or reduced growth for a few years after thinning, especially in shade-tolerant species. Trees with low crown ratios are more common in stands past the optimum PCT stage.

Some species-site combinations may not warrant a late PCT because they typically show poor growth response after thinning. Dense lodgepole pine growing on poor, eastern Oregon sites is one category. Lodgepole pine may exhibit good response; however, if trees are less dense and the stand is growing on a better site.

Ponderosa pine responds favorably to thinning even when trees are 40 to 50 years old and growth has been slow for decades. Douglas-fir and redwood will show a growth response from a late PCT, but not as great as if thinned earlier.

Damage potential

On poor sites, dense stands tend to stagnate. If you don’t thin, the stand probably will not produce merchantable products for many years. Furthermore, insect pests such as mountain pine beetle are threats to older, stagnated pine stands. In this case, a late PCT probably is justified. Otherwise, beetles will kill the larger trees about the time they reach harvest size.

Stands with small or poorly developed crowns and long, slender stems are prone to windthrow, permanent bending, or top breakage from ice storms. Such stands may be thinned in two or three stages. Thinning in stages is beneficial because it gives trees time to build stems and root systems before they’re fully exposed to weather hazards.

However, reentry into a stand runs your costs up. Normally, stage thinning is considered only when a highly valuable stand is threatened and the added costs are justified by potential returns.

Sunscald also is a potential problem after a late PCT. Species with thin bark are sensitive to sudden increases in sun exposure on the south and southwest sides of their trunks. The heat generated can kill the cambium (growth zone of the tree).

As Table 2 indicates, grand fir and western hemlock (shade-tolerant species) are most susceptible.
Forest Pests and PCT

Insects and diseases that can attack your forest have a big influence on how you thin your stands. Because pests can cause costly damage problems, you’ll need to evaluate each stand and direct questions to your Extension forestry agent, service forester, or consultant forester.

The following sections contain recommendations for moderating pest impacts as they relate to a PCT.

**Thinning acts to “beetle proof” your stands. For further details, see Thinning to Prevent Mountain Pine Beetles in Lodgepole and Ponderosa Pine.**

**Defoliators**, such as Douglas-fir tussock moth and western spruce budworm, feed on the foliage of Douglas-fir, grand fir, and white fir. They can cause increased radial growth, top kill, and mortality.

**Table 4.** — PCT guidelines for four major insect pests in Oregon.

<table>
<thead>
<tr>
<th>Insect/pest</th>
<th>Primary pest species</th>
<th>Geographic location</th>
<th>Why PCT affects pest</th>
<th>PCT management recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine engraver beetles (Ips)</td>
<td>Ponderosa and lodgepole pine</td>
<td>Eastern and southwest Oregon</td>
<td>Builds high populations in slash, then kills green trees.</td>
<td>Enhances tree vigor, thus increasing tree resistance to beetle attack. PCT can lead to high populations in slash.</td>
</tr>
<tr>
<td>Mountain pine beetle</td>
<td>Lodgepole and ponderosa pine</td>
<td>Eastern Oregon</td>
<td>Kills standing green trees.</td>
<td>Enhances tree vigor and reduces tree killing. “Beetle proofs” stands.</td>
</tr>
<tr>
<td>Western spruce budworm and tussock moth</td>
<td>True firs, Douglas-fir</td>
<td>Eastern Oregon primarily</td>
<td>Causes decreased growth, top damage, and mortality.</td>
<td>Unknown—appears to have no positive effect during outbreak in Oregon. Needs further study.</td>
</tr>
</tbody>
</table>

**Bark beetles and wood borers** are mostly “secondary” pests.

**Usually, something else weakens the trees—then these insects move in and cause tree death. Weakening agents include drought, disease, insect defoliators, and competition with other trees. PCT can help by enhancing tree vigor, increasing the trees’ ability to resist attack.**

**Table 2.** — PCT guidelines for four major insect pests in Oregon.

<table>
<thead>
<tr>
<th>Pest</th>
<th>Geographic Distribution</th>
<th>Why PCT affects pest</th>
<th>PCT management recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine engraver beetles (Ips)</td>
<td>Ponderosa and lodgepole pine</td>
<td>Builds high populations in slash, then kills green trees.</td>
<td>Enhances tree vigor, thus increasing tree resistance to beetle attack. PCT can lead to high populations in slash.</td>
</tr>
<tr>
<td>Mountain pine beetle</td>
<td>Lodgepole and ponderosa pine</td>
<td>Kills standing green trees.</td>
<td>Enhances tree vigor and reduces tree killing. “Beetle proofs” stands.</td>
</tr>
<tr>
<td>Western spruce budworm and tussock moth</td>
<td>True firs, Douglas-fir</td>
<td>Causes decreased growth, top damage, and mortality.</td>
<td>Unknown—appears to have no positive effect during outbreak in Oregon. Needs further study.</td>
</tr>
</tbody>
</table>

As you can see from this discussion, late PCT can be risky business. Avoid it if you can by doing PCT in a timely manner, as shown in Table 2.

**Table 3.** — PCT guidelines for four major insect pests in Oregon.

<table>
<thead>
<tr>
<th>Pest</th>
<th>Geographic Distribution</th>
<th>Why PCT affects pest</th>
<th>PCT management recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine engraver beetles (Ips)</td>
<td>Ponderosa and lodgepole pine</td>
<td>Builds high populations in slash, then kills green trees.</td>
<td>Enhances tree vigor, thus increasing tree resistance to beetle attack. PCT can lead to high populations in slash.</td>
</tr>
<tr>
<td>Mountain pine beetle</td>
<td>Lodgepole and ponderosa pine</td>
<td>Kills standing green trees.</td>
<td>Enhances tree vigor and reduces tree killing. “Beetle proofs” stands.</td>
</tr>
<tr>
<td>Western spruce budworm and tussock moth</td>
<td>True firs, Douglas-fir</td>
<td>Causes decreased growth, top damage, and mortality.</td>
<td>Unknown—appears to have no positive effect during outbreak in Oregon. Needs further study.</td>
</tr>
</tbody>
</table>

Avoiding it if you can by doing PCT in a timely manner, as shown in Table 2.
healthy trees through roots. Thinning in root-rot-infested, single-species stands means putting money into trees that probably will die anyway. A PCT in mixed stands offers a chance to change species composition to more resistant species.

You’ll need to evaluate separately the effects of PCT for each root disease and situation. In some cases, you can use PCT as a tool to reduce losses; in others, it’s a risky investment.

**Black stain root disease** affects west side Douglas-fir, causing growth loss and mortality in young stands.

Apparently, this disease has always been present at low levels in the forest, but it’s been expanding—and it’s cause for concern. Increases in the incidence of black stain root disease have largely been associated with young stand management practices such as PCT.

In infected stands, black stain root disease spreads from root contacts and through the soil. Areas free of the disease can become inoculated by several species of bark beetles and weevils that carry the fungus from infected host trees to uninfected stands.

Fresh thinning slash, tree injuries, and cut stumps “attract” and concentrate beetles into new areas. The insects colonize and reproduce in slash and at the root collar of stumps.

Keeping these insects out of your stand is a key strategy for reducing losses. If your stands are within 1 mile of known infection centers, it will be safer to thin in July and early August, after the beetles have completed their spring and early summer flights. This should render the slash from the thinning too dry to act as a host material by the following spring.

Any trees thinned in late winter or spring are prime host material—avoid this timing in areas where black stain has been identified.

**Dwarf mistletoes** are parasitic green plants that can infect the branches and/or main stem of all conifers east of the Cascades and western hemlock west of the Cascades. Heavy infection reduces tree vigor, lowers productivity per acre, increases susceptibility to other pests, and lowers log quality.

Each tree species is infected by a specific dwarf mistletoe species, and cross infections from one tree species to another are rare. New infections get started when the mistletoe plant “shoots” sticky seeds that land on branches or stems. Use these facts in your management operations.

Convert heavily infected stands to new, disease-free stands. Lightly to moderately infected stands with an infected overstory need the overstory removed before thinning can occur in the understory.

Thin early your young stands without infected overstories. Discriminate against trees with heavier infestations of mistletoe and encourage nonhost species. Well-formed ponderosa pine trees, with light infestation in the lower crown, can outgrow the mistletoe once they’re released.

### Table 5.—PCT guidelines for three major forest diseases in Oregon.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Primary host species</th>
<th>Geographic location</th>
<th>Mode of infection</th>
<th>PCT affects pest</th>
<th>PCT management recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root rots</td>
<td>Most conifers</td>
<td>Eastern and western Oregon</td>
<td>Healthy root contacts infected</td>
<td>May enhance tree vigor, but tree will die anyway.</td>
<td>• Don’t thin within 50’ of infection centers in single species stands, or don’t thin infected stands at all.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Leave trees that are least susceptible to disease in mixed stands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• You need to evaluate each root rot situation.</td>
</tr>
<tr>
<td>Black stain root disease</td>
<td>Douglas-fir</td>
<td>Western Oregon</td>
<td>Beetles carry fungus and inoculate new stands. Once stand is infected, disease spreads through soil and root contacts.</td>
<td>Slash, cut stumps, and injured trees “attract” beetles that infect disease-free stands.</td>
<td>• If your stands are within 1 mile of infection center: 1. Thin in July and early August. 2. Minimize tree injury during thinning.</td>
</tr>
<tr>
<td>Dwarf mistletoes</td>
<td>Eastern and western Oregon</td>
<td></td>
<td>Parasitic green plant on branches and main stem. Sticky seed falls on new host and infects. Each tree species has its own dwarf mistletoe species—cross infections rare.</td>
<td>Improves vigor in light to moderately infected trees. PCT offers way to sanitize stand and reduce growth losses.</td>
<td>• Heavily infected stands: convert to disease-free stands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lightly to moderately infected stands with infected overstory: remove overstory, then thin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Lightly to moderately infected stands with no overstory: thin early, discriminate against trees with heavier infestations.</td>
</tr>
</tbody>
</table>
Slash Disposal

Slash is the residue of cut trees left after your thinning. Problems from PCT slash include fire hazard and restricting livestock and wildlife access. Benefits include the slow return of nutrients to the soil and the enhancement of small animal habitat.

Eastern Oregon practices

In eastern Oregon, slash most often treated is in one of the following ways:
1. Pile and burn
2. Underburn
3. Lop and scatter
4. Purchase slash release
5. Do nothing

Pile and burn is most common. Slash is piled by hand or with a small dozer. Piling by hand generally is too labor-intensive. Dozer piling, however, can be a reasonable and desirable alternative as long as you take certain precautions to maintain stand productivity and limit tree damage.

Focus on cleaning up large concentrations, leaving scattered slash to decompose in place. Keep equipment and logs from rubbing the bark off leave trees, so stem rots won’t rob your stand of future usable wood. Mechanical piling when soils are frozen or dry helps minimize soil compaction. Use a toothed “brush blade” to keep from moving too much topsoil into piles.

Piles usually are stored in the fall or spring. Keep them small to moderate size and tightly packed. Place them far from live trees as practical, to prevent scorching. Burn when weather conditions are cool and calm. This will minimize heat damage to soil and trees.

Underburning (a prescribed burn of fuel under a residual stand) is becoming more common, but it’s risky. It requires considerable expertise. Conduct it only under the correct climatic and fuel conditions and with appropriate control and supervision.

Underburning does offer you a good method of seedbed preparation for forage enhancement or conifer reproduction, and it reduces some of the negative aspects of machine piling, such as soil compaction and cost.

Lop and scatter involves:
1. Cutting downed trees (slash) into several sections
2. Cutting the limbs off the top of downed trees
3. Leaving this material spread throughout your stand

Lop and scatter increases your costs over doing nothing, but it gets slash down closer to the ground, which encourages faster decomposition and reduces fire hazards.

Western Oregon practices

In western Oregon, PCT slash usually is left untreated, and the landowner purchases a slash release (see the next section). Here slash typically is allowed to decompose or “melt down” naturally.

Because grazing usually isn’t an option and because the moderate, wet climate hastens decomposition, there’s little incentive to treat slash. The steeper slopes in western Oregon also limit slash disposal opportunities. Lopping accelerates slash breakdown, but it’s more expensive.

Slash-release purchase

The State considers any slash you leave after PCT an additional fire hazard. This is a hazard that’s over and above what your fire patrol assessment fee covers. Under Oregon fire laws, you have three choices:
1. Implement one or a combination of acceptable practices to reduce the extra hazard, such as piling and burning.
2. Pay an additional fee (a slash-release purchase; the rate you pay depends on the degree of hazard).
3. Accept the responsibility yourself—but this means you pay the firefighting costs if a fire occurs in the thinning area.

Contact the Oregon Department of Forestry for more information.

Contracting PCT

Thinning contractors are available throughout the Pacific Northwest. It’s important to be prepared with information about your stand when you talk to a potential contractor.

Items for each contract bid include: PCT location, map with thinning boundaries, number of acres, average stand diameter, trees per acre, slope, spacing requirements, stump height, whether cut trees are lopped or not, and how close cut trees should be pushed to the ground.

Be prepared to discuss your requirements and the results you expect. However, be flexible—the more “perfect” you want your stand, the more it’s going to cost. Select a contractor only after you have received references from other landowners, and several bids.

You can locate thinning contractors by contacting your Extension forestry agent, consulting foresters, the Oregon Department of Forestry, U.S. Forest Service, Bureau of Land Management, and the Oregon Bureau of Labor.

A written contract agreement between you and your contractor provides a means of communication and helps protect you from poor thinning results or an incomplete job. The box on page 10 shows some of the items to consider (for further details, see Contracts for Woodland Owners and Christmas Tree Growers).
Setting Priorities

If you have several PCT opportunities, establish priorities for your stands. Consider these factors: the site’s productive potential, trees per acre, accessibility, the general health of the stand, average tree size, and your objectives. Table 6 reviews these factors.

Examples

We can highlight the principles in Table 6 by using the examples in Table 7.

First, let’s examine stand A. Because of its young age and high growth rate, this stand probably offers the greatest return for each dollar invested. It’s close to an ideal thinning condition now.

Thinning stand A should be relatively inexpensive because of the small tree size, gentle terrain, and low number of trees to cut. Thin to 300 trees/acre to maximize the saw log production objective.

Stand B is past the optimum size and age for precommercial thinning and probably should be left for a commercial thinning at age 35 to 40. It has high growth potential, so stand stagnation shouldn’t be a problem. In 10 to 15 years, the average stand diameter will be about 12 inches, large enough for a commercial thinning.

In stand C, the high number of trees per acre, moderate site, grazing objective, and disease problems make it a good candidate for thinning. Without thinning, it will be decades before trees are large enough for a commercial harvest— and mountain pine beetle action could begin killing dominants.

Thinning, however, may require a conservative approach. You should consider a PCT in two stages, 3 to 5 years apart, to prevent thinning shock and wind or snow damage because of small crowns.

You can expect a more than twofold increase in forage production, gain beetle protection, and still expect good gains in merchantable wood production. Thin this stand to an 18 x 18 foot spacing (135 trees per acre), so that trees will grow to 14 inches before a commercial thinning is needed.

In summary: Thin stand A first, leave stand B alone, and thin stand C gradually.

Things to consider in a precommercial thinning contract

- Legal description of land area
- External boundary designation, map of unit to thin
- Payment schedule and rate per acre
- Work starting date, work completion date
- Criteria for cutting trees: stump height, species priorities for leaving, spacing, minimum tree height to be cut, description of leave and take trees
- Slash disposal: lop and scatter, machine pile, hand pile, do nothing, pile location and size
- Hold-harmless clause (protection against negligent performance by contractor)
- Contractor insurance policies (bodily injury or death, property damage, workers compensation)
- Compliance of contractor with State laws
- Responsibility for licenses and permits
- Oregon Forest Practices Act compliance
- Precaution against fire
- Fire responsibilities
- Access, road maintenance
- Suspensory-of-activities clause
- Penalty clause for unacceptable performance by contractor

Final Comments

PCT is an essential management practice that will help you get the most from your woodland acres. You can use PCT to accomplish a number of your woodland objectives, including timber, grazing, wildlife, and recreation. You should follow the seven steps in Table 1 when you plan and carry out PCT operations.

You can use the information provided here as a guide to precommercial thinning on your property. The success of your operation will depend on your knowledge of thinning and on setting realistic goals. If it’s your first experience with thinning, start small, then enlarge the project.

Don’t be unrealistic in your expectations. For practical purposes, your stand doesn’t have to look “perfect” or “parklike.” Expect some damaged trees, imperfect spacing, and “holes.” In conclusion, we leave you with the following suggestions for PCT.

Highlights of PCT

1. Precommercial thinning makes dollars and sense—don’t delay!
2. Do PCT early rather than late, but beware of ingrowth problems.
3. Don’t leave too many trees! Know your target stand.
4. Avoid damaging the soil or crop trees.
5. Thin the most productive stands first.
6. Plan ahead, have realistic expectations, and keep after it.
7. Seek assistance from your Extension forestry agent, service foresters, and consultants.

Operational considerations

1. Cut below live green branches.
2. Have thinners push cut trees to the ground.
3. Closely supervise a PCT project that you hire out.
Table 6.—Setting PCT priorities for woodlands.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Priority</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site productivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better sites, large crowns</td>
<td>High</td>
<td>Greater gains in board-foot volume.</td>
</tr>
<tr>
<td>Less productive sites</td>
<td>Low</td>
<td>Thinning on poorer sites is a low priority because gains are less; however, an exception occurs when stands on low sites won’t produce marketable trees for decades.</td>
</tr>
<tr>
<td>Trees per acre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grossly overstocked</td>
<td>High</td>
<td>The higher the trees/acre, the greater the PCT benefit, especially on lower-quality sites.</td>
</tr>
<tr>
<td>Up to 20% above recommended stocking</td>
<td>Low</td>
<td>Gains from PCT are not significant enough to justify costs.</td>
</tr>
<tr>
<td>Access/Slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy access, gentle slopes</td>
<td>High</td>
<td>Less expensive; lower logging cost at commercial harvest.</td>
</tr>
<tr>
<td>Poor access, steep slopes</td>
<td>Low</td>
<td>Much higher harvest costs; thin to crop tree spacing.</td>
</tr>
<tr>
<td>Stand health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk from insects and disease</td>
<td>High</td>
<td>PCT can sanitize stands and improve health and resistance to pests, lowering future losses.</td>
</tr>
<tr>
<td>Most trees poorly formed</td>
<td>Low</td>
<td>Future tree quality doesn’t justify treatment.</td>
</tr>
<tr>
<td>Tree diameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closest to ideal diameter</td>
<td>High</td>
<td>Best gains from trees closest to ideal PCT condition.</td>
</tr>
<tr>
<td>Nearly marketable trees</td>
<td>Low</td>
<td>Allow unthinned stands to grow to marketable size.</td>
</tr>
<tr>
<td>Landowner stand objectives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximize wood production</td>
<td>High</td>
<td>High stands on productive soils: easy access, gentle to moderate slopes, and young trees.</td>
</tr>
<tr>
<td>Encourage forage</td>
<td>High</td>
<td>Thin stands to forage-grazing potential.</td>
</tr>
<tr>
<td>Provide for wildlife-hiding cover</td>
<td>Low</td>
<td>Opening stands up through PCT eliminates hiding for a time. Plan PCT around hiding-cover needs.</td>
</tr>
</tbody>
</table>

Table 7.—Setting priorities for precommercial thinning: three examples.

<table>
<thead>
<tr>
<th>Stand A</th>
<th>Stand B</th>
<th>Stand C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth potential</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Trees per acre</td>
<td>1000</td>
<td>500+</td>
</tr>
<tr>
<td>Stand age/height</td>
<td>10/14'</td>
<td>25/60'</td>
</tr>
<tr>
<td>Crown ratio</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>Growth rate: rings/inch</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Slope</td>
<td>Gentle</td>
<td>Gentle</td>
</tr>
<tr>
<td>Species</td>
<td>Douglas-fir</td>
<td>Douglas-fir</td>
</tr>
<tr>
<td>Average stand diameter</td>
<td>3&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Ingrowth</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Stand health</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Objectives</td>
<td>Saw logs</td>
<td>Saw logs</td>
</tr>
<tr>
<td>Market for small logs</td>
<td>Good</td>
<td>Good</td>
</tr>
</tbody>
</table>
For More Information

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:

Publication Orders
Extension & Station Communications
Oregon State University
422 Kerr Administration
Corvallis, OR 97331-2119
Fax: 541-737-0817

If you would like additional copies of this publication, Using Precommercial Thinning to Enhance Woodland Productivity, EC 1189, send $2.00 per copy to the above address.

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

You can access our Educational Materials catalog and some of our publications through our Web page at http://wwwagcomm.ads.orst.edu/

Emmingham, William H., and Norman E. Elwood, Thinning: An Important Timber Management Tool, PNW 184 (Oregon State University, Corvallis, reprinted 1993). $1.00


Fletcher, Richard, Cost Sharing and Woodland Management, EC 1119 (Oregon State University, Corvallis, reprinted 1992). 75¢


Mukatis, W. Alfred, and Charles F. Sutherland, Contracts for Woodland Owners and Christmas Tree Growers, EC 1192 (Oregon State University, Corvallis, revised 1996). $2.00

Pitman, Gary B., David A. Perry, and William H. Emmingham, Thinning to Prevent Mountain Pine Beetles in Lodgepole and Ponderosa Pine, EC 1106 (Oregon State University, Corvallis, reprinted 1993). $1.00

THIS PUBLICATION IS OUT OF DATE. For most current information: http://extension.oregonstate.edu/catalog